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One-year follow-up of depression, anxiety, and quality of life of Peruvian patients who survived COVID-19

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Abstract

Purpose To assess health-related quality of life (HRQoL) and its associated factors in patients who survived COVID-19 and to assess a prospective evaluation of the prevalence and severity of their depression and anxiety symptoms.

Methods We followed up a sample of hospitalized patients who survived COVID-19 at 3 and 12 months after discharge. We assessed HRQoL (Euroqol-5D-5L) through telephone interviews. Any problem in any dimension of Euroqol-5D-5L was considered as low HRQoL. The depression and anxiety symptoms were measured using the Patient Health Questionnaire-9 and Generalized Anxiety Disorder-7 tools, respectively. We estimated the adjusted prevalence ratios (aPR) to low HRQoL using Poisson regression and the changes on their depression and anxiety symptoms during the follow-up.

Results We included 119 patients with a mean follow-up time of 363.6 days. 74% of the participants had low HRQoL at one year after hospital discharge and were associated with being ≥ 41 years old (aPR: 1.95), having a previous history of psychiatric diagnoses before COVID-19 infection (aPR: 1.47), having any COVID-19 symptom during the follow-up at one year (aPR: 1.84), and having a family member who had died from COVID-19 during the first wave (aPR: 1.24). In addition, the clinically relevant depression symptoms were frequent, and they increased from 3 (14.3%) to 12 months (18.5%).

Conclusion One year after COVID-19 hospitalization discharge, patients had low HRQoL, and their depression symptoms increased. These findings acknowledge the need to provide services that adequately address mental health sequels and HRQoL to reduce the burden of the COVID-19.

Keywords COVID-19 · Depression · Anxiety · Quality of life · Peru

Introduction

The pandemic of the coronavirus disease 2019 (COVID-19) severely affected the general population's physical, psychological, social, and spiritual well-being [1]. The patients who recovered and survived the disease are one of the most affected groups. Until January 2022, they are more than 250 million people [2]. However, observational studies reported that around 80% of these patients had some clinical manifestations that persisted several months after the discharge or recovery from the infection [3]. In addition, COVID-19 survivors have a low health-related quality of life (HRQoL) months after hospital discharge, especially in physical activities and pain/discomfort [4], mainly related to clinical manifestations. Furthermore, the long-term effects of COVID-19 might have a negative impact on the overall HRQoL of the COVID-19 survivors [5].

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Mental health afflictions caused by the pandemic are more frequent in vulnerable groups such as children, elders, frontline workers, people with pre-existing mental pathologies, and, more specifically, individuals who recovered from COVID-19 [6, 7]. In this last group, depression, anxiety, posttraumatic stress, and poor sleep quality persist for several months after hospital discharge [8–10]. In addition, some factors associated with a higher frequency of mental disorders have also been identified, such as being female, having a greater severity of COVID-19, the persistence of physical sequelae, death of a family member due to COVID-19, and previous psychiatric diagnosis and treatment [11, 12]. Moreover, longitudinal studies reported the deterioration in their HRQoL up to six months after hospital discharge [13–15]. However, few studies described a correlation between the quality of life decline and the severity of the disease during hospital stay [13, 16, 17].

Some studies reported the effects on mental health and HRQoL one-year post-COVID-19 recovery [18], but not many in low- and middle-income countries. Latin America is one of the most affected regions by the pandemic [19, 20]. Specifically, Peru is one of the countries with the highest number of infections and deaths associated with COVID-19 per inhabitant in the world [21]. In addition, Peru's political, health, and socioeconomic crisis has generated persisting challenges in health management during the pandemic, such as limited health infrastructure, patient care equipment, and availability of hospital beds and specialist physicians [22]. This context in the country during the pandemic impacted several populations, such as students and elders [23, 24]. However, there is still missing data about the COVID-19 survivors. Therefore, the objectives of this study were to include patients who survived COVID-19 and 1) to evaluate the HRQoL and their associated factors after the second COVID-19 wave in Peru (T2), after one year of hospital discharge, and 2) to carry out a prospective analysis of the frequency and severity of depression and anxiety symptoms after the end of the first (T1) and second COVID-19 waves in Peru (T2). We hypothesized that COVID-19 survivors 1) had an overall low HRQoL associated with age, history of psychiatric diagnoses, and persistent COVID-19 symptoms, and 2) they had persistent depression and anxiety symptoms after three months and one year of follow-up after hospital discharge.

Materials and methods

Study design and context

This observational study assessed the follow-up of individuals who survived COVID-19 and were discharged from the hospital, as evaluated in a previous study [12]. The follow-up includes two assessment moments. We conducted the first evaluation after hospital discharge at the end of the first COVID-19 infections wave in Peru, during October and November 2020 (T1), approximately three months after hospital discharge. The second evaluation was at the end of the second COVID-19 infections wave, during July and August 2021 (T2), about one year after hospital discharge. Therefore, we developed two different analyses: (a) A cross-sectional analysis of HRQoL measured at T2 and (b) a longitudinal analysis of depression and anxiety symptoms measured at T1 and T2.

The first wave of the COVID-19 pandemic in Peru was from March to November 2020 and caused more than 173 thousand deaths probably to COVID-19, one of the highest per-capita rates of excess mortality in the world [25]. During that time, the Peruvian government established a strict national lockdown from March 16th to June 30th. During October and November 2020 (T1), the Peruvian government announced the end of focalized lockdowns due to the reduction of positive and hospitalized cases. However, the night curfew and restriction of using private vehicles on Sundays remained. Also, there was a progressive opening of land and air transport in and outside the country. The second wave of the COVID-19 pandemic in Peru was from January to August 2021, reaching more than 200 thousand confirmed deaths due to COVID-19 [26]. During July and August 2021 (T2), the Peruvian government was distributing the COVID-19 vaccine to adults, and there weren't specific restrictions on the population, besides using masks out and indoors, social events restriction, and partial obligation of COVID-19 vaccination to enter inside shopping malls, restaurants, and public transport.

We carry out this study at Hospital Nacional Guillermo Almenara Irigoyen (HNGAI) in Lima, Peru, which is the second-largest hospital in the "Peruvian Social Health Insurance" (EsSalud, in Spanish), with a total of 815 hospital beds. Furthermore, it is a third-level hospital and has all medical specialties. EsSalud is one of the leading Peruvian medical insurances and treats patients who are formal employees and their relatives. During the COVID-19 pandemic, HNGAI is a national referral center for the care of COVID-19 patients.

Participants and sampling

We assessed a simple random sample of 318 patients who had been hospitalized due to COVID-19 during March and September 2020 and survived. The original randomized sampling and recruitment techniques were explained in a previous report [12]. In brief, we identified this sample after reviewing the list of 1910 adult patients diagnosed with COVID-19 and discharged from the HNGAI during that period. Then, we excluded deceased patients, those referred

to another center, those with voluntary discharge, and those who had two or more hospitalizations since March 2020. The original sample size for T1 considered a margin error of 5%, a design effect of 1, and a 95% confidence interval. Then, for T2, we excluded patients who didn't answer the follow-up call, refused to participate, or died due to an illness unrelated to COVID-19 since November 2020.

Variables

At T1, we only assessed depression and anxiety symptoms as the main outcomes. Then, at T2, we evaluated depression, anxiety symptoms, and HRQoL as the main outcomes.

Health-related quality of life

The Euroqol-5D-5L (EQ-5D) scale applies to patients and the general population for describing and assessing HRQoL [27]. It can be applied through a personalized interview or telephone [28]. This scale had two parts where individuals self-assess their health status: the EQ-5D descriptive system and the Visual Analogue Scale (VAS). The EQ-5D descriptive system comprises five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension is encoded in 1 (No problems) to 5 (extreme problems), where the combination 1–1-1–1-1 indicates the best health state possible in the five dimensions and 5–5-5–5-5, the worst health state. Therefore, we considered the result of 1–1-1–1-1 as adequate HRQoL while any other combination as low HRQoL. On the other hand, in the VAS system, subjects could self-assess their health condition through a scoring system ranging from 0 to 100, representing the worst and best possible health conditions, respectively [27]. Widely used globally, the EQ-5D-5L version is available in more than 130 languages, including Spanish, and it has a Cronbach's alpha reliability score of 0.90 [27].

Depression symptoms

For the assessment of depression symptoms, we used the Patient Health Questionnaire-9 (PHQ-9). As is known, PHQ-9 is also a self-administered scale consisting of 9 items, rated on a Likert scale ranging from 0 ("not at all") to 3 ("almost every day"). The PHQ-9 score reflects five categories of severity of depression: Normal (0 to 4), Mild (5 to 9), Moderate (10 to 14), Moderately severe (15 to 19), and Severe (20 to 27). We used the PHQ-9 version adapted to Peruvians [29]. In studies carried out in Latin America, PHQ-9 had a Cronbach's alpha reliability score higher than 0.80 and a ROC curve of 0.86 to identify depression assessed by DSM-IV criteria. We considered moderate, moderately severe, or severe depression symptoms as clinically relevant depression symptoms [30, 31].

Anxiety symptoms

Generalized Anxiety Disorder-7 (GAD-7) is a universally valid and efficient self-administered scale to assess the severity of anxiety disorders in clinical practice. This scale has a Cronbach's alpha reliability score of 0.92 and a test–retest reliability correlation of 0.83 [32], and it has been translated and validated into Spanish [33]. It consists of seven items to measure anxiety symptoms during the two weeks before self-application. We rated each item on a Likert scale ranging from 0 ("not at all") to 3 ("almost every day"). GAD-7 ratings reflect four levels of severity of anxiety symptoms: Normal (0 to 4), Mild (5 to 9), Moderate (10 to 14), and Severe (15 to 21). A score of 10 or more has a sensitivity of 86.8% and a specificity of 93.4% to diagnosed general anxiety disorder assessed by DSM-IV criteria. We considered moderate or severe anxiety symptoms as clinically relevant anxiety symptoms [33].

Covariates

We also collected information regarding the following covariates: (a) sociodemographic data, including sex, age, job status, with whom they lived during the hospitalization, history of relative deceased due to COVID-19 during the first wave; (b) clinical and hospitalization data, including diagnosis and/or treatment history for psychiatric diagnosis before hospitalization (made by a health professional: physician, psychologist, or psychiatric), and self-perception of COVID-19 severity during hospitalization; and the presence of COVID-19-related symptoms at follow-up at T1 and T2. The interviewer asked for the self-report of fever, dyspnea, myalgia, rhinorrhea, cough, or headache at follow-up. Then, these symptoms were categorized into no symptoms, only general symptoms (at least reported fever, myalgia, or headache, and no respiratory symptoms), only respiratory symptoms (at least reported dyspnea, rhinorrhea, or cough, and no general symptoms), and both symptoms (at least reported one general symptom and one respiratory symptom). All covariates were self-responded after direct singles questions.

Data collection

We measured all the covariates and the depression and anxiety symptoms outcomes during the first follow-up at T1. In addition, we extracted the hospitalization duration from the patients' electronic clinical history. Then at T2, we only measured the COVID-19-related symptoms, and the outcomes of HRQoL, depression, and anxiety symptoms. Finally, we also collected the days from discharge to the interview at T2 (follow-up time) and presence of

COVID-19 symptoms during the interview (at T1 and T2, independently).

Both T1 and T2 evaluations were collected in a virtual file through telephone calls to the patients, using the cell phone number registered in each patient's electronic medical record. Researchers, who were psychiatrists with clinical and research experience, called the participants to collect their data. These calls lasted approximately 20 min. If the participant had some acute anxiety or depression event during the call, the interviewers stopped the questionnaire and offered them psychiatric help. This help included a psychiatric consultation and the management of the acute event. In addition, the psychiatrist interviewer offered the participant to continue the psychiatric consultations during the following weeks and consider them as patients, following the usual health care by hospital protocols. We not collected this information about the psychiatric help, and the confidentiality was not affected.

Statistical analysis

Before analysis, we categorized the age variable according to its quartiles and the "hospitalization time" variable into 1–7, 8–14, and > 14 days. We used these last cut-off values considering that seven or fewer days of hospitalization probably is due to a mild disease with lesser antibiotic treatment and procedures [34] and that the average hospitalization time in COVID-19 patients is about 14 days [35]. The depression and anxiety symptoms outcomes were dichotomized as not clinically relevant (normal–mild) and clinically relevant (moderate–severe). In addition, the patients were categorized as asymptomatic, with general symptoms only (fever, fatigue, myalgia, or headache), with respiratory symptoms only (dyspnea, rhinorrhea, or cough), and with both types of symptoms according to their self-report regarding COVID-19 symptoms present during follow-up interviews. We measured the relative and absolute frequencies of the qualitative variables, and the median and interquartile range of the quantitative variables.

We performed Poisson regression analysis with log link function to calculate the prevalence ratios and their confidence intervals for "low HRQoL." The variables to be adjusted in each regression model were selected considering the design of a directed acyclic graph [36]. All regression models were adjusted by follow-up time. The regression model for exposure variables "employment status," "self-perceived severity of COVID-19," "persistent COVID-19 symptoms," and "depression and anxiety symptoms" were adjusted by sex and age. The regression model for the exposure variable "living with someone" was adjusted by "marital status" and "death of a relative from COVID-19." The regression model for the "history of psychiatric disorder" variable was adjusted by sex and the variable "living with someone." The history regression model for "psychiatric treatment" was adjusted by "history of psychiatric disorder." The regression model for the variable "persistent symptoms due to COVID-19 at T2" was additionally adjusted by "self-perceived severity of COVID-19." Finally, the regression models for clinically relevant depression and anxiety symptoms were adjusted by "history of psychiatric disorder," "self-perceived severity of COVID-19," and "death of a family member from COVID-19."

On the other hand, Sankey diagrams were performed with the absolute frequency of the depression and anxiety symptoms categories after three months and one year of follow-up, using the free online software SankeyMATIC (https://sankeymatic.com/). A Sankey diagram includes nodes and arcs to highlight the movement from one state/time to another [37]. As transitions occur, each arc flows from its source node to the target node(s), and the node's size and arc's width represents the number of objects/members, thus indicating the magnitude of movement [38]. Student's t-tests were used for paired samples to calculate the mean difference of the depression and anxiety symptoms scores by comparing the measurement at three months (T1) versus one year (T2). A p-value of < 0.05 was considered statistically significant. We used Stata MP v.17.0 (StataCorp LLC, TX, United States) statistical software for all analyses.

Results

A total of 318 patients were assessed at T1. Then, at T2, 185 patients did not answer the follow-up call, eight had a wrong number, four refused to participate, and two died due to illnesses unrelated to COVID-19 since November 2020. Finally, 119 participants (37.4%) were assessed and included at T2 assessment.

General characteristics of the sample

The mean follow-up time after hospitalization discharge at T2 was 363.6 ± 48.6 days (range: 260 to 476 days). The mean days between T2 and T1 was 260 ± 33.4 (range: 203 to 307 days). The characteristics of the participants at T1 and T2 are described in Table 1. No significant differences were observed between both assessed samples.

Health-related quality of life

According to the EQ-5D results, the respondents demonstrated some degree of problems when performing activities related to usual activities (14.3%), mobility (28.6%), self-care (32.8%), anxiety/depression (42%), or pain/discomfort (59.7%). Regarding HRQoL, the median score was 80 (IQR: 70–90) according to VAS. People aged

Table 1 Baseline characteristics of hospitalized patients for COVID-19 and discharged after the first wave (T1) ($n=318$) and the second wave (T2) ($n=119$)

Variable	T1 participants ($n=318$)	T2 participants ($n=119$)
Male	196 (61.3)	64 (53.8)
Age (years)*	53.1 (51.8–54.4)	55.0 (41.0–67.0)
Job status		
Unemployment	95 (30.5)	34 (28.6)
Informal employment	31 (9.2)	11 (9.2)
Formal employment	143 (45.5)	51 (42.9)
Retired	49 (14.8)	23 (19.3)
Live		
Alone	17 (5.1)	4 (3.4)
With partner and/or sons/daughters	256 (79.8)	99 (83.2)
With parents and/or another family member	45 (15.1)	16 (13.5)
Death of family member for COVID-19 during first wave	90 (30.4)	40 (33.6)
History of psychiatric diagnosis	32 (10.4)	13 (10.9)
History of psychiatric treatment	27 (8.7)	9 (7.6)
Self-perception of severity of COVID-19		
Mild	89 (29.1)	32 (26.9)
Moderate	107 (32.6)	38 (31.9)
Severe	99 (31.2)	40 (33.6)
Critically ill	23 (7)	9 (7.6)
Hospitalization time		
1 to 7 days	154 (48.4)	58 (48.7)
8 to 14 days	84 (26.4)	33 (27.7)
More than 14 days	80 (25.2)	28 (23.5)
Persistent symptoms due to COVID-19 at follow-up		
No symptoms	141 (44.3)	44 (37.0)
General symptoms	78 (24.5)	30 (25.2)
Respiratory symptoms	44 (13.8)	11 (9.2)
Both symptoms	55 (17.3)	34 (28.6)
Depression symptoms		
None	222 (69)	75 (63.0)
Mild	62 (20.2)	22 (18.5)
Moderate	18 (5.6)	13 (10.9)
Moderate–Severe	11 (3.7)	5 (4.2)
Severe	5 (1.4)	4 (3.4)
Anxiety symptoms		
None	223 (68.9)	82 (68.9)
Mild	71 (23.5)	22 (18.5)
Moderate	17 (5.4)	9 (7.6)
Severe	7 (2.2)	6 (5.0)
Low quality of life	–	88 (74.0)

*Median and interquartile range

41 years or above were more likely to have a low HRQoL (adjusted prevalence ratios [aPR]: 1.95, 95% confidence intervals [95% CI]: 1.29–2.93) when compared with the younger participants. Similar results were observed for those patients with a history of psychiatric diagnosis (aPR: 1.47, 95%CI: 1.25–1.73) and those who reported only general, only respiratory, or both kinds of COVID-19 symptoms during the follow-up at one year (aPR: 1.42, 95% CI: 1.00–2.03; aPR: 1.83, 95% CI: 1.33–2.52; aPR: 1.84, 95%CI: 1.36–2.48, respectively) than asymptomatic. Finally, those with a family member who died due

Table 2 Association between characteristics and low quality of life ($n = 119$)

Characteristics	Quality of life		
	Good	Low	aPR (95%CI)
Sex			
Men	16 (25.0)	48 (75.0)	Ref
Women	15 (27.3)	40 (72.7)	0.97 (0.78–1.21)
Age (years)			
20 to 41 years	17 (54.8)	14 (45.2)	Ref
42 to 53 years	4 (12.1)	29 (87.9)	**1.95 (1.29–2.93)**
54 to 65 years	6 (20.7)	23 (79.3)	**1.75 (1.13–2.70)**
66 to 94 years	4 (15.4)	22 (84.6)	**1.87 (1.22–2.85)**
Marital status			
Single	7 (38.9)	11 (61.1)	Ref
Married	21 (25.0)	63 (75.0)	1.22 (0.83–1.80)
Divorced or widower	3 (17.7)	14 (82.4)	1.34 (0.87–2.06)
Job status*			
Unemployment	8 (23.5)	26 (76.5)	Ref
Informal employment	4 (36.4)	7 (63.6)	0.80 (0.49–1.30)
Formal employment	16 (31.4)	35 (68.6)	1.02 (0.79–1.32)
Retired	3 (13.0)	20 (87.0)	1.20 (0.84–1.70)
Profess a religion			
No	4 (36.4)	7 (63.6)	Ref
Yes	27 (25.0)	81 (75.0)	1.20 (0.75–1.90)
Live with**			
Alone	0 (0.0)	4 (100.0)	Ref
Couple and/or children	26 (26.3)	73 (73.7)	0.79 (0.57–1.10)
Fathers and/or other family members	5 (31.3)	11 (68.8)	0.56 (0.57–1.22)
Death of family member for COVID-19 during first wave			
No	25 (31.7)	54 (38.4)	Ref
Yes	6 (15.0)	34 (85.0)	**1.24 (1.02–1.52)**
History of psychiatric diagnosis***			
No	31 (29.3)	75 (70.8)	Ref
Yes	0 (0.0)	13 (100.0)	**1.47 (1.25–1.73)**
History of psychiatric treatment[†]			
No	31 (28.2)	79 (71.8)	Ref
Yes	0 (0.0)	9 (100.0)	0.98 (0.85–1.13)
Self-perception of the severity of COVID-19*			
Mild	11 (34.4)	21 (65.6)	Ref
Moderate	6 (15.8)	32 (84.2)	1.02 (0.78–1.33)
Severe	12 (30.0)	28 (70.0)	0.92 (0.69–1.24)
Critically ill	2 (22.2)	7 (77.8)	0.96 (0.61–1.49)
Symptoms due to COVID-19 at one-year follow-up[*‡]			
No symptoms	22 (50.0)	22 (50.0)	Ref
General symptoms	8 (26.7)	22 (73.3)	1.42 (1.00–2.03)
Respiratory symptoms	0 (0.0)	11 (100.0)	**1.83 (1.33–2.52)**
Both symptoms	1 (2.9)	33 (97.1)	**1.84 (1.36–2.48)**
Depression symptoms at one-year follow-up[*†‡£]			
Normal–Mild	29 (29.9)	68 (70.1)	Ref
Moderate–Severe	2 (9.1)	20 (90.9)	1.09 (0.91–1.31)
Anxiety symptoms at one-year follow-up[*†‡£]			
Normal–Mild	31 (29.8)	73 (70.2)	Ref
Moderate–Severe	0 (0.0)	15 (100.0)	1.17 (0.99–1.37)

aPR Adjusted prevalence ratio by time of follow-up

Bold values denote statistical significance at the p-value < 0.05

CI 95%: 95% Confidence Intervals

*Adjusted prevalence ratio for sex and age

**Adjusted prevalence ratio for civil status and death of a family member due COVID-19

***Adjusted prevalence ratio for sex and living with

[†]Adjusted prevalence ratio for history of psychiatric diagnosis; [‡]Adjusted prevalence ratio for self-perception of severity of COVID-19

[£]Adjusted prevalence ratio for death of a family member due COVID-19

to COVID-19 were more likely to have a lower HRQoL (aPR: 1.24, 95% CI: 1.02–1.52) (Table 2).

Follow-up of psychiatric symptoms

Of the patients who completed both follow-ups, 14.3% reported clinically relevant depression symptoms at T1 and 18.5% at T2, while 12.6% showed clinically relevant anxiety symptoms at both T1 and T2. Regarding the changes in the severity of depression (Fig. 1A) and anxiety (Fig. 1B) symptoms between T1 and T2, we observed the persistence of moderate and severe symptoms in both outcomes. However, concerning depression symptoms, we observed that an important group of patients had moderate or severe symptoms at T2, although they had mild or no depression symptoms at T1. So, we assessed this change by calculating the mean difference in the PHQ-9 depression symptoms score between T2 and T1, which was 0.94 units higher ($p = 0.04$). In contrast, the mean difference in the GAD-7 anxiety symptoms score between T2 and T1 was 0.13 units higher ($p = 0.72$).

Discussion

Main results

The objectives of the study were (1) to cross-sectionally evaluate HRQoL and its associated factors one year after hospital discharge (T2) and (2) to perform a prospective assessment of depression and anxiety symptoms at three months (T1) and one year (T2) after hospitalization discharge, in a

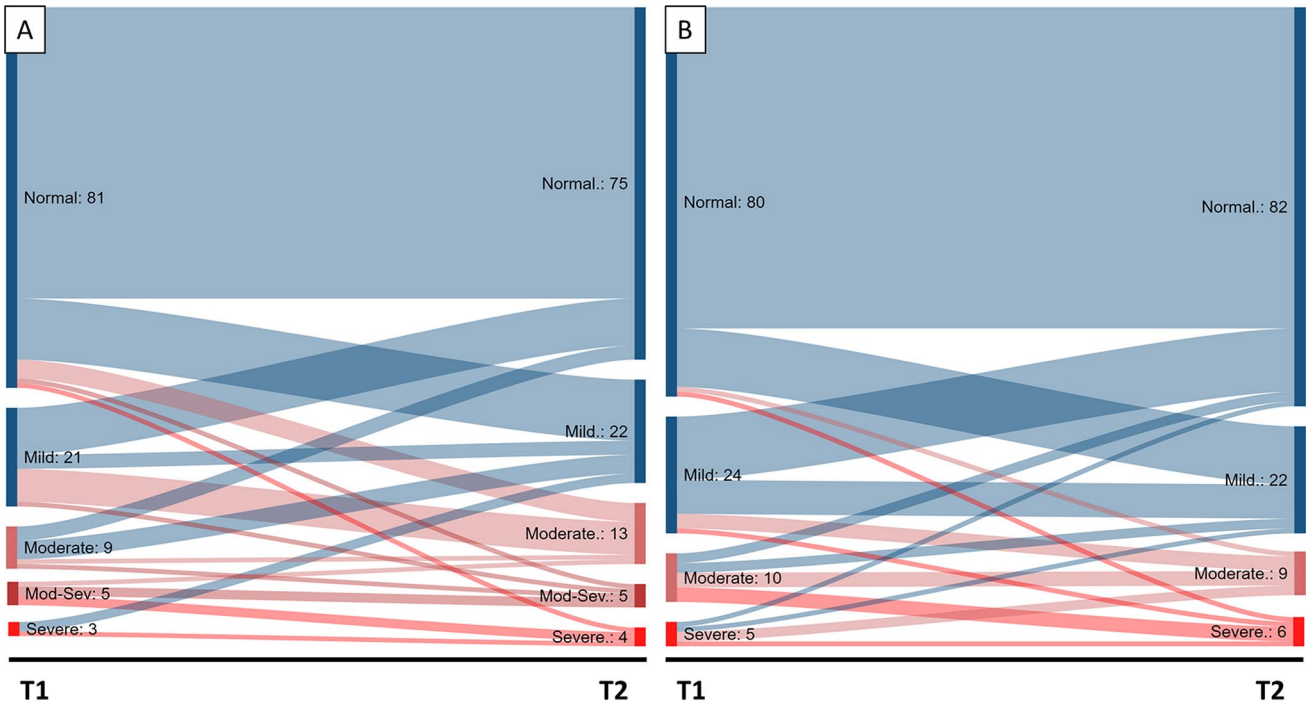

Fig. 1 Changes in the intensity of depression (**A**) and anxiety (**B**) symptoms from 3-month follow-up (T1) to 1 year (T2). In Blue: Changes to normal or mild depression and anxiety symptoms at T2. In Red: Changes to moderate, moderate-severe, or severe depression and anxiety symptoms at T2

sample of patients who survived COVID-19. We found that most included patients had a low health-related quality of life one year after hospital discharge, especially in those with greater age, with self-reported previous history of psychiatric diagnoses, and with persistent COVID-19 symptoms. In addition, the depression and anxiety symptoms remained high one year after hospital discharge.

Three-quarters of the included patients reported some problems in their usual activities, mobility, self-care, anxiety/depression, or pain/discomfort. Their prevalence of clinically relevant depression and anxiety symptoms was 18.5% and 12.6%, respectively. COVID-19 can negatively impact the respiratory, motor, and nervous systems [39]. Thus, it causes lower physical resistance, incapacities, and permanent symptoms in those with COVID-19 infection [40]. In addition, due to the saturation of the health system and other restrictions during the pandemic, the COVID-19 survivors didn't have access to healthcare, rehabilitation services, and follow-up after discharge, persisting their health problems [41]. Therefore, these problems might affect their daily life activities, HRQoL, and mental health.

Associated variables to low HRQoL

We found that older patients reported worse HRQoL at one-year follow-up, similarly reported by a study conducted in a sample of 361 COVID-19 patients, where age was negatively associated with the dimensions of physical strength and physical role of HRQoL at the one-month follow-up [42]. This could be due to older people's higher prevalence of chronic diseases [43]. Other factors to consider are their loss of immune function, reduced protection against infectious agents [44], and poor family support network [45]. So, elderly COVID-19 survivors will need better access to healthcare for earlier identification and rehabilitation of their impairments.

In addition, we found that a history of psychiatric disorders was independently associated with a greater probability of having a low HRQoL. Any patient with a psychiatric diagnosis had an impairment in their HRQoL [46]. So, in addition to their mental illness, these patients had to afford the effects of COVID-19 health sequels and traumatic events during hospitalization. Similarly, the patients with persistent COVID-19 symptoms were more likely to experience a low HRQoL, as reported in patients from Italy, Germany, and the United States, where low HRQoL is associated with the persistence of COVID-19 symptoms up to one year after hospital discharge [47–49]. The post-COVID-19 syndrome significantly impacts people's health, and symptoms such as dyspnea, myalgia, or headache have become factors that obstruct or limit daily activities [50]. This presents a further challenge for the

attempts of health systems to prepare for the diagnosis, management, and follow-up of such patients [51].

The patients with a relative who died due to COVID-19 during the first wave in Peru were more likely to have a low HRQoL. The direct relatives of a COVID-19 patient suffer a deterioration of their own HRQoL and generate concern, frustration, sadness, and sleep disorders [52]. Thus, we can infer an even more significant impact on HRQoL because of the loss of a family member. This stressful event may affect individuals since it affects the depression- and anxiety-related domains of HRQoL. Thus, the psychological impact of personal and family stresses during the pandemic would be crucial in the HRQoL of the patients who survived COVID-19.

Depression and anxiety symptoms

The depression symptoms significantly increased from T1 (three months) to T2 (one year after discharge). A study conducted on COVID-19 survivors in China reported a higher frequency of depression or anxiety symptoms 12 months following the hospital discharge (26%) compared with after six months (23%) [53]. In addition, another study conducted on Italian patients who survived COVID-19 found an increase in depression and anxiety symptoms in men [18]. Consistent results demonstrate the plausible underlying mechanisms of psychiatric sequelae from COVID-19 infection, such as neurotropism, interrupted neuronal circuits, neuroinflammation, and neuronal death [11]. Thus, several interventions were proposed during the pandemic to prevent and manage the mental health symptoms in COVID-19 survivors. These mainly include technology or distance methodologies, such as telehealth, chat support groups, and hotlines [54].

However, to our knowledge, our study is one of the first reports of one-year follow-ups of patients who survived COVID-19 in Latin America and low- and middle-income countries [55]. Moreover, these countries had limited access to mental healthcare, which worsened during the pandemic [56], and they cannot fully extrapolate most technology-based interventions [57]. For this reason, the potential long-term impact of COVID-19 on mental health in patients from these countries could be even more critical and may need low-budget interventions capable of accessing all patients.

Limitations of the study

The study's main limitation is that only 37.4% of the patients completed the one-year follow-up, which implies that the results do not adequately represent the original population of patients from the hospital who survived COVID-19 during the first wave. However, we found no significant differences between the currently analyzed sample and all the patients evaluated at T1, so we can consider these missing data were at random. Future studies need to assess larger and more representative samples from different hospital centers to estimate the long-term consequences of COVID-19. In addition, we have not evaluated the mental health and HRQoL status of patients who survived COVID-19 before acute infection or at hospital discharge. This could cause the interpretation of the follow-up outcomes to be biased due to the patients' baseline levels before the disease.

Furthermore, the time between T2 and T1 was different for each patient (203 to 307 days), causing a mismatch of time points. However, more than 200 days are sufficient to observe changes in mental health outcomes, especially during the COVID-19 pandemic [58]. Finally, despite considering the self-perceived COVID-19 severity and COVID-19 symptoms during T1 and T2 interviews, which partially are proxies of comorbidities, there may be remaining residual confusion bias in addition to other non-collected variables such as education level, lifestyle, marital status, and economic status associated to mental health and HRQoL outcomes [59, 60]. However, this study is one of the first to assess these outcomes in survivors of COVID-19 after one year following their hospital discharge and find associations with the relevant variables, especially in low- and middle-income countries.

Conclusions

One year after COVID-19 hospital discharge, patients show a high frequency of low HRQoL. This is associated with increased age, a history of psychiatric diagnosis, the death of a relative from COVID-19, and persistent COVID-19 symptoms. In addition, the clinically relevant depression symptoms were prevalent, showing an increase from 3 to 12 months. These findings reveal the need to provide services that adequately address mental health sequelae and HRQoL to reduce the burden of the disease due to COVID-19.

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Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

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Consent to participate Before including them in the study, we obtained verbal informed consent from all patients.

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