

## Public perception of the persistence of COVID-19 symptoms and potential strategies to address Long COVID

Percepção pública sobre a persistência dos sintomas da COVID-19 e estratégias potenciais para enfrentar a COVID longa

Percepción pública de los síntomas persistentes de COVID-19 y posibles estrategias para abordar la COVID prolongada

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**Abstract** Long COVID is characterized by symptoms that persist for more than 12 weeks after a SARS-CoV-2 infection. This study investigated public perceptions of long COVID in Brazil. Interviews were conducted with 1,295 participants selected based on variable quotas, according to the population distribution in each region of the country, using data from the 2021 National Household Sample Survey (PNAD) and the 2010 IBGE Census. The findings revealed that 40.6% reported having had COVID-19 between 2020 and 2023, with 33.4% experiencing persistent symptoms for at least three months. The most common symptoms included fatigue (44.6%), headache (43.7%), hair loss (40.9%), memory loss (34.7%), and difficulty concentrating (28.7%). The study highlights that Brazilians are unaware of the correlation between these symptoms and the acute phase of the disease. By increasing public awareness of the issue, society becomes more capable of demanding better healthcare services for long COVID and insisting on effective policies. The importance of social education on this topic is fundamental to improving the healthcare system.

**Key words** Long COVID, Public perception, COVID-19, Persistent symptoms, Public health

**Resumo** A COVID longa é caracterizada por sintomas que persistem por mais de 12 semanas após uma infecção por SARS-CoV-2. No entanto, ainda há falta de conscientização sobre o tema. Este estudo de pesquisa investigou as percepções públicas sobre a COVID longa no Brasil, com foco na diversidade de sintomas percebidos após a fase aguda da COVID-19. Foram realizadas entrevistas com 1.295 participantes selecionados por quotas variáveis, de acordo com a distribuição populacional do país em cada região, com proporções definidas por dados da Pesquisa Nacional por Amostra de Domicílios (PNAD) de 2021 e do Censo IBGE de 2010, as quais revelaram que 40,6% relataram ter tido COVID-19 entre 2020 e 2023, sendo que 33,4% apresentaram sintomas por pelo menos três meses após a infecção. Os sintomas mais comuns incluíram fadiga (44,6%), dor de cabeça (43,7%), queda de cabelo (40,9%), perda de memória (34,7%) e dificuldade de concentração (28,7%). O estudo destaca que, embora os brasileiros tenham vivenciado os possíveis sintomas a longo prazo, eles desconhecem os detalhes da condição. Assim, ao aumentar a percepção pública sobre o tema, a sociedade se torna apta a cobrar das autoridades públicas de todas as esferas de poder, exigindo um melhor atendimento direcionado à COVID longa, insistindo em políticas públicas eficazes. A importância da educação social sobre o tema, portanto, é a base para um sistema de saúde melhor voltado ao cuidado da população.

**Palavras-chave** COVID longa, Percepção pública, COVID-19, Sintomas persistentes, Saúde pública

**Resumen** La COVID prolongada se caracteriza por síntomas que persisten durante más de 12 semanas tras una infección por SARS-CoV-2. Este estudio investigó las percepciones públicas sobre la COVID prolongada en Brasil. Se realizaron entrevistas con 1.295 participantes seleccionados por cuotas variables, según la distribución poblacional del país en cada región, con proporciones definidas por datos de la Encuesta Nacional por Muestra de Hogares (PNAD) de 2021 y del Censo IBGE de 2010, que revelaron que el 40,6% reportó haber tenido COVID-19 entre 2020 y 2023, y el 33,4% presentó síntomas durante al menos tres meses después de la infección. Los síntomas más comunes incluyeron fatiga (44,6%), dolor de cabeza (43,7%), caída del cabello (40,9%), pérdida de memoria (34,7%) y dificultad para concentrarse (28,7%). El estudio destaca que aunque los brasileños han experimentado posibles síntomas a largo plazo, desconocen los detalles de la condición. De esta manera, al aumentar la conciencia pública sobre el tema, la sociedad se vuelve capaz de exigir cuentas a las autoridades públicas en todos los niveles de poder, exigiendo una mejor atención para la COVID prolongada e insistiendo en políticas públicas efectivas. La importancia de la educación social en el tema es la base para un sistema de salud mejor enfocado a la atención de la población.

**Palabras clave** COVID prolongado, Percepción pública, COVID-19, Síntomas persistentes, Salud pública

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## Introduction

According to the recent World Health Organization (WHO) definition, long COVID is defined as the onset or persistence of a variety of symptoms occurring for more than 12 weeks after acute SARS-CoV-2 infection, without an alternative diagnosis. This condition is characterized primarily by many reported symptoms such as fatigue, dyspnea, and neurological and cognitive impairment and affects multiple organs and systems<sup>1</sup>. The etiology of long COVID is still poorly understood; hence, treatments focus only on symptom relief. Furthermore, the consequences of this syndrome are still unknown, as is the epidemiology of long COVID, which remains debated in the scientific community and among policy makers<sup>2</sup>.

Multiple hypotheses regarding the pathophysiology of long COVID, including virus persistence in tissues, host mitochondrial dysfunction, immune system dysregulation, persistent vascular injuries, preexisting comorbidities, and the clinical evolution of acute infection, have emerged and have recently been described in the literature<sup>3</sup>. However, the pathophysiology of long COVID remains an unanswered question in the academic world.

The delineation of this syndrome is complex, and epidemiological studies and clinical trials aiming to better understand it face substantial challenges. This complexity stems from the diversity of symptomatic manifestations among affected individuals, which hinders the development of an effective therapeutic approach and specific guidelines to guide clinical management. Nevertheless, the most frequently reported symptoms of long COVID include fatigue, dyspnea, altered senses of smell and taste, cognitive impairments such as memory loss and insomnia, and systemic impairments across multiple organs<sup>4,5</sup>. Studies have shown that even mild COVID-19 infections can lead to what is known as “brain fog”, which includes memory lapses and issues with executive functions. These impairments have persisted for up to 7 months post-infection, directly affecting patients’ quality of life and work performance<sup>6</sup>.

Recent studies have shown that among survivors of the acute phase of the pandemic between 2020 and 2021, 6.2% reported experiencing at least one long COVID symptom three months after acute infection. A recent study conducted in Brazil<sup>7</sup> indicated that 80% of the sample experienced persistent symptoms from the acute phase of COVID-19, with most patients

reporting more than one symptom for at least 120 days after the acute phase. Unfortunately, it is estimated that up to 20% of SARS-CoV-2 patients in the world experienced persistent symptoms after the acute phase of the infection, underscoring the importance of understanding the underlying factors of this prolonged symptomatology and appropriately guiding ongoing medical care<sup>8</sup>.

Some studies have reported strong correlations between the persistence of symptoms after the acute phase of the disease with groups that are more adversely affected during the initial phase, such as elderly individuals or those with preexisting conditions such as hypertension, diabetes, or heart disease. On the other hand, the long-term symptoms of COVID-19 also appear in patients whose acute disease phase is characterized as mild or asymptomatic across all age groups and even in the absence of preexisting conditions<sup>9</sup>.

A prospective study conducted in Brazil in 2023 analyzed the prevalence of factors associated with Long COVID, highlighting that three out of four adult participants continued to experience long-term symptoms from the acute phase. The study strongly associated this condition with being female, a sedentary lifestyle, and found an inverse relationship between COVID-19 vaccination and the prevalence of Long COVID<sup>10</sup>.

Unfortunately, little is being talked about the effects of long COVID in the population and there are only a few countries establishing public policies to combat the long-term symptoms of COVID-19. In addition, public perception of population might be evaluated to understand if there is a clear awareness about the risks of long COVID and how much it affects the lives of millions of people around the world. Furthermore, it is necessary to know what the gaps among the medical doctors and the understanding of the effects of long COVID are.

Brazil was strongly affected by COVID-19 and the pandemics have made more than 700.000 deaths, 250.000 people hospitalized and 39 million people infected<sup>11</sup>. There are few studies on epidemiology of the long-term symptoms of long COVID in Brazil and few studies are being conducted now using retrospective data analyzes and artificial intelligence (AI).

When searches concerning participants perception of long COVID are conducted in databases such as the PubMed, EMBASE, and Latin American and Caribbean Health Sciences Literature (LILACS) databases, the results are always

the same: there are no studies on the public's knowledge about the long-term symptoms after the acute phase of COVID-19. Therefore, given the current lack of comprehensive studies on this in the literature as well as in relation to the public perception of this health condition, this study aimed to estimate and analyze the public perception of post-COVID long-term symptoms in the Brazilian adult population. For this purpose, a national opinion survey was conducted and data were compiled among people who reported infection by COVID-19 and the post-COVID symptoms after the acute phase of infection. This perception was evaluated in the light of recent studies showing that characteristic symptoms of long COVID and brings several worries to the health system and the need to the rehabilitation.

## Methods

A quantitative sample study was conducted, consisting of a public opinion survey carried out from July 5<sup>th</sup> to July 10<sup>th</sup>, 2023, by the SoU\_Ciência Study Center and the Idea Institute. The survey was conducted using a structured questionnaire with 53 questions, targeting a representative sample of the Brazilian population, comprising 1,295 respondents of both sexes, residing throughout the country, aged 16 and older, with diverse demographic characteristics.

The sample was organized by variable quotas in line with the country's population distribution across each region, with proportions defined by data from the 2021 PNAD survey and the 2010 IBGE Census. Respondents were segmented by demographic characteristics (gender, age, ethnicity, region, education, social class, income, religion, municipality, and political orientation). A national sample of 1,250 to 1,300 interviews, with a 95% confidence interval, has a margin of sampling error of plus or minus 2.85 to 3 percentage points. Public opinion samples for national elections, for example, are composed on a similar scale. At the beginning of the questionnaire, we ask whether the participant consents to take part in the study. Both the control of inconsistencies and the breakdown of sociodemographic data are conducted daily throughout the data collection period.

All the selected participants stated that they had been previously diagnosed (between 2020 and 2023) with COVID-19, accounting for 40.6% of the initial sample. 661 (51%) participants reported not having been diagnosed with

the disease, and 108 (8.3%) stated that they did not know whether they had the disease; therefore, these participants were excluded from the next step analysis of the results.

The results obtained were analyzed categorically, considering such variables. The quantitative questions allowed only one response, whereas the qualitative questions allowed more than one response. The study was based on self-reported data, which may be subject to errors in memory or interpretation.

Participation in the survey was voluntary, and no financial incentives were offered to the participants. The project was conducted following Brazilian ethical norms for studies involving human subjects (Resolution CNS 466/2012) and was registered with the Ethics and Research Committee (CEP/UNIFESP) under number 1309/2021.

## Results

Between July 5<sup>th</sup> and 10<sup>th</sup>, 2023, 1295 individuals were interviewed via telephone to complete a questionnaire. From this pool, 526 participants reported to have had COVID-19 and then were considered for this study. This included 302 women (57.4%) and 224 men (42.6%). Among the participants, 240 (45.7%) were aged 45 years or older, 126 (24%) were between 35 and 44 years old, 107 (20.3%) were between 25 and 34 years old, and 57 (10%) were between 18 and 24 years old. Concerning the region of residence, 197 (37%) participants were residents of the Southeast Region; the percentages for the Northeast, South, North, and Midwest Regions were 28.9% (152 respondents), 12.6% (66), 12.3% (67), and 9.2% (48), respectively. The subjects answered several questions related to the COVID-19, the symptoms reported and the duration of them after the infection. Questions on the number of infections were also included. Table 1 shows the main persistent symptoms reported by the participants after COVID-19 and which might be related to the long COVID.

Regarding the need for hospitalization in the acute phase of the infection, 41 (7.8%) participants who were diagnosed with COVID-19 required hospitalization, while 341 (64.8%) sought outpatient medical care, and the remaining 138 (26.3%) abstained from seeking medical help during the infection. Additionally, questions were asked regarding the persistence of symptoms for more than 12 weeks and/or the appearance of symptoms perceived by the in-

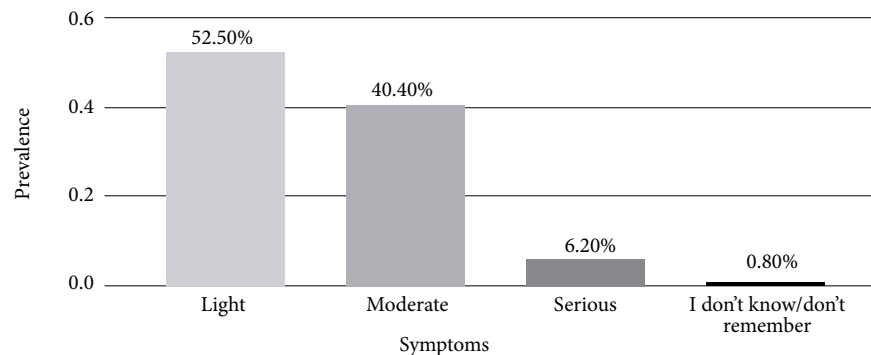
**Table 1.** Public perceptions about the persistence of symptoms after the acute phase.

|                                | Answer       |              | Did not answer |
|--------------------------------|--------------|--------------|----------------|
|                                | Yes          | No           |                |
| <b>Persistence of symptoms</b> | 285 (54.20%) | 241 (45.80%) | -              |
| Class of symptoms              |              |              |                |
| Respiratory                    | 276 (52.5%)  | 250 (47.5%)  |                |
| Cognitive                      | 292 (55.6%)  | 234 (44.4%)  |                |
| Others                         | 127 (24.1%)  | -            |                |
| Respiratory Symptoms           |              |              |                |
| Dyspnea                        | 89 (32.4%)   | 187 (67.6%)  |                |
| Cough                          | 136 (49.2%)  | 140 (50.8%)  |                |
| Fatigue                        | 200 (72.4%)  | 76 (27.6%)   |                |
| Others                         | 19 (6.9%)    | -            |                |
| No answer                      | -            | -            | 1.3%           |
| Cognitive Symptoms             |              |              |                |
| Memory loss                    | 189 (64.6%)  | 103 (35.4%)  |                |
| Insomnia                       | 108 (37%)    | 184 (63%)    |                |
| Mental confusion               | 60 (20.7%)   | 232 (79.3%)  |                |
| Difficulty concentrating       | 156 (53.5%)  | 136 (46.5%)  |                |
| Others                         | 23 (7.9%)    | -            |                |
| No answer                      | -            | -            | 2.6%           |
| Other reported symptoms        |              |              |                |
| Tachycardia                    | 50 (39.4%)   | 77 (60.6%)   |                |
| Headache                       | 81 (63.7%)   | 46 (36.3%)   |                |
| Severe hair loss               | 52 (40.9%)   | 75 (59.1%)   |                |
| Weight loss                    | 35 (27.2%)   | 92 (72.8%)   |                |
| Fever                          | 32 (25.2%)   | 95 (74.8%)   |                |
| Constipation                   | 26 (20.2%)   | 101 (79.8%)  |                |
| Others                         | 22 (17.7%)   | -            |                |
| No answer                      | -            | -            | 4.8%           |

Source: Authors.

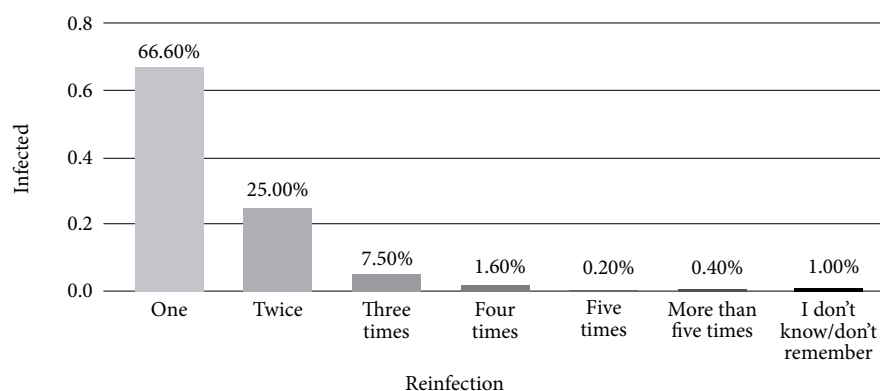
dividual. A total of 52.5% (276 individuals) of the participants reported that they experienced mild symptoms, 40.4% (212) reported experiencing moderate symptoms, and only 33 (6.2%) reported experiencing severe symptoms (Figure 1). Among the 526 study participants who have contracted COVID-19, 66% (348) reported to have been infected only once; 25% (131) were infected twice; 7.5% (39) were infected at least three times, and 1% (5) did not remember, indicating a reinfection rate of approximately 32.5% among patients with a history of COVID-19 (Figure 2).

All responses in this topic were considered regardless of the time of symptom onset after the acute phase, and this interval was distributed among participants as follows: Regarding the temporality of the clinical picture, 176 (33.4%) participants reported having symptom onset and/or persistence for at least three months, as follows: 52 (30%) participants stated that their symptoms persisted for two weeks after the end of the acute infection, followed by 35 (19.9%) who reported a duration of four weeks, 15 (8.5%) with a duration of two months, 9 (5.4%) with a duration of three months, 5 (2.8%) with a duration of four months, 2 (0.9%) with a duration of five months, 5 (2.7%) with a duration of six months, and 38 (21.6%) with a duration of more than 6 months (Figure 3).



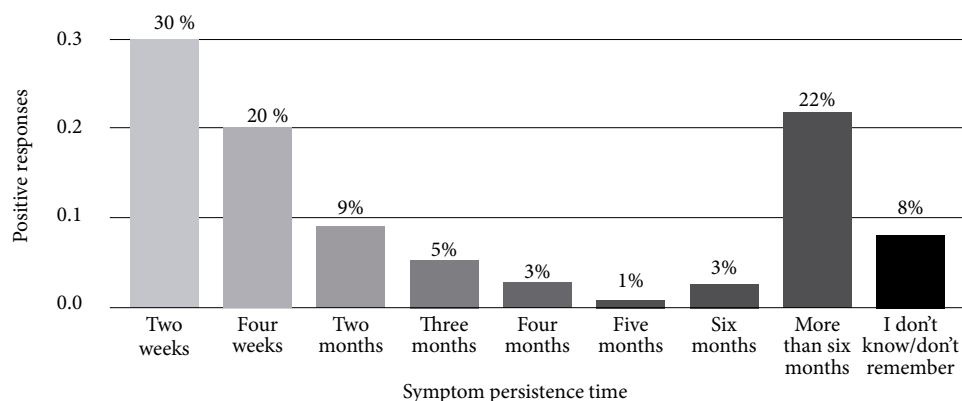
**Figure 1.** Participants perceptions of symptoms reported by people who were infected by SARS-CoV-2 during the analyzed period. The histogram shows the results of the responses to the question “What were the symptoms you experienced when you contracted COVID-19?” of patients who had mild, moderate or severe symptoms related to COVID-19.

Source: Authors.



**Figure 2.** Participants perceptions of symptoms reported by people who were infected with SARS-CoV-2 one, two, three, four or more than five times during the analyzed period. The histogram shows the results of the responses to the question “How many times have you had COVID-19?”.

Source: Authors.



**Figure 3.** Participants perceptions of the duration of symptoms reported by people with a history of COVID-19. The histogram shows the results of the responses to the question “How long (approximately) do you think the symptoms lasted after COVID-19?”.

Source: Authors.

## Discussion

The study presents some important limitations, mainly due to the methodology of telephone interviews. Among the limitations are information bias from participants and selection bias, as only individuals with access to telephones who were available to respond to the survey were

included. Additionally, it is not possible to objectively verify the information provided, as the questions relied on the participants' perception and memory without considering positive tests or medical records. We do not know the interval until the symptoms were investigated, only the perception of how long after the acute phase the symptoms persisted or appeared.

Proceeding with the analysis of the previously documented data obtained through the research conducted by the SoU\_Ciência Center<sup>12</sup>, it is possible to establish congruence between the literature and the responses provided by the participants in the present study. It is important to note that according to the WHO, long COVID is defined as the persistence or emergence of symptoms for at least three months after COVID-19 with a duration of at least two months without any other explanations or diagnoses<sup>9</sup>. On the basis of the definition of long COVID, the present study shows that approximately 33.4% (176) of the sample participants who reported symptoms after the acute phase of the disease, would be classified as long COVID subjects according to the WHO criteria.

A recent study revealed that 54% of patients diagnosed with COVID-19 experienced at least one symptom of long COVID which persists for one month<sup>13</sup>, these results are consistent with the Centers for Disease Control and Prevention (CDC) definition, which considers long COVID as symptoms lasting from 4 weeks onward<sup>3</sup> similar to what is observed in the present study, in which 49.9% of the patients experienced symptoms of long COVID for up to one month. Moreover, the appearance of symptoms related to the postacute sequelae of COVID-19 does not appear to be linked to the need for hospitalization during the acute phase of the infection, although it is considered a high risk factor<sup>5</sup>. This is evidenced by the fact that 54.2% of the interviewed patients who had been diagnosed with COVID-19 reported the persistence or emergence of symptoms after acute infection, whereas only 7.8% were hospitalized during the initial phase of the disease. Once again, participants perception reported in the present study aligns with the known literature, since studies estimate that the incidence of long COVID in adults who do not require hospitalization during the acute phase of COVID-19 ranges from 7.5% to 41%<sup>5</sup>. These data reveal a scenario of extreme heterogeneity and inconclusiveness in previous studies regarding hospitalization rates, which has significant implications for public health actions due to the wide variation in the results. It also demonstrates a concerning level of uncertainty about this matter in the literature which shows that it is necessary to further investigate this problem<sup>14</sup>.

On the other hand, another point showed an important similarity with the literature. The interviews revealed the following temporal distribution in terms of the duration of symptoms after the acute phase of infection: symptoms

lasting for two weeks (30%), symptoms lasting for one month (19.9%), or symptoms lasting for more than six months (21.6%). This finding is corroborated by others<sup>14</sup>, in which a pattern or temporal trend for the persistence of long COVID symptoms has not been established; in the referred study, the persistence of symptoms was reported to last for two, five, and eight months. When long-term symptoms are analyzed by organ systems, the risks of pulmonary, gastrointestinal, and musculoskeletal impairments remain high even two years after acute SARS-CoV-2 infection<sup>15</sup>.

In terms of general and respiratory symptoms, the results of the present study differ from those reported in the literature, as the percentages of patients who reported experiencing respiratory symptoms and fatigue after the initial SARS-CoV-2 infection (52.5% and 72.4%, respectively) are greater than those reported in previously published studies (39% and 49.6%)<sup>13</sup>. This highlights that fatigue is one of the most prevalent symptoms in patients experiencing long COVID, surpassing even common respiratory symptoms, such as cough and dyspnea, in the acute phase of the infection. In contrast to other long-term symptoms, some studies have noted that fatigue and neurocognitive impairment persist longer and may even worsen over time<sup>16</sup>. The same study revealed that, between hospitalized and nonhospitalized individuals, there was no statistically significant difference among those who reported some level of fatigue after the acute phase of the disease.

Finally, with respect to cognitive symptoms, it is known from preexisting studies that a subjective cognitive impairment (SCI) is reported globally among patients experiencing long COVID, meaning that patients experience a subjective change in their own performance, with areas such as memory, concentration, orientation, and language affected<sup>17</sup>. In the present study, the majority of participants (55.6%) who had been infected with COVID-19 reported experiencing persistent subjective cognitive symptoms after the initial infection; 64.6% of the patients reported experiencing memory loss, 53.5% reported experiencing difficulty concentrating, and 20.7% reported experiencing mental confusion, which is in line with the conclusions of the listed studies<sup>2,17</sup>. Consequently, depending on symptoms, the cognitive aspect may be affected in the majority of people, implying a long-term need for specific attention to the neuropsychological system in each individual affected by COVID-19.

Some published studies have aimed to relate long COVID to some specific antiviral medications for COVID-19 that combine nirmatrelvir and ritonavir. Certain publications from early 2023 indicate that this medication is associated with a 26% lower risk of developing long COVID over a 6-month period, in addition to reduced risks of hospitalization and death after the acute phase of the infection – 24% and 47%, respectively<sup>15</sup>. However, more recent studies from 2024 revealed that, based on a specific sample analyzed, the likelihood of developing postacute symptoms was 16% among patients who used the antiviral during the acute phase of infection, whereas it was 14% among those who had long COVID but did not use the medication<sup>18</sup>. There is still not enough scientific consensus on the efficacy of this medication in treating, preventing, or minimizing the effects of long COVID; more studies are needed to better understand the long-term effects of this medication.

It is important to mention that Long COVID has been studied by many authors by using retrospective data analyses and Artificial Intelligence (AI) to achieve an accurate analysis of the symptoms. In a recent study<sup>11</sup>, our group developed a method that allows analysis from medical records our University Hospital in São Paulo, Brazil. This tool showed excellent performance in investigating the effects of Long COVID on patients admitted to this hospital and followed up for several months after discharge. It is interesting to note that the analyses of the collected data from patients showed that dyspnea is a prevalent symptom which is similar to what we observed among the participants of the present study. These facts reinforce the idea that the perception of the Long COVID symptoms might become a very important element to identify the possible long-term symptoms associated with post COVID-19 and to prospect the seek for treatment and to prepare the health system for rehabilitation programs.

#### **Applicability and management of public policies**

Considering the entire context involving the perception of the participants of this study, it is necessary to evaluate the conditions of the post-COVID symptoms, especially in basic health units (UBSs) of the Health System in Brazil which may also be applicable in other countries that were severely affected by the pandemics. It is clear by several studies that many people have

faced long-term symptoms or residual manifestations after COVID-19 and they are unaware of the proper way to seek assistance. Thus, it is important to listen to the public need according to their perception. In light of this reality, it is crucial for healthcare professionals, in collaboration with health managers from different government spheres, to develop strategies to manage the care of these patients.

The first initiative of the Federal Government regarding long COVID was implemented through GM/MS Ordinance 3872 in December 2021. This measure allocates specific resources to patients affected by the syndrome while also disseminating guidelines aimed at ensuring follow-up care for those experiencing postacute infection sequelae, covering a period of six months<sup>19</sup>. However, importantly, the limited understanding of the topic among professionals still hinders the implementation of specific measures in the care of these patients.

In 2022, the Manual for Assessment and Management of Post-COVID Conditions in Primary Health Care<sup>20</sup> was released by the federal government, but the decentralization of actions resulted in local initiatives at the state and municipal levels, causing care for these patients to be uneven and ineffective across different territories. However, the mentioned manual is outdated and does not align with the reality of UBSs in the country. This happens because a significant portion of the guidelines require tests and consultations with specialists, with notoriously long waiting lists, leading to prolonged waiting times for patients to receive adequate treatment. Therefore, there is an urgent need to implement effective public policies focused on primary care in integrated regional networks with other levels of health care, aiming to encompass the significant portion of patients affected by post-COVID syndrome. Additionally, it is important to increase awareness among the population about the existence of long COVID, encouraging individuals to seek medical assistance and appropriate treatment.

The underreporting of COVID-19 cases in Brazil was a complex and heterogeneous phenomenon throughout the pandemic. It is estimated that the average rate of actual cases is 3.4 times higher than the reported number<sup>21</sup>, meaning that approximately 130 million Brazilians were infected, compared with the 38 million reported cases between 2020 and 2023. At the beginning of the pandemic, underreporting was particularly high, estimated at a rate of 9.2%; this means that for every 100 actual cases,

only 9.2 were reported<sup>22,23</sup>. This underreporting hindered the understanding of the true extent of the pandemic and the adoption of adequate and effective control measures. In the present study, 40.6% of the respondents reported having been previously infected with SARS-CoV-2, a number that may still be underestimated, reflecting the underreporting of cases. These data reflect a total of 215 people who are subreporting in this small universe, which, when expanded, aligns with the pandemic scenario in Brazil: the reporting rate of COVID-19 cases in the country is extremely low, which indicates an important lack of knowledge among government agencies on the real impact of the disease and the persistence of the long-term symptoms. Notably, without case reporting and without knowledge about acute infections among the population, the understanding of persistence and/or emergence of new symptoms is hindered; thus, the perception of long COVID cases is completely biased. Therefore, it is important to implement prevalence studies and measures to reduce the underreporting of COVID-19 cases, as this will help public authorities make more informed decisions and protect public health.

Finally, reinfection with SARS-CoV-2 is an important event to consider, as the number of reinfections can worsen an individual's health condition. Previous studies have shown that individuals who are reinfected with COVID-19 are at high risk of postacute symptoms, including pulmonary, cardiovascular, hematological, gastrointestinal, renal, metabolic, neurological, musculoskeletal, and psychological long-term symptoms<sup>24</sup>. These results indicate that virus reinfection may contribute to the development of long COVID, with evident risk even in vaccinated individuals. Furthermore, the collected data indicating a considerable reinfection rate (171 participants) raises another concern because

these patients are more likely to experience long-term symptoms in the acute phase of the disease than those who contract the disease only once.

## Conclusion

As discussed earlier, to reduce the risk of long COVID after SARS-CoV-2 reinfection, it is imperative that public authorities provide support to reinfected individuals, primarily through comprehensive health care measures provided by multidisciplinary teams, aiming to treat severe long COVID symptoms and improve patients' quality of life, along with quality rehabilitation, which can help individuals recover their physical and cognitive functions. In the Brazilian context, public policies to support reinfected individuals are still in the early stages, and it is necessary to ensure coverage and meet the specific needs of these individuals.

In this way, this study demonstrates it is important valuing public perception about Long COVID. Thus, by investigating the social perception of symptoms, we highlight which systems are most affected, allowing these patients to perceive the symptoms and seek appropriate help. Furthermore, by increasing public perception on the subject, society is allowed to cover public authorities from all spheres of power, demanding better care directed to Long COVID, insisting on effective public policies so that the problem can be combated with seriousness. Public agencies need to value public opinion, and studies that investigate social perception of the consequences of COVID highlight the need for popular prestige, listening and action aimed at the population. The importance of social education on the topic, therefore, is the basis for a better health system aimed at caring for the population.

## Collaborations

CRS Cavalcanti: study design, data analysis, manuscript writing, review and editing, manuscript adaptation. SS Smaili: study conception and design, critical review of the manuscript, project supervision, language review, guidance and mentoring. MH Citibaldi: data analysis, manuscript writing. CV Luis e PF Arantes: data analysis and figures revision. PF Arantes: study conception and design, data analysis and critical review of the manuscript. VM Sigolo: data analysis and critical review and figures preparedness. A Chioro: critical writing and review of the manuscript and support. PTV Fiorentino: methodology for data acquisition, critical review of the manuscript and support. M Moura: methodology for data acquisition, data analyses. D Foguel: data organization and critical review of the manuscript and support.

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