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Original article

Post-COVID-19 symptoms in a community sample: Exploratory study in two Chilean cities, 2023–2024

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ABSTRACT

Background: SARS-CoV-2 infection affects health, well-being, and the economy, especially considering the persistence of symptoms following an acute episode. This study aims to (1) estimate the frequency of symptoms following SARS-CoV-2 infections, (2) characterize symptoms compatible with post-COVID-19 conditions, and (3) explore risk factors for persistent symptoms among individuals from two Chilean cities diagnosed with COVID-19 at least once.

Methods: This cross-sectional exploratory study involved a convenience sample of individuals who participated in a prior seroprevalence study in Chile. Participants were recruited by phone between November 2023 and January 2024, and self-reported persistent COVID-19 symptoms using the modified Yorkshire Rehabilitation Scale, which assessed symptom severity and functional disability across three dimensions. Bivariate analysis explores the association between sociodemographic and health variables and reported symptoms using the Mann-Whitney-Wilcoxon and Kruskal-Wallis tests. Two Negative binomial models (Model 1: clinical factors and Model 2: clinical plus sociodemographic factors) evaluated factors associated with the severity of post-COVID-19 symptoms.

Results: Of the 144 participants successfully contacted, 83 met the inclusion criteria. A total of 80.7 % reported symptoms consistent with post-COVID-19. The most frequently reported symptoms were sleep disturbances (59.7 %), anxiety (59.7 %), and memory problems (58.2 %). Only three participants had received a formal post-COVID diagnosis, and none were receiving care through Chile's universal post-COVID program. Symptom severity was significantly higher in women ($p = 0.04$), individuals with two or more COVID-19 episodes ($p = 0.04$), and those with comorbidities ($p = 0.02$). Negative binomial regression analysis indicated that multiple COVID-19 episodes were associated with greater symptom severity.

Conclusions: A high percentage of participants experienced post-COVID-19 symptoms. Despite the high symptom burden, access to formal diagnosis and care was minimal, highlighting the need to strengthen diagnostic and management protocols within the Chilean healthcare system.

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Introduction

Since late 2019, the world has experienced an unprecedented pandemic caused by SARS-CoV-2, resulting in over six million deaths and 700 million reported cases within the first 36 months [1]. In Chile, the first COVID-19 case was identified in March 2020. To date, over five million cases and approximately 58,000 deaths attributed to the disease have been reported [2]. During the first wave of COVID-19, Chile ranked among the countries with the highest global

Abbreviations: C-19, COVID-19; C19-YRS, COVID-19 Yorkshire Rehabilitation Scale; C19-YRSm, Modified Yorkshire Rehabilitation Scale; CDC, Centers for disease control and prevention; COVID-19, Coronavirus Disease 2019; IQR, Interquartile range; NHS, National Health Service; PCR, Polymerase Chain Reaction; RR, Rate Ratio; SD, Standard deviation; SARS-CoV-2, Severe acute respiratory syndrome coronavirus 2; UK, United Kingdom; WHO, World Health Organization

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incidence rates during the southern hemisphere winter (June 2020). The virus's introduction and transmission dynamics during the first year were heterogeneous across the country's regions. While some areas experienced a pronounced peak in winter, others saw peaks during spring or summer, toward the year's end.

In contrast, reports from the World Health Organization (WHO) indicate that since late summer (March 2021), transmission dynamics have become more homogeneous across Chile and the broader Latin American region [3,4].

While most individuals infected with SARS-CoV-2 recover within a few weeks, some develop persistent symptoms that impair their physical capacity and quality of life over time, even if they were asymptomatic during the acute phase of COVID-19 [5]. The WHO has officially recognized prolonged or post-COVID-19 conditions [6]. This syndrome is characterized by the persistence of symptoms for at least three months after the onset of COVID-19, lasting more than two months without an alternative explanation. Globally, it is estimated that 10–20 % of individuals infected with COVID-19 may develop this condition [7].

National-level studies on post-COVID-19 conditions exist, but most focus on individuals hospitalized during the acute phase of infection. However, evidence shows that non-hospitalized individuals can also develop sequelae that impact their health [8–10].

According to WHO [11] and recent studies [12] common symptoms of post-COVID-19 conditions include fatigue, shortness of breath, and cognitive dysfunction. However, over 200 different symptoms have been reported, affecting daily functioning. These symptoms are typically categorized into several groups. General symptoms: Fatigue that interferes with daily life, and symptoms that worsen after physical or mental exertion. Respiratory and cardiac symptoms: Shortness of breath (dyspnea), cough, chest pain, and tachycardia. Neurological symptoms: Difficulty concentrating, headache, insomnia, dizziness upon waking, pins and needles sensation, changes in smell or taste, and depression or anxiety. Digestive symptoms: Diarrhea, abdominal pain.

The Centers for disease control and prevention (CDC) [13], identifies several factors that increase the risk of developing post-COVID-19 conditions, including more severe COVID-19 illness, particularly among those who were hospitalized or required intensive care. Other risk factors include pre-existing health conditions, lack of vaccination, and the experience of multisystem inflammatory syndrome during or after COVID-19 infection. Additional studies suggest that being female, as well as having obesity or hypertension, may also increase the risk [14].

Conversely, COVID-19 vaccination [15–17] prior to infection has been identified as a protective factor, associated with a reduced risk of developing post-COVID-19 conditions.

By the end of 2022, multiple variants of the virus had been reported, with the Omicron variant being of particular concern, according to the WHO. A recent systematic review indicated that the Omicron variant is associated with a lower likelihood of developing post-COVID-19 conditions [12]. In Chile, the Omicron variant has been predominantly circulating since late 2022 [18]

SARS-CoV-2 infection has significant health and economic implications [19] and presents a unique challenge due to its associated psychosocial burden [20]. Common symptoms such as anxiety, depression, post-traumatic stress disorder, psychological distress, and sleep disorders contribute to medical leave and absenteeism, among other negative outcomes. This highlights the need to reconsider the approach to post-COVID-19 conditions and the potential changes it may bring to the therapeutic relationship between doctors, patients, and healthcare providers [21].

In Chile, the current COVID-19 Rehabilitation policy does not address post-COVID-19 conditions for patients diagnosed before October 2022, and it defines the condition as one that begins within two weeks after hospital discharge [22].

While few tools have been developed to assess post-COVID-19 conditions, the COVID-19 Yorkshire Rehabilitation Scale (C19-YRS) is the most widely used. This screening tool, developed and recommended by the UK National Health Service (NHS), is used to assess the severity and disability of symptoms in patients diagnosed with COVID-19. It allows patients to compare their current symptoms with previous assessments, providing a baseline for targeted rehabilitation [23]

Systematic reviews have mapped the various post-COVID-19 symptoms, but these studies often have limitations, particularly regarding geographical representativeness. There is a need for more evidence from populations outside Europe, Asia, and North America [24]. Furthermore, there is a gap in understanding the social implications of the disease and its impact on population well-being. This underscores the importance of allocating resources to studies that deepen our understanding of the condition and help develop better treatments. This study aims to (1) estimate the frequency of symptoms following SARS-CoV-2 infections, (2) characterize symptoms compatible with post-COVID-19 conditions, and (3) explore risk factors associated with the development of these persistent symptoms among individuals from two cities in Chile diagnosed with COVID-19 at least once.

Methods

Study design

This is a cross-sectional exploratory study.

Study setting and participants

A convenience sample of 390 individuals with complete contact information, who had participated in a previous population-based seroprevalence study conducted in two Chilean cities (La Serena-Coquimbo and Talca) during April-May 2022, was invited to participate [25,26]. Recruitment occurred between November 2023 and January 2024. Inclusion required a previous diagnosis of COVID-19, with no exclusion criteria. This study reports findings from 83 individuals who met the inclusion criteria and consented to participate (Fig. 1).

Data sources and measurements

Sociodemographic, epidemiological, and clinical data were collected via telephone interviews. Interviewers, who were healthcare students, were trained to ensure accurate information gathering. The calling protocol involved at least three attempts on different days and times. Self-reported persistent symptoms of COVID-19 were assessed using the Modified Yorkshire Rehabilitation Scale (C19-YRSm), developed and recommended by the UK National Health Service (NHS). This scale measures symptom severity and functional disability, serving as an initial screening tool during triage appointments, rather than for diagnosing post-COVID-19 condition [23]. This approach enabled the identification of key symptoms, symptom spectrum, and disease course.

Variables

The dependent variable was the presence of symptoms as assessed by the post-COVID-19 National Health Service (C19-YRSm) [23]. The symptoms were categorized into different dimensions. The C19-YRSm includes 17 items, rated on a scale from 0 (no symptom) to 4 (extremely severe), evaluating symptoms after COVID-19. The questionnaire is divided into three dimensions: *Dimension 1*: Symptom severity score (e.g., fatigue, cough, cognitive symptoms) (0–30); *Dimension 2:* Functional disability score (e.g., social

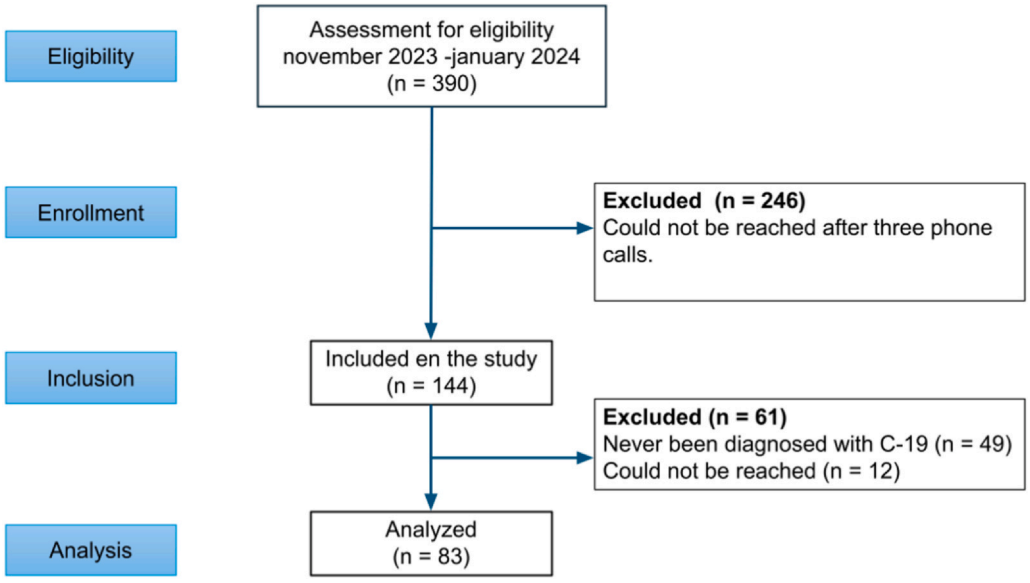


Fig. 1. Participant enrollment for the nested cross-sectional study in two Chilean cities, 2023–2024.

behaviors, communication, mobility) (0–15); *Dimension 3*: Additional symptoms (e.g., fever, rash, hair loss, tinnitus, nausea, etc.) (0–25). We defined post-COVID-19 symptoms as symptoms related to post-COVID-19 that they did not have before having COVID-19.

Independent variables included sociodemographic factors (age, sex [self-reported as female, male, or other], education, indigenous affiliation [self-reported as yes/no], medical insurance, city), and clinical/epidemiological factors (nutritional status, smoking habits, comorbidities, number of COVID-19 episodes, COVID-19 symptomatology, and access to the "Post-COVID-19 Rehabilitation Program").

Statistical analysis

Proportions were used to describe categorical variables. Each dimension of the C19-YRSm scale [23] was evaluated using a score derived from the sum of individual responses within the dimension, with higher scores indicating more severe symptomatology. The Shapiro-Wilk test was applied to assess the normality of the score distributions.

Bivariate analyses examined associations between sociodemographic and health variables and the scores for each dimension. The Mann-Whitney-Wilcoxon nonparametric test was employed for independent variables with two categories, while the Kruskal-Wallis test was used for variables with three or more categories with 95 % significance.

Given the social and well-being implications of symptom severity scores and the data structure, a negative binomial model was applied [27]. Two models were used to assess the factors associated with the C19-TRSm Dimension 1 symptom severity score. In Model 1, the independent variables included only medical conditions—specifically, comorbidities, the number of self-reported COVID-19 episodes (confirmed by PCR, antigen, rapid tests, or medical diagnosis), and vaccination status (categorized as yes/no). Model 2 incorporated additional independent variables: age, sex, and type of health insurance (public or private). Both models were specified to estimate incidence rate ratios (RRs) and their corresponding 95 % confidence intervals for each variable using bootstrap standard errors with 1000 replications to improve the reliability of the estimates given the small sample size. Analyses were performed in RStudio (version 2024.12.1 +563) using R (version 4.5.0) or in STATA/IC version 15 (StataCorp LLC).

Ethical considerations

All procedures adhered to relevant laws and institutional guidelines and were approved by the following ethics committees: Ethics Committee of the Universidad del Desarrollo (Approval number: 2023–52, June 8, 2023); Ethics Committee of the Universidad de Talca (Statement number: 14–2023, August 2, 2023), and Faculty of Medicine, Universidad Católica del Norte (Statement number: 27/2023, August 2, 2023). Informed consent was obtained from all participants prior to their involvement in the study.

Results

A total of 63.1 % of possible eligible individuals could not be reached (Fig. 1).

Participants had a mean age of 44 years, and the majority identified as female. Most participants reported being beneficiaries of public health insurance, and approximately one-third had completed university education (Table 1). The demographic characteristics of participants were similar to those of non-participants. Among non-participants, the mean age was 54 years (range: 7–93), 65.8 % identified as female, 82.7 % had public health insurance, and 32.8 % had completed high school (data not shown).

Hypertension was the most reported comorbidity among participants, followed by hypothyroidism, prediabetes, and diabetes. Additionally, approximately one-quarter of participants reported being current smokers (Table 1).

Most participants reported only one COVID-19 episode. Nearly two-thirds contracted the infections in 2022, compared to 13.9 % in 2023. During the first episode, the vast majority experienced at least one symptom. This proportion declined by 10 percentage points in the second episode and dropped to just half by the third. Hospitalization was required by one participant. Regarding COVID-19 vaccination, nearly all participants had received vaccines, with approximately one-third reporting five doses and nearly half reporting four doses (Table 2).

Approximately four-fifths of participants reported post-COVID-19 symptoms (symptoms related to post-COVID-19 that they did not have before having COVID-19) (Table 3). Fig. 2 illustrates the most frequently reported symptoms, which included sleep disturbances (59.7 %), anxiety (59.7 %), memory problems (58.2 %), concentration or attention difficulties (52.2 %), fatigue in daily activities (49.3 %),

Table 1
Biodemographic and health characteristics of participants in the post-COVID-19 condition symptoms study in two Chilean cities, 2023–2024.

Variable		n (n = 83)	Percentage (%)
Age-median (range)		43.9 (10–77)	
Sex*	Male	29	34,9
	Female	54	65,1
Education	Elementary education and lower	7	8,4
	High school education	27	32,5
	Technical education	24	28,9
	University	25	30,1
Indigenous affiliation	Yes	8	9,6
Medical Insurance	Public insurance	74	89,2
	Private insurance	9	10,8
Comorbidities	Cancer	1	1,2
	Diabetes/metabolic syndrome	15	18,1
	Hypertension	17	20,5
	Cardiopathy	4	4,8
	Hypothyroidism	12	14,5
	Chronic obstructive pulmonary disease	8	9,6
	Chronic renal failure	2	2,4
	Fibromyalgia	4	4,8
	Osteoarthritis	4	4,8
	Other	16	19,3
Smoking habits	Yes	21	25,3
Daily smoking (number of cigarettes)	Less than 1	4	19
	1–5	10	47,6
	6–10	3	14,3
	11 or more	3	14,3
	Electronic cigarette	1	4,8

* No participants self-identified as belonging to the "other" category.

Table 2
Clinical characteristics of participants in post-COVID-19 condition symptom study conducted in two Chilean cities, 2023–2024.

Variable			n (n = 83)	Percentage %
Number of COVID−19 episodes* (n = 108)	One		62	74.7
	Two		17	20.5
	Three or more		4	4.8
Year of COVID−19 episode (n = 108)	2020		11	10.2
	2021		17	15.7
	2022		65	60.2
	2023		15	13.9
Average time elapsed between last episode and survey day (Mean- SD)			516	275.3
Symptomatology COVID−19 (at least one symptom)	First episode	Yes	77	92.8
	Second episode	Yes	17	81.0
	Third episode	Yes	2	50.0
COVID−19 hospitalization	Yes		1	1.2
COVID−19 vaccine	Yes		82	98.8
Doses of COVID−19 vaccine	2345		3113729	3.613.344.634.9

SD: Standard deviation
* A total of 108 episodes

and feelings of depression (46.3 %). Additional symptoms reported were muscle pain (44.8 %), headaches (43.3 %), dyspnea while walking (41.8 %), and joint pain (40.3 %). Among these, the symptoms with the highest reported severity were sleep disturbances, anxiety, memory problems, feelings of depression, and headaches.

The most frequently reported specific symptoms included paresthesia (numbness, tingling, or itching), hair loss, tinnitus, ocular dryness/redness, and visual disturbances (Table 3).

When asked about the impact of post-COVID-19 symptoms on their jobs or occupations, more than half reported no changes, while approximately one-fifth had taken sick leave, and one-tenth had reduced their work hours. Notably, one participant resigned from their job due to post-COVID-19 symptoms. Additionally, three participants were formally diagnosed with long COVID-19. However, none of these individuals reported receiving care through the universal post-COVID-19 program available in the Chilean Health System (Table 3).

Table 4 presents the analysis of sociodemographic variables related to post-COVID-19 symptomatology, based on Dimension 1 (symptom severity score) assessed by the C19-YRSm. In Dimension 1, significant differences were observed between sexes, comorbidities, and the number of COVID-19 episodes. Women reported higher median severity scores than men, with the difference reaching statistical significance. Furthermore, individuals with two or more COVID-19 episodes had higher symptom severity scores than those with only one episode, with a p-value of 0.04. A significant difference in Dimension 2 (functional disability) was observed only by city (p-value < 0.01), with a higher score in La Serena-Coquimbo. In Dimension 3 (additional symptoms), differences were observed by sex (p-value < 0.01) (higher scores in females) and education level (p-value = 0.02) (higher scores among individuals with a high school education).

Two Negative Binomial regression models were used to assess the symptom severity score (dimension 1) as a function of two sets of independent variables. Model 1 includes only clinical variables, while Model 2 additionally incorporates sociodemographic factors such as sex, age, and health insurance as a proxy for socioeconomic status and access to healthcare services. The results of this regression for the common variables are shown in Fig. 3, and detailed results are available in the supplementary files.

In Model 1, COVID-19 vaccination, having experienced two or more episodes of COVID-19, and the number of comorbidities were significantly associated with symptom severity. Vaccination showed a protective effect, while multiple episodes of COVID-19 and a higher number of comorbidities were associated with increased symptom severity. When sociodemographic variables are included in Model 2, neither clinical nor sociodemographic variables remain statistically significant, except for the number of COVID-19 episodes. Specifically, participants who had experienced two or more episodes of COVID-19 were 1.42 (95 % CI 0.98–2.05 and 90 % CI 1.04–1.95) times more likely to report severe symptoms compared to those with only one episode.

Discussion

The study examined post-COVID-19 symptoms in a community sample from two Chilean cities. A high proportion of participants (80.7 %) reported experiencing post-COVID-19 symptoms. The most common symptoms included sleep disturbance, anxiety, memory problems, and difficulties with concentration or attention. The symptoms with the highest severity were sleep disturbance, anxiety, memory problems, depression, and headaches. Individuals with two or more COVID-19 episodes were more likely to report higher symptom severity scores. These findings underline the multidimensional nature of the syndrome, encompassing physical, cognitive, and physiological symptoms.

This study highlights the high frequency of persistent post-COVID-19 symptoms in a significant proportion of the population, emphasizing the importance of understanding the underlying mechanisms and factors influencing the onset and persistence of these symptoms. The time elapsed between the COVID-19 episode and the questionnaire administration may impact the frequency of reported symptoms. If the questionnaire is administered long after the episode, some individuals may no longer recall their symptoms

Table 3
Symptoms and changes in living conditions of participants in the post COVID-19 symptoms study in two Chilean cities, 2023–2024.

Variable		(n = 83)	Percentage (%)
Post COVID−19 Symptomatology	Yes	67	80.7
	No	16	19.3
Detailed post- COVID−19 Symptomatology (n = 67)	**Dermatologic/Hematologic**	41	66.1
	- Skin rash/skin discoloration	18	27.3
	- New allergy	13	20
	- Hair loss	30	46.2
	- Easy bruising and/or bleeding	15	22.4
	Gastrointestinal	34	50.7
	- Difficulty swallowing liquids	6	9
	- Difficulty swallowing solids	6	9
	- Nausea	10	14.9
	- Dry mouth and/or mouth sores	19	28.4
	- Reflux and/or heartburn	19	28.4
	- Constipation. diarrhea or bowel incontinence	16	23.9
	General	30	47.6
	- Fever	7	10.8
	- Change in appetite	20	30.3
	- Unintentional weight changes	22	33.3
	Genitourinary/Reproductive	26	41.9
	- Bladder frequency. urgency or incontinence	18	26.9
	- Change in menstrual cycles or menstrual flow	15	24.2
	Metabolic	21	38.2
	- Alteration in glycemic profile	17	28.8
	- Alteration in lipid profile	17	30.4
	Neurologic/Sensory	47	74.6
	- Sensation such as numbness, tingling or itching	33	49.3
	- Visual changes	24	36.4
	- Problems with balance. weakness and coordination	17	25.4
	- Tinnitus	28	43.1
	- Thoughts of self-harm	4	6.1
	Others	37	56.1
	- Dryness and/or redness of eyes	25	37.3
	- Swelling of feet and/or hands	18	27.3
	- Waking up at night without air	17	25.4
Did COVID−19 affect your Job/Occupation? Multiple answer allowed	No change	36	53.7
	Reduced my work hours	8	11.9
	Took sick leave from COVID−19	15	22.4
	Changes in my job role: working from home	8	11.9
	Changes in my job role: quieter activities	1	1.5
	Had to resign	1	1.5
	I had to quit and change jobs	4	6
	I was laid off	3	4.5
Have you been diagnosed with Long COVID−19?	Yes	3	4.5
	No	64	95.5
Have you been enrolled in the rehabilitation program? (n = 3)*	Yes	0	0

* In Chile, the rehabilitation program is available only to individuals diagnosed with Long COVID-19.

accurately. A systematic review [28] comprising 194 studies it was reported that 45 % of participants, regardless of hospitalization status, experienced persistent symptoms approximately four months after infection. Among non-hospitalized participants, the five most prevalent symptoms were fatigue/weakness (34.8 %), breathlessness (20.4 %), muscle pain (17 %), and sleep problems (15.3 %). In hospitalized participants, the most commonly reported symptoms were fatigue/weakness (28.4 %), general pain/discomfort (27.5 %), sleep problems (23.5 %), breathlessness (20.4 %), and loss of smell (12.6 %), which closely align with the findings of this study in Chile [28].

This indicates that a considerable proportion of individuals who have had COVID-19 may continue to experience long-term health consequences, even if they were not hospitalized, as reflected in the findings of this research. The symptoms reported by participants not only affect their quality of life, but also significantly impact their work capacity. This is evident from participants taking sick leave or reducing their working hours due to these symptoms.

In a study conducted in the Qassim Region of Saudi Arabia [29], the most common symptoms reported four weeks after infection included laryngeal complications (50 %), swallowing changes (43.8 %), and fatigue (31.3 %). These findings are lower than our study's 49 % reporting fatigue. This discrepancy may be explained by the higher proportion of individuals with comorbidities in our sample (51.8 %) compared to the Saudi Arabia study (40 %). Another possible explanation is selection bias, as participants with persistent symptoms may have been more likely to participate in our study.

Several studies have identified female sex and the presence of comorbidities as significant risk factors for developing post-COVID conditions [30]. However, our study did not find this association. This discrepancy may be the result of our convenience sample, potential selection bias, or insufficient demographic variability. Nevertheless, the history of the number of episodes of acute illness appears as the main risk factor. Understanding these risk factors is essential for identifying vulnerable populations and implementing effective preventive strategies.

Although the mechanisms underlying post-COVID conditions are not yet fully understood, it is hypothesized that a combination of factors may contribute to their development.

In summary, these findings emphasize the critical need to investigate the natural history and long-term sequelae of COVID-19. It is also essential to account for potential biases in studies and assess their impact on reported outcomes. The limited availability of medical care for individuals with persistent post-COVID-19

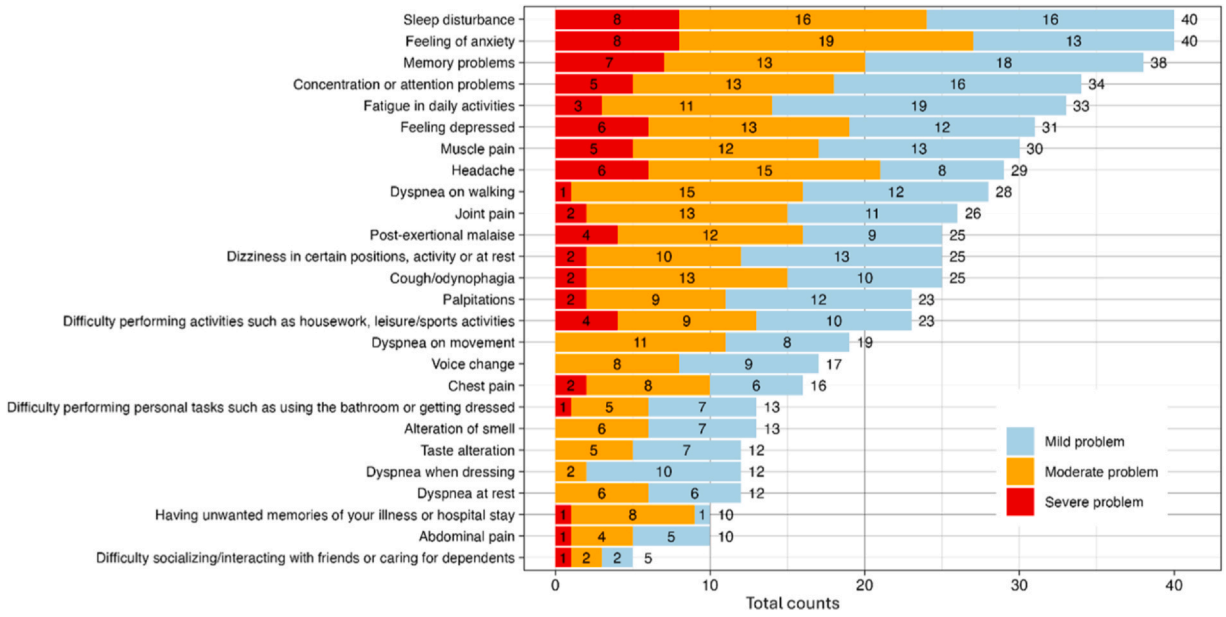


Fig. 2. Presence and severity of symptoms or worsening of pre-existing symptoms after COVID-19 in two Chilean cities, 2023–2024. (n = 67) Mild problem; does not affect daily life, Moderate problem; affects daily life to a certain extent, and Severe problem; affects all aspects of daily life; life-disturbing.

Table 4
Analysis of sociodemographic variables related to post-COVID-19 condition symptomatology score, according to dimensions 1 of the COVID-19 Modified Yorkshire Rehabilitation Scale Questionnaire.

Variable	Categories			Dimension 1 (symptom severity)		
		n	%	median	IQR	p-value
Sex	Male	29	34.9	5	3–10	0.04
	Female	54	65.1	9	5–13	
Age group	7–19	4	4.8	2.5	0.5–9.5	0.34
	20–29	11	13.3	5	2–10	
	30–49	37	44.6	8	3–12	
	50–59	19	22.9	10	5–13	
	60 or more	12	14.5	8.5	4.5–11.5	
Education	Elementary education and lower	7	8.4	2	0–13	0.12
	High school education	51	61.5	9	5–13	
	University or technical education	25	30.1	8	3–11	
Medical Insurance (n = 81)	Public insurance	69	85.2	8	4–12	0.50
	Private insurance)	12	14.8	8.5	2–11	
Indigenous affiliation	Yes	75	90.4	8	4–12	0.53
	No	8	9.6	9	4.5–13.5	
Smoking habits	Yes	62	74.7	9.5	3–13	0.43
	No	21	25.3	6	4–9	
City	Coquimbo-La Serena	48	57.8	6	3–11.5	0.14
	Talca	35	42.2	10	5–13	
Comorbidities	No	40	48.2	5	2.5–10.5	0.02
	Yes	43	51.8	10	5–13	
Number of COVID−19 episodes	One	45	54.2	7	3–10	0.03
	Two or more	38	45.8	10	4–14	
Vaccine	No	1	1.2	14	0–1	
	Yes	82	98.8	8	4–12	0.21
Doses of COVID−19 vaccines	Basal schedule plus boosters	51	63.8	9	4–13	0.48
	bivalent	29	36.2	6	3–10	

IQR: interquartile range; *p*-value corresponds to bivariate analysis (Mann-Whitney or Kruskal-Wallis). Dimension 1: symptom severity score (e.g. fatigue, cough, cognitive) (0–30).

symptoms raises significant concerns about the effectiveness and accessibility of rehabilitation programs within the healthcare system, particularly in countries like Chile.

In Chile, the national health program that guarantees universal access to rehabilitation services is designed exclusively for patients hospitalized with COVID-19, excluding outpatient cases. This limitation underscores a substantial gap in identifying and managing Long COVID cases, potentially restricting patients' access to appropriate care and adversely affecting their quality of life.

This study has several limitations that should be considered when interpreting the results. The non-probabilistic convenience sampling approach may have introduced selection bias, as individuals experiencing post-COVID symptoms were potentially more motivated to participate, possibly resulting in an overestimation of symptoms and severity. Although our response rate is comparable to those reported in similar telephone surveys [31,32], a substantial proportion of unreachable participants (63.1 %) suggests a potential non-response bias that could affect the representativeness of our findings. Therefore, these findings may not be generalized outside the study population, even though the socio-demographic characteristics of the participants were similar to those of individuals who were not interviewed.

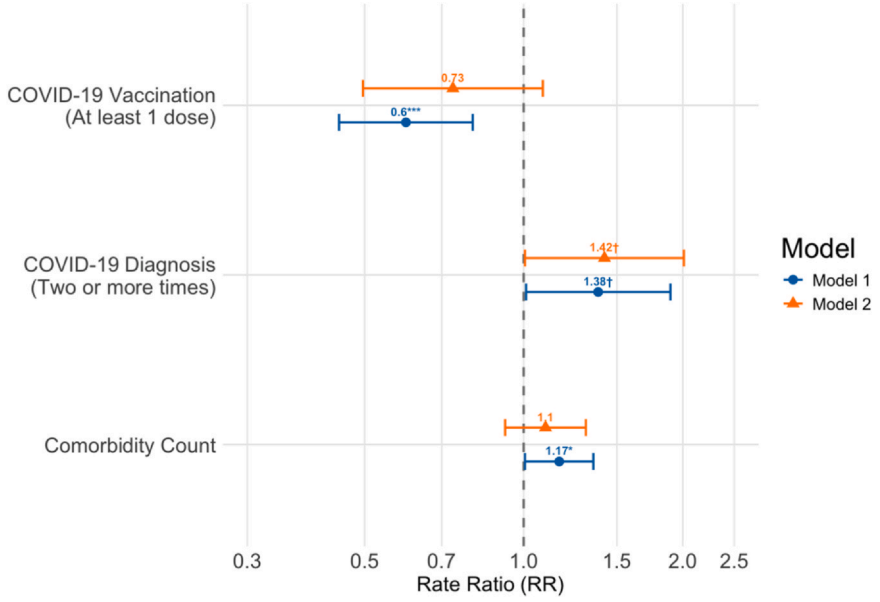


Fig. 3. Negative binomial regression results. Model 1: COVID-19 vaccination, having experienced two or more episodes of COVID-19, and the number of comorbidities. Model 2: incorporated additional independent variables: age, sex, and type of health insurance (public or private). Error bars represent 95 % confidence intervals. Dashed line indicates RR = 1 (no effect) and Significance: *** p < 0.001, ** p < 0.01, * p < 0.05, † p < 0.10.

The reliance on self-reported symptomatology using the C19-YRSm questionnaire introduces potential recall bias considering the time (79–1379 days) between infections and assessment. Additionally, without a control group of individuals without a COVID-19 history, we cannot attribute all reported symptoms specifically to SARS-CoV-2 infection rather than other health conditions or psychosocial factors.

The cross-sectional design prevents establishing a causal relationship between identified risk factors and post-COVID-19 symptoms and does not capture the temporal evolution of symptomatology. Additionally, although the final sample size (n = 83) met the minimum calculated requirements, its relatively small size limits statistical power for subgroup analysis and the detection of less common symptom patterns.

Despite these methodological constraints, this study provides valuable community-based insights into Chile's burden and pattern of post-COVID symptoms, complementing hospital-based cohorts that may overrepresent severe cases. Future longitudinal studies with more extensive, probability-based samples and objective clinical assessments must address these limitations.

Conclusions

A high symptoms burden was observed. Formal diagnosis and care through the Chilean post-COVID-19 program were extremely low, suggesting a significant under-recognition of this condition. A critical gap exists between reported symptoms and formal diagnosis, highlighting the need for improved diagnosis and management protocols within the Chilean healthcare system.

Ethical approval

This research was approved by the Ethics Committees of the Universidad del Desarrollo number 52/2023, Ethics Committees of the Universidad de Talca Statement number 14/2023, and the Facultad de Medicina of the Universidad Católica del Norte Statement number 27/2023. Informed consent was obtained from all subjects involved in the study.

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Data availability

The authors declare their willingness to share data of interest from this paper upon request to the corresponding author.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used the free version of ChatGPT-4.0 to check for grammar and readability. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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