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Symptoms, Mental Health, and Quality of Life Among Patients After COVID-19 Infection: A Cross-sectional Study in Vietnam

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Objectives: This study was conducted to characterize the symptoms, mental health, quality of life (QoL), and associated factors following the coronavirus disease 2019 (COVID-19) infection.

Methods: This cross-sectional study included 394 participants previously infected with COVID-19 in Ho Chi Minh City, Vietnam. Mental health was assessed using the 21-item Depression, Anxiety, and Stress Scale (DASS-21). Participants self-reported health-related QoL was measured with the EuroQol 5-Dimension 5-Level (EQ-5D-5L) scale.

Results: Among the participants, 76.4% reported experiencing at least one symptom following COVID-19 infection. The most common symptoms were fatigue (42.1%), cognitive dysfunction (42.9%), and hair loss (27.9%). According to the DASS-21 results, the proportions of depression, anxiety, and stress were 28.7%, 26.4%, and 20.6%, respectively. The mean scores on the EQ-5D-5L and the EuroQol Visual Analog Scale were 0.94±0.11 and 84.20±13.11, respectively. Regarding QoL issues, the highest proportion of participants (32.7%) reported experiencing anxiety or depression, followed by pain or discomfort (25.4%). Multivariable logistic regression analysis revealed that factors associated with the presence of symptoms following COVID-19 infection included female (odds ratio [OR], 2.84; 95% confidence interval [CI], 1.65 to 4.91) and having QoL issues (OR, 3.25; 95% CI, 1.71 to 6.19).

Conclusions: The study investigated the prevalence rates of various symptoms following COVID-19 infection. These findings underscore the need to prioritize comprehensive care for individuals recovering from COVID-19 and to implement strategies to mitigate the long-term impact of the disease on mental health and QoL.

Key words: Mental health, Quality of life, COVID-19, Vietnam

INTRODUCTION

In late 2019, coronavirus disease 2019 (COVID-19) was first reported in Wuhan, Hubei province, China [1]. Due to its rapid infection rate, the World Health Organization (WHO) declared a global pandemic on March 11, 2020, urging countries to collaborate and implement international response measures to combat the disease [1]. As of July 31, 2022, over 574 million cases and more than 6.3 million deaths have been reported worldwide [2]. The COVID-19 pandemic has had a substantial impact on Vietnam. As of November 2023, Vietnam has reported a total of 11 624 000 COVID-19 cases and 43 206 deaths [3].

Under the guidelines of the UK National Institute for Health and Care Excellence, the period following COVID-19 infection is categorized into three stages: acute COVID-19 (representing disease signs and symptoms observed for up to 4 weeks after

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infection), ongoing symptomatic COVID-19 (referring to disease signs and symptoms experienced from 4 weeks to 12 weeks after infection), and post-COVID-19 syndrome (describing signs and symptoms that develop during or after COVID-19 infection, continue for more than 12 weeks, and are not explained by an alternative diagnosis) [4]. Medical efforts have primarily been focused on addressing the acute burden of the disease. However, a growing body of evidence indicates that COVID-19 can result in long-term physical and mental health consequences [5]. According to the WHO, these long-term effects can impact individuals exposed to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus, regardless of age or the initial severity of the illness. The WHO has identified over 200 symptoms that can meaningfully affect a person's daily functioning. Common symptoms associated with long-term COVID-19 include fatigue, shortness of breath, and cognitive dysfunction [6]. Health consequences lasting more than three months after infection are now referred to as "post-COVID-19 syndrome" or "long COVID" [7]. Commonly reported symptoms include fatigue, dyspnea, cognitive impairment, insomnia, anxiety, and depression [8-12]. These persistent symptoms significantly impact individuals, reducing their quality of life (QoL) and ability to work and perform routine daily activities [13,14]. A systematic review of 39 studies revealed that fatigue was the most common symptom in patients 4 weeks to 12 weeks and more than 12 weeks after COVID-19 infection, with prevalence rates of 43% and 44%, respectively. Other symptoms reported in patients from 4 weeks to 12 weeks and more than 12 weeks after COVID-19 infection included sleep disorders (36 and 33%, respectively), difficulty breathing (31 and 40%), cough (26 and 22%), cognitive decline (20 and 15%), anxiety (28 and 34%), depression (25 and 32%), and reduction in QoL (40 and 57%) [11]. In a systematic review of 45 studies, Nasserie et al. [15] found that across 16 studies that reported the relevant outcome, 72.5% of people experienced at least one persistent symptom. The most common symptoms were shortness of breath or dyspnea (26 studies), fatigue or exhaustion (25 studies), and sleep disorders or insomnia (8 studies). A survey by Menges et al. [5] revealed that after 6 months to 8 months of illness, 55% of participants reported experiencing symptoms of fatigue. Additionally, 25% of participants experienced at least grade 1 dyspnea (shortness of breath), and 26% reported other symptoms. Depressive symptoms were also noted among participants. During the studied period, 10% of those initially hospitalized required readmission [5]. A study by Huang et al. [16], involving 1733 patients six months after contracting COVID-19, revealed that commonly reported symptoms included fatigue or muscle weakness (63%) and difficulty sleeping (26%). Anxiety or depression was reported by 23% of the patients. Research by Carfi et al. [17] shows that 87.4% of study participants reported having at least one symptom 60 days after the appearance of the first COVID-19 symptom. The most commonly reported symptoms were fatigue (53.1%), shortness of breath (43.4%), joint pain (27.3%), and chest pain (21.7%).

The evidence suggests that the repercussions of COVID-19 can impact individuals across all age groups, including young adults with no pre-existing medical conditions and those who experienced only mild or asymptomatic cases during the acute phase of the infection [16,18-20]. In Vietnam, limited data are available concerning the symptoms, mental health status, and QoL in individuals following COVID-19 infection. This gap in knowledge poses considerable obstacles to devising effective interventions. Consequently, this study was conducted to evaluate the prevalence of post-infection symptoms, mental health concerns, and QoL issues in patients following infection with COVID-19, as well as to identify factors associated with the manifestation of these symptoms.

METHODS

Study Design and Setting

A cross-sectional study was conducted from January 2022 to April 2022 in Ward 1, District 8, Ho Chi Minh City, Vietnam, an area that experienced one of the largest-scale epidemics in the city. The study population consisted of patients with COVID-19 who met the following selection criteria: they were at least 18 years old, met the recovery criteria as defined by the Vietnam Ministry of Health (absence of fever for at least three days without the use of medication, negative real-time reverse transcriptase-polymerase chain reaction test results for SARS-CoV-2 with a low viral load indicated by a cycle threshold value of 30 or higher for any specific gene, or a negative antigen test for the SARS-CoV-2 virus), and had provided consent to participate in the study.

Sample Size and Sampling Method

The sample size was calculated using the formula for estimating the sample size for a proportion: $N = Z^2_{(1-\alpha/2)} \times P\,(1-P)/d^2$. In this formula, Z represents the level of confidence (for a 95% confidence level, Z = 1.96); P refers to the estimated propor-

tion of patients experiencing at least one symptom following COVID-19 infection (we used P=0.5, as no prior study had been conducted in the area to inform this estimate); and d is the margin of error, set at d=0.05. The calculated minimum sample size was 384 participants. To account for an anticipated non-response rate of 10%, we aimed for a sample size of 427 participants. According to data from the Medical Station of Ward 1, 1400 individuals met the study's inclusion criteria. To select 427 participants, we employed a random sampling method, using the Microsoft Excel RANDBETWEEN function (Microsoft, Redmond, WA, USA) to choose numbers between 1 and 1400. Upon contacting the 427 individuals to seek consent, 33 (7.7%) declined to participate. Consequently, the study was carried out with 394 patients. Participants were given the option to complete the survey through Google Forms or a telephone interview. The link to the questionnaire or a QR code was sent to 242 participants, while the remaining 152 opted for the telephone interview.

Instrument

The questionnaire was composed of 4 parts:

(1) General information: This section included data on sex, age, ethnicity, average monthly income, education level, marital status, family size, height, weight, history of chronic disease, smoking status, physical activity level, alcohol consumption status, and hours of sleep per day. Furthermore, information regarding COVID-19 vaccination status, whether a family member had been infected with COVID-19, duration of treatment, treatment location, treatment method, and time elapsed after COVID-19 infection was collected.

(2) Symptoms following COVID-19 infection: Participants self-reported their symptoms, categorized into systemic, cardiovascular, digestive, sensory, respiratory, musculoskeletal, and neurological.

(3) Signs of mental health: We utilized the 21-item Depression, Anxiety, and Stress Scale (DASS-21) to evaluate the mental health of study participants. Initially developed by Lovibond and Lovibond [21] in 1995 as a 42-item questionnaire (DASS-42), this tool was condensed to 21 items in 1997 [22]. The scale was validated in Vietnam in 2013, demonstrating a sensitivity of 79.1%, a specificity of 77.0%, and Cronbach alpha coefficients for depression, anxiety, and stress of 0.86, 0.79, and 0.86, respectively [23]. Comprising 21 questions, the scale is segmented into three dimensions—depression, anxiety, and stress—each containing seven questions. Responses to each question are scored on a scale ranging from 0 to 3.

(4) QoL: To assess the QoL of participants, we employed the EuroQol 5-Dimension 5-Level (EQ-5D-5L) scale. The EQ-5D-5L, developed by the EuroQol Group in 2009 [24], has been utilized in Vietnam [25]. This instrument encompasses five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension is rated on a 5-level scale: no problems, slight problems, moderate problems, severe problems, and extreme problems. The EQ-5D-5L scores were calculated using the Vietnamese value set [25]. The EuroQol Visual Analog Scale (EQ-VAS) is a component of the EQ-5D questionnaire. The EQ-VAS is a self-reporting instrument that enables participants to evaluate their health status on a vertical visual analog scale that ranges from 0 to 100 [24].

Statistical Analysis

All analyses were performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). We reported frequencies and percentages (%) for categorical variables, while we presented data as means and standard deviations for continuous variables. Chi-square tests were utilized to assess differences in the proportions of patients with at least one symptom and the associated factors. We conducted both univariate and multivariate logistic regression analyses to investigate potential associations between the occurrence of symptoms following COVID-19 and various factors. Variables that demonstrated a *p*-value of less than 0.2 in the univariate logistic regression analysis were included in the subsequent multivariable analysis. A *p*-value of less than 0.05 was considered to indicate statistical significance.

Ethics Statement

The research protocol received approval under Decision No. 2809/QĐ-YDHP, dated December 26, 2021, by the Institutional Review Board of Haiphong University of Medicine and Pharmacy, Vietnam. Participants were fully informed about the purpose of the study and their role within it. A consent form accompanied the questionnaire, and the completed questionnaire was submitted as consent to participate in the research. Participants were not provided any financial compensation for their involvement in the study. To protect participant privacy, all collected data were treated with strict confidentiality.

RESULTS

General Information of Participants

Female participants comprised 63.7% of the sample. The average respondent age was 29.46±12.17 years. Most participants (85.5%) had completed at least a high school education, and a large proportion were single (72.8%). Chronic diseases were reported by 18.3% of the participants. Nearly half (48.7%) had received three vaccine doses, and 66.0% reported having family members infected with COVID-19. The average duration of COVID-19 treatment was 9.34±4.55 days, and the average time elapsed since COVID-19 infection was 62.5±57.6 days. Most participants (93.2%) managed their therapy at home, with 68.8% using paracetamol and vitamin C in their treatment regimen (Table 1).

Symptoms Following Coronavirus Disease 2019 Infection

The percentage of patients who experienced at least one symptom following COVID-19 infection was 76.4%. When ex-

Table 1. General information of participants

Variables	n (%) or mean±SD
Demographic information	
Sex	
Male	143 (36.3)
Female	251 (63.7)
Age (y)	29.46±12.17
Ethnicity	
Kinh	367 (93.1)
Other	27 (6.9)
Average monthly income (USD)	
≥180	165 (41.9)
<180	229 (58.1)
Education	
Secondary school or below	57 (14.5)
High school or above	337 (85.5)
Marital status	
Single	287 (72.8)
Married	91 (23.1)
Separated/divorced/widowed	16 (4.1)
No. of members in the family	3.93±1.96
Body mass index (kg/m^2)	21.38±3.20
Underweight (<18.5)	66 (16.8)
Normal (18.5-22.9)	216 (54.8)
Overweight/obesity (≥23.0)	112 (28.4)
Medical history and lifestyle information	
History of chronic disease	
Yes	72 (18.3)
No	322 (81.7)
Smoking status	
Active	36 (9.1)
Never or former	358 (90.9)
Exercise (min/wk)	
<150	278 (70.6)
≥150	116 (29.4)
Alcohol consumption status	
Active	149 (37.8)
Never or former	245 (62.2)
Hours of sleep per day (hr)	
<7	144 (36.5)
≥7	250 (63.5)
Information related to COVID-19	
Vaccination against COVID-19 (dose)	
None	21 (5.3)
1	55 (14.0)
2	126 (32.0)
3	192 (48.7)
Family member infected with COVID-19	
Yes	260 (66.0)
No	134 (34.0)
Family member died due to COVID-19	
Yes	22 (5.6)
No	372 (94.4)
Duration of COVID-19 treatment (day)	9.34±4.55
COVID-19 treatment location	
Home	367 (93.2)
Medical facility	27 (6.8)
COVID-19 treatment method(s)	
No medicine	75 (19.0)
Paracetamol, vitamin C	271 (68.8)
Anti-inflammatory corticosteroids, anticoagulant	17 (4.3)
Molnupiravir	10 (2.9)
Administered oxygen	5 (1.3)
Unknown	21 (5.3)
Time since COVID-19 infection (wk)	
<4	175 (44.4)
4-12	73 (18.5)
>12	146 (37.1)
Average time (day)	62.5±57.6

(*Continued to the next*)

SD, standard deviation; USD, US dollar; COVID-19, coronavirus disease 2019.

Table 2. Self-reported symptoms[1] after coronavirus disease 2019 infection

Variables	Total	<4 wk (n=175)	4-12 wk (n=73)	>12 wk (n=146)
At least 1 symptom	301 (76.4)	138 (78.9)	60 (82.2)	103 (70.5)
Specific symptoms				
Fatigue	166 (42.1)	87 (49.7)	41 (56.2)	38 (26.0)
Insomnia	101 (25.6)	52 (29.7)	18 (24.7)	31 (21.2)
Olfactory disturbances	15 (3.8)	9 (5.1)	2 (2.7)	4 (2.7)
Loss of taste	12 (3.0)	4 (2.3)	3 (4.1)	5 (3.4)
Blurred vision	23 (5.8)	11 (6.3)	4 (5.5)	8 (5.5)
Headache	90 (22.8)	40 (22.9)	29 (39.7)	21 (14.4)
Decreased concentration	103 (26.1)	55 (31.4)	35 (47.9)	13 (8.9)
Memory loss	136 (34.5)	51 (29.1)	29 (39.7)	56 (38.4)
Brain fog	169 (42.9)	68 (38.9)	40 (54.8)	61 (41.8)
Shortness of breath	76 (19.3)	26 (14.9)	12 (16.4)	38 (26.0)
Cough	107 (27.2)	59 (33.7)	37 (50.7)	11 (7.5)
Sore throat	61 (15.5)	39 (22.3)	20 (27.4)	2 (1.4)
Runny nose	38 (9.6)	25 (14.3)	13 (17.8)	0 (0.0)
Chest pain	29 (7.4)	14 (8.0)	7 (9.6)	8 (5.5)
Muscle pain	51 (12.9)	28 (16.0)	15 (20.5)	8 (5.5)
Arthritis	26 (6.6)	8 (4.6)	7 (9.6)	11 (7.5)
Digestive disorders	24 (6.1)	10 (5.7)	8 (11.0)	6 (4.1)
Hearing loss or tinnitus	3 (0.8)	1 (0.6)	1 (1.4)	1 (0.7)
Hair loss	110 (27.9)	35 (20.0)	13 (17.8)	62 (42.5)
Sweating	21 (5.3)	9 (5.1)	8 (11.0)	4 (2.7)
Chills	19 (4.8)	9 (5.1)	7 (9.6)	3 (2.1)
Fever	18 (4.6)	11 (6.3)	5 (6.8)	2 (1.4)
Vomiting or nausea	9 (2.3)	6 (3.4)	3 (4.1)	0 (0.0)
Skin rash	3 (0.8)	1 (0.6)	2 (2.7)	0 (0.0)
Symptom groups				
Systemic	225 (57.1)	95 (54.3)	48 (65.8)	82 (56.2)
Respiratory	156 (39.6)	78 (44.6)	44 (60.3)	34 (23.3)
Cardiovascular	29 (7.4)	14 (8.0)	7 (9.6)	8 (5.5)
Musculoskeletal	64 (16.2)	34 (19.4)	16 (21.9)	14 (9.6)
Digestive	29 (7.4)	13 (7.4)	10 (13.7)	6 (4.1)
Neurological	218 (55.3)	95 (54.3)	48 (65.8)	75 (51.4)
Sensory	46 (11.7)	22 (12.6)	8 (11.0)	16 (11.0)

Values are presented as number (%).
[1]Systemic symptoms include fever, hair loss, fatigue, skin rash, chills, and sweating; cardiovascular symptoms include chest pain; digestive symptoms include digestive disorders and vomiting or nausea; Sensory symptoms include blurred vision, loss of taste, olfactory disturbances, and hearing loss or tinnitus; respiratory symptoms include cough, sore throat, runny nose, and shortness of breath; Musculoskeletal symptoms include muscle pain and arthritis; and neurological symptoms include headache, memory loss, decreased concentration, and insomnia.

amined by the time elapsed since infection, this proportion was 78.9%, 82.2%, and 70.5% after 4 weeks, between 4 weeks and 12 weeks, and beyond 12 weeks, respectively. The most frequent symptoms were fatigue (42.1%), brain fog (42.9%), and hair loss (27.9%). Among those with less than 4 weeks since infection, the predominant symptoms were fatigue (49.7%), cough (33.7%), and impaired concentration (31.4%). For individuals in the 4-12 week category, the most common symptoms were fatigue (56.2%), brain fog (54.8%), and cough (50.7%). In the group with over 12 weeks since infection, the most prevalent symptoms were fatigue (26.0%), brain fog (41.8%), and hair loss (42.5%). More than 50% of patients experienced systemic and neurological symptoms, as detailed in Table 2.

Prevalence of Mental Health Symptoms

The prevalence of at least one mental health issue among participants, as measured by the DASS-21, was 38.3%. The overall proportions of depression, anxiety, and stress were 28.7%, 26.4%, and 20.6%, respectively. The rates of at least one mental health symptom in the patients under 4 weeks, 4-12 weeks, and over 12 weeks since infection were 47.4%, 39.7%, and 26.7%, respectively (Table 3).

Table 3. Prevalence of mental health symptoms after coronavirus disease 2019 infection

Mental health	Total	<4 wk (n=175)	4-12 wk (n=73)	>12 wk (n=146)
Mental health problem	151 (38.3)	83 (47.4)	29 (39.7)	39 (26.7)
Depression	113 (28.7)	66 (37.7)	22 (30.1)	25 (17.1)
Mild	47 (11.9)	28 (16.0)	12 (16.4)	7 (4.8)
Moderate	44 (11.2)	28 (16.0)	7 (9.6)	9 (6.2)
Severe	10 (2.5)	4 (2.3)	1 (1.4)	5 (3.4)
Extremely severe	12 (3.0)	6 (3.4)	2 (2.7)	4 (2.7)
Anxiety	104 (26.4)	56 (32.0)	19 (26.0)	29 (19.9)
Mild	28 (7.1)	12 (6.9)	5 (6.8)	11 (7.5)
Moderate	46 (11.7)	29 (16.6)	9 (12.3)	8 (5.5)
Severe	16 (4.1)	9 (5.1)	3 (4.1)	4 (2.7)
Extremely severe	14 (3.6)	6 (3.4)	2 (2.7)	6 (4.1)
Stress	81 (20.6)	40 (22.9)	17 (23.3)	24 (16.4)
Mild	38 (9.6)	19 (10.9)	7 (13.7)	9 (6.2)
Moderate	22 (5.6)	11 (6.3)	5 (6.8)	6 (4.1)
Severe	18 (4.6)	8 (4.6)	2 (2.7)	8 (5.5)
Extremely severe	3 (0.8)	2 (1.1)	0 (0.0)	1 (0.7)

Values are presented as number (%).

Table 4. Prevalence of quality of life issues according to the EQ-5D-5L scale

EQ-5D-5L	Total	<4 wk (n=175)	4-12 wk (n=73)	>12 wk (n=146)
At least 1 issue	173 (43.9)	83 (47.4)	29 (39.7)	61 (41.8)
Mobility limitation	22 (5.6)	7 (4.0)	2 (2.7)	13 (8.9)
Problem with self-care	5 (1.3)	0 (0.0)	1 (1.4)	4 (2.7)
Problem with usual activities	21 (5.3)	9 (5.1)	4 (5.5)	8 (5.5)
Pain/discomfort	100 (25.4)	34 (19.4)	16 (21.9)	50 (34.2)
Anxiety/depression	129 (32.7)	70 (40.0)	24 (32.9)	35 (24.0)
Average EQ-5D-5L score	0.94±0.11	0.94±0.08	0.95±0.07	0.92±0.15
Average EQ-VAS score	84.20±13.11	82.11±12.11	83.18±10.77	87.92±14.67

Values are presented as number (%) or mean±standard deviation.
EQ-5D-5L, EuroQoL 5-Dimension 5-Level; EQ-VAS, EuroQol Visual Analog Scale.

Prevalence of Quality of Life Issues

The proportion of participants who reported experiencing anxiety or depression was 32.7%, representing the most frequently reported QoL issue; this was followed by pain or discomfort at 25.4%. Among those in the group with less than 4 weeks since COVID-19 infection, anxiety or depression was the most prevalent issue, affecting 40.0% of patients. In the 4-12 week group, the prevalence of anxiety or depression was slightly lower, at 32.9%. Pain or discomfort was most frequently reported in the group with over 12 weeks since infection, at a rate of 34.2%. The mean scores for the EQ-5D-5L and EQ-VAS were 0.94±0.11 and 84.20±13.11, respectively (Table 4).

Factors Associated With Symptoms Following Coronavirus Disease 2019 Infection

Based on the multivariate analysis, the factors associated with the occurrence of symptoms included female (odds ratio [OR], 2.84; 95% confidence interval [CI], 1.65 to 4.91) and having QoL issues (OR, 3.25; 95% CI, 1.71 to 6.19) (Table 5).

DISCUSSION

Symptoms Following Coronavirus Disease 2019 Infection and Associated Factors

The present cross-sectional study, which involved 394 participants, revealed that symptoms after COVID-19 infection were prevalent; approximately 76.4% of patients reported experiencing at least one symptom. These findings are consistent with those reported in a systematic review [15] and in research conducted in the United Kingdom [9].

Our findings indicated that the prevalence of symptoms was higher among individuals infected with COVID-19 between 4 weeks and 12 weeks prior than those with less than 4 weeks since infection. This observation contrasts with a study conducted in Saudi Arabia [26]. In the present research, fatigue and cognitive dysfunction-also known as brain fog syndrome- were the most frequently reported symptoms and were common in all three time periods following COVID-19 infection. This aligns with findings reported by the WHO [6]. However, the proportion of participants in our study who reported fatigue was lower than those observed in the studies by Carfi et al. [17] and Huang et al. [16]. This discrepancy may have arisen because our study was a cross-sectional analysis within a community setting, while the studies by Carfi et al. [17] and Huang et al. [16] involved hospitalized patients. Additionally, our participants were predominantly young (with an average age of 29.46 years), had no chronic diseases, and did not require hospitalization.

Regarding cognitive dysfunction, the rate reported in the present study was substantially higher than in the meta-analysis conducted by Ceban et al. [27]. This suggests that COVID-19 symptoms are not confined to the elderly, those with chronic diseases, or individuals who were hospitalized during the acute phase of the illness. Rather, these symptoms can also affect healthy young adults who do not require hospital care during the acute phase.

The multivariate analysis identified two factors significantly associated with symptoms after COVID-19 infection: females and participants having at least one QoL issue across five dimensions, as measured by the EQ-5D-5L scale. These findings align with those of a previous multicenter study, pinpointing female sex, length of hospital stay, history of chronic diseases, and number of symptoms at admission as predictors of symptoms after COVID-19 infection [28]. Additionally, Menges et al. [5] found that female sex, severe symptoms during the initial acute phase of the illness, and the presence of at least one chronic comorbidity were associated with a lack of recovery.

Table 5. Factors related to symptoms after COVID-19 infection: univariate and multivariate logistic regression analysis

Variables	Symptom(s)		Univariate OR (95% CI)	Multivariate aOR (95% CI)
	Yes (n=301)[1]	No (n=93)		
Sex				
Male	90	53	1.00 (reference)	1.00 (reference)
Female	211	40	3.10 (1.92, 5.02)***	2.84 (1.65, 4.91)***
Education				
Secondary school or below	37	20	1.00 (reference)	1.00 (reference)
High school or above	264	73	1.96 (1.07, 3.57)**	1.76 (0.81, 3.83)
Average monthly income (US dollar)				
≥180	118	47	1.00 (reference)	1.00 (reference)
<180	183	46	1.59 (0.99, 2.53)	1.10 (0.59, 2.07)
Smoking status				
Active	279	79	1.00 (reference)	1.00 (reference)
Never or former	22	14	0.45 (0.22, 0.91)*	0.82 (0.35, 1.92)
Hours of sleep per day (hr)				
≥7	184	66	1.00 (reference)	1.00 (reference)
<7	117	27	1.55 (0.94, 2.57)	0.67 (0.38, 1.18)
Vaccination against COVID-19 (dose)				
None	14	7	1.00 (reference)	1.00 (reference)
1	38	17	1.19 (0.38, 3.27)	1.42 (0.42, 4.77)
2	93	33	1.41 (0.52, 3.79)	1.33 (0.42, 4.17)
3	156	36	2.17 (0.82, 5.76)	1.67 (0.48, 5.82)
Depression				
No	203	78	1.00 (reference)	1.00 (reference)
Yes	98	15	2.51 (1.37, 4.59)**	1.43 (0.63, 3.25)
Anxiety				
No	206	84	1.00 (reference)	1.00 (reference)
Yes	95	9	4.30 (2.08, 8.92)***	2.07 (0.83, 5.19)
Stress				
No	227	86	1.00 (reference)	1.00 (reference)
Yes	74	7	4.01 (1.78, 9.04)***	1.69 (0.61, 4.70)
Quality of life problems[2]				
No	146	75	1.00 (reference)	1.00 (reference)
Yes	155	18	4.42 (2.52, 7.76)***	3.25 (1.71, 6.19)***

COVID-19, coronavirus disease 2019; OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval; USD, US dollar; EQ-5D-5L, EuroQoL 5-Dimension 5-Level.
[1]Refers to reporting at least 1 symptom after COVID-19 infection.
[2]Refers to experiencing a problem on at least 1 dimension of the EQ-5D-5L scale.
*$p<0.05$, **$p<0.01$, ***$p<0.001$.

Prevalence of Mental Health Symptoms

In the present research, approximately 40% of the participants experienced mental health issues. The prevalence rates of depression, anxiety, and stress were 28.7%, 26.4%, and 20.6%, respectively. These figures were substantially higher than those reported in studies of the general population in Vietnam during the COVID-19 pandemic [29,30]. Furthermore, research has shown that individuals who have recovered from COVID-19 tend to experience higher levels of anxiety and depression compared to the general population [31,32]. The heightened risk of mental health problems observed in our study among individuals who had recovered from COVID-19 may also be linked to potential side effects of the medications used to treat the disease [33]. In our study, the proportions of patients exhibiting symptoms of depression and stress were higher than those reported in similar research conducted in the Philippines [34]. However, they were lower than the rates found in a study from Iraq [35]. These discrepancies could be

due to the use of different assessment tools, cultural factors, and the specific epidemic conditions in each region at the time of the research, which may influence the variation in mental health issues observed after COVID-19 infection. These findings highlight the prevalence rates of depression, anxiety, and stress among individuals who have recovered from COVID-19, regardless of their hospitalization history. This information is potentially valuable for policymakers and health professionals, as it underscores the mental health status of those with a history of COVID-19. It also may aid in developing targeted mental health care interventions and formulating management policies.

Our study revealed a trend toward diminishing mental health issues over time among participants. Specifically, patients for whom more than 12 months had elapsed since COVID-19 infection exhibited lower rates of mental health problems compared to those in the earlier periods. This observation aligns with the findings of Huang et al. [16]. The trend of decreasing mental health problems observed in our study could be attributed to gradual health improvement among patients and reduced manifestation of symptoms as the duration of the disease increases. Furthermore, changes in epidemic measures, including a shift from stringent quarantine and social distancing policies to an approach of coexisting with the virus, may also have influenced the results.

Mental health issues are prevalent among patients following COVID-19 infection; therefore, policymakers and healthcare professionals must implement appropriate interventions to address and improve patients' mental well-being comprehensively.

Prevalence of Quality of Life Issues

Our research findings indicate that the average EQ-5D-5L and EQ-VAS scores were 0.94±0.11 and 84.20±13.11, respectively. These scores align with those reported for the general populations in Vietnam [36] and Thailand [37]. During the study period, Ho Chi Minh City represented the epicenter of Vietnam's battle against the virus, with District 8 experiencing one of the most severe outbreaks. Thousands were tested, and rigorous quarantine measures were implemented [38], which had the potential to impact QoL. Contrary to expectations, our study revealed that QoL in respondents was not significantly diminished following COVID-19 infection. This may be attributed to the fact that our study participants were relatively young, with a mean age of 29.46±12.17 years, and the majority had no history of chronic disease.

Our findings indicate that approximately 45% of patients reported experiencing at least one QoL issue as measured by the EQ-5D-5L scale, a rate consistent with that observed in the general population of Vietnam [25]. The two most prevalent issues reported were anxiety/depression (32.7%) and pain/discomfort (25.4%). These findings align with a study conducted in China, where anxiety/depression and pain/discomfort were also the most commonly reported problems [39]. While these outcomes cannot be wholly attributed to COVID-19, our research suggests that a large proportion of those infected with the virus experience mental health issues and pain/discomfort, which in turn impacts their QoL. Therefore, addressing pain levels and mental health issues should be a priority, and screening patients for these symptoms following COVID-19 infection may improve their QoL. These insights can assist policymakers in providing enhanced medical healthcare services to patients after COVID-19 infection.

Limitations of the Study

Our research did not incorporate a baseline assessment of participants' physical and psychological health before COVID-19 infection. Thus, distinguishing the effects of COVID-19 from those of pre-existing conditions was challenging. The research also employed a cross-sectional design, limiting our capacity to determine causality. However, this approach enabled us to generate hypotheses and provides a foundation for subsequent studies.

NOTES

Conflict of Interest

The authors have no conflicts of interest associated with the material presented in this paper.

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Author Contributions

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