ORIGINAL RESEARCH

Long COVID Symptoms and Five Dimensions of HRQoL: A Retrospective Regional Study of Patients Recovered from COVID-19 Infection in Saudi Arabia

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Background/Aim: 10–20% of people infected with the coronavirus infection have long COVID symptoms, therefore, current research is the first regional assessment in Saudi Arabia to determine the relationship between long-term health complaints of COVID-19 survivors and health-related quality of life (HRQoL).

Methods: The study population comprised COVID-19 infection cases registered in the Ha'il region of Saudi Arabia from the beginning of the COVID-19 pandemic until September 2022. A retrospective research design was employed, and 295 participants completed a self-report questionnaire to assess long COVID symptoms and the Arabic version of the European 5-Dimensional Quality of Life (EQ-5D). Multiple linear regression was used to evaluate the predictive role of long COVID symptoms on the HRQoL of patients by choosing (p-value < 0.05).

Results: The mean (SD) age of the participants was 38 years, (67.1%) were male and (58.6%) were married. On the long COVID-19 symptoms, the highest mean values were fatigue (M=2.3; 95% CI 2.1–2.4) followed by headache (M=2.1; 95% CI 2.0–2.3) and persistent cough (M=1.9; 95% CI 1.8–2.1). Findings show that HRQoL was problematic in domains of pain/discomfort as depicted by a highest mean score on this domain (M=4.24; 95% CI 4.14–4.33) followed by anxiety/depression (M=4.17: 95% CI 4.08–4.27). Multiple regression analysis showed that marital status (p=0.05), irregular exercise (p<0.01), duration of hospitalization (p<0.01), and oxygen therapy (p<0.05) were the independent background factors affecting HRQoL post-COVID-19. Among the long-COVID-19 symptoms, fatigue (p=0.05), persistent cough (p=0.001), dyspnea (p=0.02), and sexual dysfunction (p<0.001) were the independent factors that impacted the HRQoL after controlling for background variables.

Conclusion: The study has significant implications for Saudi Arabia's Health Sector Transformation Program that could achieve its goals of human centric care and patient satisfaction though addressing the negative impacts of specific long-COVID symptoms such as fatigue, persistent cough, dyspnea and sexual dysfunction and improving the HRQoL in domains of pain/discomfort and anxiety/depression.

Keywords: pandemic, healthcare, fatigue, pain, discomfort, anxiety, sexual dysfunction

Introduction

Mortality estimates based on data from 191 countries and territories reported that severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2 or COVID-19) claimed around 18 million lives around the globe.[1] The harsh impacts of

COVID-19 were not limited to the high rates of death but extended to disability and poor health-related quality of life. This has been demonstrated by a systematic review of various original studies carried out during the pandemic among various segments of the population in different regions of the world.[2] The lockdown measures during the pandemic propagated a sedentary lifestyle that impacted both physical and emotional health of the general population and, more specifically, people recovered from the COVID-19 infection.[3] Few studies also investigated the prevalence of poor physical[4] and mental health symptoms[5] among people who had a prior diagnosis of COVID-19. Clinical investigations and observations of healthcare providers indicated that many recovered patients experienced various health complaints for a longer duration after the acute phase. The term long-term complaints or post-COVID-19 illness has been used to describe persistent symptoms in people who have either recovered from COVID-19 or have had the usual symptoms for far longer than would be expected.[6]

A systematic review of 37 studies from all continents of the world confirmed a significant decrease in HRQoL among COVID-19 survivors and recommends that future research concentrate on tracking the changes in HRQoL over time to develop targeted interventions, particularly for COVID-19 survivors.[7] A study from China assessed the role of coping behaviors in dealing with the repercussions of COVID-19 on health and well-being. The study concluded that positive coping behaviors promote a sense of personal control and emotional well-being, thus enabling COVID-19 survivors to carry out physical fitness activities, manage stress reactions, and experience better physical and psychological health.[8] This study validates the need for assessment of the nature of long-term health problems faced by COVID-19 survivors and their impacts on various domains of their quality of life to develop appropriate public health interventions.

In Saudi Arabia, SEHHATY, the official health application, was used to monitor the mortality and morbidity due to the COVID-19 infection. Epidemiological studies reported the case fatality rate due to COVID-19 was 1.21% during the pandemic period.[9] Although the mortality rate declined in the post-COVID-19 period, the prolonged complications and late consequences are still unclear and cause an increased unplanned return of patients to emergency departments and related healthcare facilities.[10] Follow-up investigations demonstrated that among COVID-19 patients, 55% who underwent intensive care unit complained of impaired lung function till 3 months after discharge and restrictive respiratory patterns, while 65% of patients reported difficulty in walking a 6-minute distance.[11] Other studies investigated acute clinical manifestations and revealed that ventricular dysfunction, cardiogenic shock, myocardial ischemia/infarction, acute heart failure and renal dysfunction are the most common manifestations among hospitalised patients with COVID-19.[12,13] Among those with mild COVID-19 who experienced long-term health difficulties such as myalgia and arthralgia, the major complication of severe COVID-19 is catabolic muscle wasting because of systemic inflammation, prolonged bed rest, and malnutrition.[14]

Studies of long-term consequences and prolonged symptoms have attracted increased interest from many researchers and health agencies that have reported a wide array of post-COVID-19 complaints. In general, more than two-thirds of COVID-19 patients reported at least one long-term symptom for 6 months after the initial acute symptoms.[15,16] A meta-analysis of the long-term effects of COVID-19 revealed more than 50 late sequelae and complaints, of which fatigue was the most common, followed by headache, attention disorders, hair loss, and dyspnea.[17,18]

Impaired HRQoL is an important health outcome indicator that is traditionally employed by healthcare providers in determining the effects of various chronic diseases on the physical, mental, and social dimensions of health. Assessment of HRQoL provides a complete picture of the patient's perceptions of their health, functioning and well-being in physical and psychosocial domains of life. The concept of impaired (HRQoL) was reported with previous similar infections of severe acute respiratory syndrome (SARS-CoV-1) and Middle East respiratory syndrome infection.[19,20] The EuroQoL-5D assesses impairment in HRQol based upon the person's opinion of their health in five domains that are mobility, self-care, usual activities, pain/discomfort and anxiety/depression.[21] A systematic review of studies that have employed EQ-5D concluded that this tool demonstrated adequate psychometric properties to assess HRQoL across diverse populations, conditions and settings.[22] HRQoL is the primary outcome variable being measured in our study using EQ-5D, and the same measure has also been used previously to characterise and quantify HRQoL among COVID-19 survivors in an Ethiopian study.[23]

The evaluation of the long COVID symptoms and their relationship with HRQoL among COVID-19 survivors is crucial for developing a variety of health strategies to improve public health in the Kingdom of Saudi Arabia (KSA). The Saudi government is committed to improving several indicators of population health and taking several initiatives in this regard. The Health Sector Transformation Program was initiated in 2021 as part of Vision 2030 and one of its goals is to overhaul the

health sector, creating a comprehensive, efficient, and integrated health system that prioritizes the well-being of both individuals and the community.[24] Currently, there is a scarcity of local research to determine the common long-term complaints and consequences of COVID-19 on the (HRQoL) of the adult population in Saudi Arabia. The current study, therefore, aims at identifying long-term complaints of COVID-19 survivors living in the Hail region, Saudi Arabia and impacts on their quality of life (QoL). Findings from the study will help make an actual interpretation of post-COVID-19 symptoms, minimize the risk of long-term effects and devise community health interventions to enhance population health.

Materials and Methods

Research Design

A retrospective analytical design was utilized to determine the long-term incidence of COVID-19 and to investigate the effect of COVID-19 on the quality of life among COVID-19 survivors in the Ha'il region, the largest city in the northern district of Saudi Arabia.

Study Population, Sampling Methodology and Sample Size

The study population comprised all confirmed cases of COVID-19 infection according to the SEHHTY application, the official application of the Ministry of Health. Official permission was obtained from the health cluster in the Ha'il region. The database of the COVID-19 dashboard in the health affairs in Ha'il was officially accessed to establish a sampling frame for the study. A systematic random sample technique was applied to choose the study sample by using the list of cases that screened positive for the COVID-19 infection, and their data were available in the system. The application dashboard showed that 10800 cases of COVID-19 were confirmed through September 2022 in the Ha'il region. The sample size was determined using an epi-info calculator for the descriptive study by choosing a prevalence rate of 45% experiencing at least one unresolved long-COVID symptom reported in a systematic review of previous studies and 5% margin of error.[25] The final study sample comprised (n=295) participants who met the inclusion/exclusion criteria. The inclusion criterion was a confirmed history of COVID-19 infection at least 6 months ago, while participants who complained of cognitive disabilities or were aged less than 18 years were excluded.

Instruments of Data Collection

A structured questionnaire was formulated after reviewing the related literature.[12,13,26] This questionnaire comprises three parts. The first part included items to assess the sociodemographic and clinical data, history of acute infection, level of intervention, and length of hospital stay. The second part of the structured questionnaire was adapted from a study that assessed long-term complaints, which included headache, arthralgia/myalgia, persistent cough, dyspnea, weight loss, loss of appetite, chest pain, palpitation, dementia, depression, loss of acquired skill, sexual dysfunctions, smell and taste impairment, skin pigmentation, and repeated health seeking.[17] The intensity of symptoms experienced by patients is determined by rating each symptom on a 5-point Likert scale from (1=Never) to (5=Always). The third part of this study instrument focused on the evaluation of the level of quality of life among COVID-19 survivors using the European Quality of Life Scale-5 dimensions (EQ-5D), which is a valid and reliable scale first version was developed by the EURO group in 1987.[27] This tool to measure HRQoL has been extensively researched and upgraded. The 5-level EQ-5D version, which has also been used in this study, has been tested for the appropriateness of its psychometric properties.[21] This version of the scale contains 5 dimensions of health-related quality of life: mobility, self-care, usual life activities, pain and discomfort, and anxiety/depression. Each dimension is scored on a five-point Likert scale ranging from: (No Problems=1, Slight Problems=2, Moderate Problems=3, Severe Problems=4 and Extreme Problems=5). The patient is directed to specify his/her health state by checking the box next to the most applicable statement in each of the five dimensions. The Arabic version of the EQ-5D scale was developed and tested for validity and reliability by Aburuz et al 2009[28] and Bekairi et al 2018.[29] The validity studies report psychometric properties of the Arabic version of the tool that were determined by assessing its internal consistency, test-retest reliability, and construct and content validity which were found to be adequate. In the current study, the alpha reliability for the five dimensions and the whole scale was between 0.74–0.81.

Procedures for Data Collection and Pilot Testing of Study Tool

The researchers phoned the candidates and shared some of the details related to the study such as the aim of the study, study procedures, possible risks and benefits, assurance and procedures to retain confidentiality and anonymity of data. In addition to the participant's role and their right to give up, the agreement to participate was obtained verbally from each participant. For those who consented to participate in the study, online survey links were shared with participants through the appropriate means of online communication. A pilot study of 35 participants in the presumed sample was carried out to assess the applicability, feasibility, and reliability of the scale. The results indicated that the questionnaires were easy to understand and took 15–20 minutes. The internal consistency of scales was confirmed for the Self-report Questionnaire of COVID-19 Long-term Complaints and the EQ-5D as indicated by the Cronbach's alpha coefficient values of (α=0.87) and (α=0.82), respectively, indicating acceptable reliability indices.

Statistical Analysis

The data were analyzed using IBM SPSS Statistics software, version 27 (IBM Corp., Armonk, NY, USA). The mean and standard deviation [Mean SD] were used to report data on continuous variables, whereas frequencies and percentages were used to describe data findings on categorical variables. The Kolmogorov–Smirnov test was used to determine the normality of the distribution. The findings showed that the data were not normally distributed. Therefore, nonparametric statistics (such as the Mann–Whitney test or Kruskal–Walli's test) were employed in this investigation for bivariate analysis. For multivariate analysis, linear regression analysis was applied as it does not assume normality for either predictors (IV) or the outcome (DV). This analysis was applied to evaluate factors significantly linked to participants' quality of life after COVID-19 by choosing the (p-value < 0.05) for statistical significance.

Ethical Consideration

The study complies with the Declaration of Helsinki, which provides clear guidance on ethical principles for medical research involving human participants. Ethical approval was obtained from the Institutional Review Board (IRB) of the University of Ha'il and the General Directorate of Health Affairs, Ministry of Health. Informed consent was obtained from all research participants, and anonymity and security of data were maintained.

Results

Demographic Characteristics and Long-COVID-19 Symptoms

The findings of this study are distinguished by their comprehensive scope. The research examined various factors, including long-COVID-19 symptoms, that may relate with HRQoL among COVID-19 survivors in the Ha'il region of the Kingdom of Saudi Arabia (KSA). Furthermore, by concentrating specifically on the nature of long-term COVID-19 symptoms, the study provides clinically meaningful information to develop targeted interventions and improve individual and community health and well-being.

Table 1 provides a summary of the sociodemographic characteristics of the study participants. The mean (SD) age of the participants was (M=38.09; S.D=14.55) years, and most of them were male (67.1%) and lived in urban areas (61.7%). More than half (58.6%) were married, and less than half had secondary education or a governmental employer (48.5% and 41.7%, respectively). Table 1 also shows that most participants (43.1%) live with 3–5 family members, and more than one-third of them (39.7%) carry out less regular physical exercise and activities. Approximately one-third of the participants were nonsmokers, and more than half had no diet regimen or consumed complementary nutrients or vitamins.

History of Acute COVID-19 Illness and Healthcare

Table 2 presents findings about the history of acute COVID-19 illness at the time of diagnosis and its clinical management. Around (60%) of patients had fever, (63.7%) reported cough, (48.8%) had dyspnea, (57.6%) had fatigue and (55.6%) experienced headache. (48.5%) experienced loss of smell and taste, and around one-quarter of participants (26.8%) reported mental symptoms such as fear and distress. Over fifty per cent of participants reported that the duration of complaints lasted for more than seven days. Around one-third of patients (31.5%) reached healthcare centres through

Table 1 Descriptive Data on Sociodemographic Characteristics and Lifestyle Variables (N=295)

Variables	Descriptive Statistics		
Age	M (SD)	38.09 (14.55)	
BMI	M (SD)	25.14 (3.16)	
Variables	**Categories**	**n**	**%**
Gender	Male	198	67.1
	Female	97	32.9
Marital status	Married	173	58.6
	Single	92	31.2
	Divorced	30	10.2
Educational level	Primary	38	12.9
	Secondary	143	48.5
	University	114	38.6
Occupation	Governmental	123	41.7
	Private	76	25.8
	Unemployment	96	32.5
Number of family members	< 3	94	31.9
	3–5	127	43.1
	≥ 5	74	25.1
Exercises	Regular exercises	88	29.8
	Irregular exercise	117	39.7
	No exercise activity	90	30.5
Nutrition	Diet regime	36	12.2
	Diet consideration	85	28.8
	No diet regime	174	59.0
Smoking	Smoker	97	32.9
	Past smoker	95	32.2
	Non-smoker	103	34.9

Abbreviations: M, mean; SD, standard deviation; BMI, body mass index; n, frequency, %: percentage.

Table 2 Descriptive Data on the History of Acute COVID-19 Illness and Intervention (n=295)

Presenting Complaints	Categories	n	%
Fever	No	119	40.3
	Yes	176	59.7
Cough	No	107	36.3
	Yes	188	63.7
Dyspnea	No	151	51.2
	Yes	144	48.8
Fatigue	No	125	42.4
	Yes	170	57.6

(*Continued*)

Table 2 (Continued).

Presenting Complaints	Categories	n	%
Headache	No	131	44.4
	Yes	164	55.6
Associated symptoms	None	23	7.8
	Loss of smell and taste	143	48.5
	Insomnia	50	16.9
	Fear/Distress	79	26.8
Duration of complaints	3 days or less	75	25.4
	4–7 days	67	22.7
	More than 7 days	153	51.9
Mode of delivery to healthcare centre	Ambulance	93	31.5
	Went to ER	146	49.5
	Request home care	56	19.0
Level of help	ER-OPD	107	36.3
	IPD	122	41.4
	ICU	66	22.4
Hospitalization	3 days or less	118	40.0
	4–7 days	73	24.7
	More than 7 days	104	35.3

Abbreviations: n, frequency, %: percentage; ER-OPD, Emergency room – outpatients department; IPD, In-patient department; ICU, intensive care unit.

ambulance services, around fifty per cent (49.5%) went to the emergency room and (19.0%) requested home care. Most patients sought help through in-patient department care (IPD) (41.4%) followed by emergency outpatient department (ER-OPD) (36.3%) and (22.4%) through intensive care unit (ICU) services. Most patients were hospitalized for less than three days (40%) and (35.3%) of patients had more than seven days of hospitalization.

Early Clinical Management and Course of Treatment for COVID-19

Table 3 shows that most patients did not require oxygen supply (43.7%) and among those who needed oxygen supply the majority were given it through a mask (29.2%). Those who received oxygen through a mechanical ventilator (11.9%) and other methods (15.3%). A large percentage of patients (90.8%) were given IV fluids and antipyretics. Over fifty per cent

Table 3 Descriptive Data on Early Clinical Management and Course of Treatment (n=295)

Clinical Management	Categories	n	%
Oxygen Supply	No Oxygen Supply	129	43.7
	Oxygen Mask Supply	86	29.2
	Mechanical Ventilator	35	11.9
	Other methods	45	15.3
IV fluids and Antipyretics	No	27	9.2
	Yes	268	90.8
Antiviral	No	225	76.3
	Yes	70	23.7

(*Continued*)

Table 3 (Continued).

Clinical Management	Categories	n	%
Antibiotic	No	122	41.4
	Yes	173	58.6
Corticosteroids	No	211	71.5
	Yes	84	28.5
Protective Measures	Face Mask	67	22.7
	Hand washing	22	7.5
	Social Distancing	25	8.5
	All of above	179	60.7
Quarantine	Home Quarantine	202	68.5
	In Hospital Quarantine	84	28.5
	Others	9	3.1
Vaccination	Vaccinated before infection	149	50.5
	Vaccinated after infection	129	43.7
	Not Vaccinated	17	5.8
Follow-up for Corona	Yes	121	41.0
	No	174	59.0

Abbreviations: n, frequency, %:percentage.

of patients were treated with antibiotics (58.6%) and around one quarter and a similar percentage received antiviral (23.7%) and corticosteroids (28.5%). Most patients (60.0%) applied all protective measures including facemasks, handwashing and social distancing. Almost half of the patients made follow-up visits (41.0%).

History of Previous Illnesses/Disability

Table 4 shows that (18%) of patients had a history of cardiovascular diseases, (23.7%) had a history of respiratory illness, (16.0%) had a history of diabetes and (3.7%) had a history of Rheumatoid disease. Over fifty per cent of patients (58.6%) did not require any life-long drugs while the majority had completed regular immunization (73.2%) and (48.8%) had more than one-time hospital admission.

Table 4 Descriptive Data on the History of Previous Illnesses/Disability (N=295)

History of Previous Illness	Categories	n	%
Cardiovascular Diseases	No	242	82.0
	Yes	53	18.0
Respiratory Illnesses	No	225	76.3
	Yes	70	23.7
Diabetes Miletus	No	247	83.7
	Yes	48	16.3
Rheumatoid factor	No	284	96.3
	Yes	11	3.7

(*Continued*)

Table 4 (Continued).

History of Previous Illness	Categories	n	%
Life-long Drugs	No life-long drugs	173	58.6
	Anti-hypertensive	36	12.2
	Anti-Asthma	31	10.5
	Anti-diabetics	23	7.8
	Anti-coagulants	10	3.4
	AHTN-DM	22	7.5
Routine Childhood Immunization	No	79	26.3
	Yes	216	73.2
History of Hospital Admission	No	87	21.7
	Once	144	48.8
	More than Once	64	21.7

Abbreviations: n, frequency, %: percentage; AHTN-DM, Arterial hypertension type 2 diabetes mellitus.

Nature and Intensity of Long-COVID-19 Symptoms

Table 5 shows the mean scores with 95% CI for mean on various Long-COVID-19 symptoms. The highest mean values were fatigue (M=2.3; 95% CI 2.1–2.4) followed by headache (M=2.1; 95% CI 2.0–2.3) and persistent cough (M=1.9;

Table 5 Descriptive Findings on Long-COVID-19 Symptoms (n=295)

Long-COVID 19 Symptoms	M	SD	95% CI for Mean	Min-Max
Fatigue	2.3	1.3	2.1–2.4	1–5
Headache	2.1	1.2	2.0–2.3	1–5
Persistent Cough	1.9	1.2	1.8–2.1	1–5
Chest Pain	1.4	0.81	1.3–1.5	1–4
Dyspnea	1.5	0.87	1.4–1.6	1–4
Palpitations	1.3	0.66	1.2–1.4	1–4
Impaired Sense of Smell	1.6	0.91	1.5–1.7	1–5
Impaired Sense of Taste	1.6	0.93	1.5–1.7	1–4
Arthralgia/Myalgia	1.8	0.94	1.7–1.9	1–5
Skin Pigmentation	1.3	0.76	1.2–1.3	1–4
Weight Loss	1.2	0.42	1.1–1.2	1–3
Loss of Appetite	1.8	0.96	1.7–1.9	1–5
Loss of Acquired Skills	1.4	0.8	1.4–1.5	1–4
Confusion	1.7	0.98	1.6–1.8	1–5
Memory Problems	1.4	0.87	1.3–1.5	1–4
Depressive Episodes	1.3	0.69	1.3–1.4	1–5
Sexual Dysfunction	1.8	1.1	1.7–1.9	1–5
Repeated health-seeking	1.4	0.8	1.3–1.5	1–5

Abbreviations: M, mean; SD, standard deviation; 95% CI, 95% Confidence Interval.

95% CI 1.8–2.1). The mean scores on the loss of appetite, arthralgia/myalgia and sexual dysfunction are around (M=1.8; 95% CI 1.7–1.9). The mean score on repeated health-seeking was (M=1.5; 95% CI 1.3–1.5).

Health-Related Quality of Life

Figure 1 displays the participants' health-related quality of life, showing the means of their responses across the five dimensions of the EQ-5D. Findings show that HRQoL more was problematic in domains of pain/discomfort as depicted by a highest mean score on this domain (M=4.24; 95% CI 4.14–4.33) followed by anxiety/depression (M=4.17: 95% CI 4.08–4.27) and activity of daily living (M=4.08; 95% CI 3.97–4.17). The HRQoL was relatively less problematic in the domain of self-care activities (M=2.95; 95% CI 2.78–3.12) and the domain of walking and movement (M=2.63; 95% CI 2.44–2.81). The mean score on the full scale of HRQoL was (M=18.0 95% CI 17.6–18.0). The frequency and percentage values computed on each sub-category of the five dimensions of HRQoL are presented in Table 6. Around 25% of the participants reported being unable to walk about; 24% reported serious deficits in self-care activities, 43% reported being unable to carry out usual activities; around 46% experienced extreme pain and discomfort, and 42% experienced extreme feelings of anxiety and depression. Overall, the pattern of descriptive findings demonstrates that a higher percentage of participants experienced moderate to extreme levels of problems in the five domains of HRQoL as assessed by EQol-5D.

Predictors of Health-Related Quality of Life

Findings from bivariate analysis are presented in Tables S1–S5. Table S1 shows significant mean rank differences in the categories of marital status (p<0.05), number of family members (p<0.05), physical exercise (p<0.001) and smoking (p<0.01). Table S2 shows significant mean rank differences in the health-related quality of life for those presented with complaints of fever (p<0.001), cough (p<0.05), fatigue (p<0.01), headache (p<0.05), associated symptoms (p<0.001), and duration of complaints (p<0.001). Moreover, there were significant mean differences in the health-related quality of life in the mode of delivery for health care and level of help at (p<0.05). Table S3 shows significant mean rank differences in the health-related quality of life across categories of oxygen supply (p< 0.001), those who were given antiviral vaccination (p=0.05), quarantine (p<0.001) and vaccination (p<0.001). Table S4 shows significant mean rank differences in the health-related quality of life across categories of those who had hospital admission (p<0.001). Table S5 shows that various long-term COVID-19 symptoms are significantly associated with five domains of health-related quality of life. BMI, headache, persistent cough, palpitations, arthralgia/myalgia, weight loss, loss of appetite, loss of acquired skills and repeated health-seeking were found to be positively associated with health-related quality of life in the domain of walking and movement at p<0.01 and p<0.05. Age, BMI and all long-COVID-19 symptoms were significantly associated with health-related quality of life in the self-care domain at p<0.01 and p<0.05. BMI and headache were negatively associated with health-related quality of life in the mental health domain at p<0.01 and p<0.05, respectively.
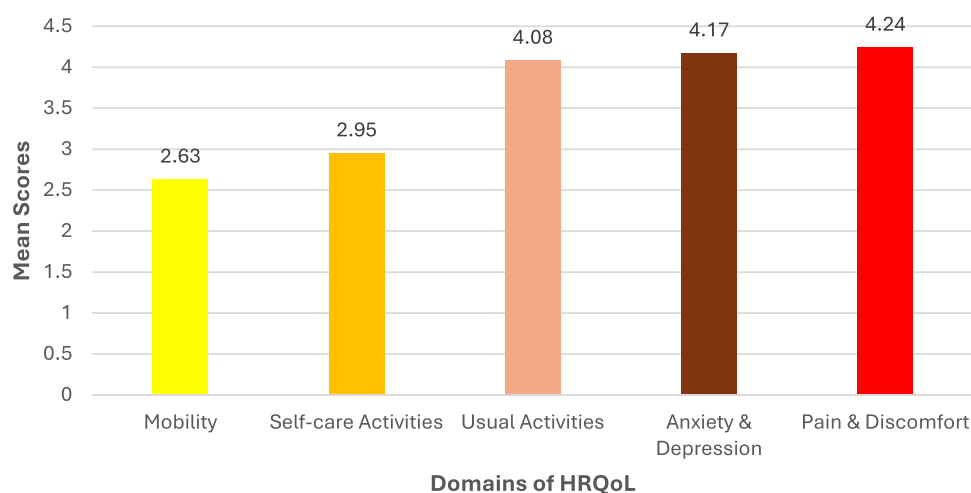

Figure 1 Mean scores on five domains of health-related quality of life (HRQoL).

Table 6 Descriptive Data on the EQoL-5D (n=295)

EQol-5D	New Scoring categories	n	%
Walking and Movement	I have no problems in walking about	118	40.0%
	I have slight problems in walking about	44	14.9%
	I have moderate problems in walking about	34	11.5%
	I have severe problems in walking about	27	9.2%
	I am unable to walk about	72	24.4%
Self-care Activities	I have no problems washing or dressing myself	75	25.4%
	I have slight problems washing or dressing myself	49	16.6%
	I have moderate problems washing or dressing myself	51	17.3%
	I have severe problems washing or dressing myself	54	18.3%
	I am unable to wash or dress myself	66	22.4%
Activities of Daily Living	I have no problems doing my usual activities	0	0%
	I have slight problems doing my usual activities	16	5.4%
	I have moderate problems doing my usual activities	70	23.7%
	I have severe problems doing my usual activities	82	27.8%
	I am unable to do my usual activities	127	43.1%
Pain & Discomfort	I have no pain or discomfort	1	0.3%
	I have slight pain or discomfort	10	3.4%
	I have moderate pain or discomfort	41	13.9%
	I have severe pain or discomfort	108	36.6%
	I have extreme pain or discomfort	135	45.8%
Depression/Anxiety	I am not anxious or depressed	0	0%
	I am slightly anxious or depressed	8	2.7%
	I am moderately anxious or depressed	56	19.0%
	I am severely anxious or depressed	107	36.3%
	I am extremely anxious or depressed	124	42.0%

Abbreviations: n, frequency, %: percentage.

Table 7 displays the findings from a multiple linear regression analysis to identify the background variables as predictors of health-related quality of life. Findings revealed that marital status ($p = 0.001$), regular exercise ($p = 0.00$), irregular exercise ($p = 0.01$), duration of hospitalization ($p = 0.01$), and oxygen therapy ($p = 0.02$) were the independent factors affecting the quality of life post-COVID-19.

Table 7 Multiple Regression Analysis to Determine the Predictive Factors of HRQoL in Patients Recovered from COVID-19 (n=295)

Variables	Categories	Unstandardized Coefficients		Standardized Coefficients	t	p-value sig.
		B	Std Error	β		
Marital Status	Married	Ref				
	Single	1.89	0.58	0.23	3.22	0.01
	Divorced	0.18	0.73	0.01	0.25	0.80
Activity	Regular exercises	−1.54	0.057	−0.18	−2.68	0.00
	Irregular exercise	−1.30	0.51	−0.17	−2.55	0.01
	No exercise activity	Ref				

(*Continued*)

Table 7 (Continued).

Variables	Categories	Unstandardized Coefficients		Standardized Coefficients	t	p-value sig.
		B	Std Error	β		
Smoking	Smoker	−0.67	0.50	−0.08	−1.32	0.18
	Past smoker	−0.66	0.54	−0.08	−1.20	0.22
	Non-smoker	Ref				
Fever	Yes	0.85	0.477	0.111	1.783	0.07
	No	Ref				
Cough	Yes	−0.76	0.43	−0.09	−1.78	0.07
	No	Ref				
Fatigue	Yes	0.49	0.46	0.06	1.07	0.28
	No	Ref				
Headache	Yes	0.48	0.42	0.06	1.14	0.25
	No	Ref				
Duration	< 3 days	−0.10	0.58	−0.01	−0.18	0.85
	4–7 days	−1.46	0.57	−0.16	−2.54	0.01
	>7 days	Ref				
Level of help	ER-OPD	Ref				
	IPD	0.34	0.55	0.04	0.61	0.53
	ICU	0.64	0.83	0.07	0.77	0.44
Oxygen	No oxygen supply	Ref				
	O2 mask supply	−1.15	0.51	−0.14	−2.22	0.02
	MV	1.03	0.88	0.08	1.16	0.24
	Others methods	0.43	0.66	0.04	0.65	0.51

Abbreviations: B, Unstandardized Coefficients; β, Standardized Coefficient; p-value significance; p<0.05.

Table 8 presents multiple regression analysis findings to determine the independent impact of long-COVID-19 symptoms on health-related quality of life. Findings showed that 22% of the variation in the outcome variable is attributed to variables in the model, and it was significant at (F=3.605;p<0.001). In this model, marital status (p=0.05)

Table 8 Multiple Regression Analysis to Determine Long-Covid-19 Symptoms Affecting HRQoL in Patients Recovered from COVID-19 After Controlling Significant Background Factors (n=295)

Study variables	Unstandardized Coefficients		Standardized Coefficients	t	p-value Sig.
	B	Standard error	β		
Constant	20.41	1.13		18.02	0.00
Marital Status	0.61	0.31	0.10	1.95	0.05

(*Continued*)

Table 8 (Continued).

Study variables	Unstandardized Coefficients		Standardized Coefficients	t	p-value Sig.
	B	Standard error	β		
Physical Activity	1.08	0.28	0.22	3.79	<0.001
Duration of hospitalization	0.43	0.28	0.09	1.50	0.13
Oxygen Supply	0.05	0.25	0.01	0.22	0.81
Fatigue	0.43	0.22	0.15	1.92	0.05
Headache	0.50	0.27	0.16	1.81	0.07
Persistent Cough	0.88	0.27	0.29	3.25	0.01
Chest Pain	0.72	0.45	0.15	1.58	0.11
Dyspnea	1.07	0.47	0.25	2.28	0.02
Palpitations	0.02	0.40	0.04	0.05	0.95
Impaired Sense of Smell	0.08	0.35	0.01	0.22	0.82
Impaired Sense of Taste	0.37	0.38	0.09	0.97	0.33
Arthralgia/Myalgia	0.38	0.31	0.09	1.26	0.20
Skin Pigmentation	0.61	0.41	0.12	1.49	0.13
Weight Loss	0.06	0.49	0.09	0.13	0.89
Loss of Appetite	0.03	0.34	0.09	0.09	0.92
Loss of Acquired Skills	0.35	0.48	0.07	0.73	0.46
Confusion	0.22	0.42	0.60	0.53	0.59
Memory Problems	0.39	0.48	0.09	0.81	0.41
Depressive Episodes	0.43	0.41	0.08	1.02	0.30
Sexual Dysfunction	1.13	0.28	0.34	3.95	0.00
Repeated health-seeking	0.48	0.31	0.10	1.58	0.11

Notes: B, Unstandardized Coefficients, β, Standardized Coefficients; p-value significance; p<0.05 The anonymous dataset used for this analysis is available at https://www.kaggle.com/datasets/drseharunnisahassan/long-covid-symptoms-and-(HRQoL).
Abbreviations: HQoL, Health related Quality of Life; COVID, Coronavirus disease infectious disease; EQ-5D, EuroQol 5 D; SARS, Severe Acute Respiratory Syndrome.

and physical activity (p=0.000) remained significant factors in (HRQoL). Among the long-Covid-19 symptoms, fatigue (p=0.05), persistent cough (p=0.001), dyspnea (p=0.023) and sexual dysfunction (p=0.000) were the independent factors that impacted the (HRQoL) post-COVID-19.

Discussion

Global, national and local health organizations are continuously exerting efforts to grapple with the health consequences of the COVID-19 pandemic.[30] Recent research studies document the emergence of long COVID symptoms in patients recovered from COVID-19 infection.[31,32] Many COVID-19 survivors reported a variety of long-term complications;

therefore, it is important to identify, evaluate and determine its impact on the various dimensions of quality of life to ensure adequate management of persistent or emerging health consequences.[33]

In the present study, the long COVID-19 symptoms were assessed among the sample of registered cases of COVID-19 in the Hail region, KSA. The results revealed that fatigue was the most prevalent symptom among participants, followed by headaches and persistent cough. Besides, COVID-19-recovered patients experienced a loss of appetite, arthralgia/myalgia and sexual dysfunction. A similar pattern of long symptoms has been reported in previous studies. For instance, two research studies validated that fatigue was the most common symptom that occurred for one month post-discharge, followed by other symptoms, such as shortness of breath, cough, lack of taste, muscular pain, diarrhea, lack of smell, production of sputum, and headache.[34,35] A recent local study demonstrated that fatigue was the most prevalent long-COVID symptom experienced by over fifty percent of the participants in the study sample.[36] Headache is among the second most reported long-COVID-19 symptoms and is among the neuropsychiatric long-term complications of COVID-19.[17] It may be an iceberg symptom of neurocognitive complications due to systemic inflammatory damage, although pathological studies of the brain and real-time PCR have failed to detect coronavirus in cerebrospinal fluid.[37] On the other hand, some studies did not report headaches as a long-term complaint.[38] Persistent cough was another common long-term COVID symptom experienced by survivors. Mandal et al reported that dyspnea, cough, and shortness of breath were frequently reported post-COVID-19 infection.[39] In addition, Halpin et al reported that two-thirds of ICU-discharged patients complained of breathlessness compared to two-fifths of ward-discharged.[34] The respiratory system is the primary site of coronavirus infections; thus, long-term complaints such as cough and chest pain, which can accompany dyspnea, may be related to frequent exposure to viruses during subsequent waves of pandemics. Regarding gastrointestinal alterations, participants experienced loss of appetite, and this persistent complaint may be related to the replication of the virus within the digestive tract.[40] Musculoskeletal symptoms were defined as complaints of COVID-19, both at the acute and sub-acute phases. According to one possible explanation, the presence of ACE 2 receptors in skeletal muscle and synovial tissue suggests that viral invasion causes these symptoms. Even though arthritis is common with many viral illnesses, COVID-19 typically causes myalgia and arthralgia without true inflammatory arthritis.[41] Medical research has shown that a dysregulated immune system with subsequent heightened release of proinflammatory cytokines leads to chronic low-grade inflammation and multiorgan symptomatology. Therefore, a dysregulated immune system may be a primary mechanism involved in the pathogenesis of SARS-CoV-2 infection. The persistence of coronavirus and resultant hyperproduction of proinflammatory cytokines are proposed to form the basis of longer-term health symptoms.

Among other long COVID-19 symptoms, survivors experienced confusion, memory loss, and depression. High levels of stress, extreme anxiety, and apprehension may aggravate symptoms and long-term complaints, particularly when individuals have a low level of knowledge about the novel cause of COVID-19 and when there is controversy among health agencies and many governments. Lopez et al, in a systematic review and meta-analysis study, reported that attention disorders, memory loss, and depression were 26%, 16%, and 12%, respectively, among COVID-19 survivors.[42] Similarly, a cohort study was carried out to investigate the 6-month psychiatric outcomes among COVID-19 patients; 46.2% of the hospitalized patients had neuropsychiatric problems, whereas 33.6% of the overall participants had neuropsychiatric problems. These complaints were disruptive to the extent that survivors of COVID-19 in this study reported frequent health-seeking for these long-term health complaints.[31]

The impact of COVID-19 infection on the quality of life has been assessed in many studies worldwide. Jacobs, L.G et al indicated that persistent symptoms for 35 days after discharge were significantly related to impaired ability to perform activities of daily living and impaired mental, social, and physical functions.[35]

To the best of our knowledge, no study has evaluated the impact of long COVID-19 symptoms experienced by patients who survived COVID-19 on their health-related quality of life (HRQoL) in Saudi Arabia and the Arabian Peninsula. The current study revealed that (HRQoL) was significantly affected by the post-COVID-19 infection of participants. Anxiety/depression and unexplained pain and discomfort were the most common deficits faced by patients as measured by EQ-5D scale and congruent with prior evidence.[43] The low (HRQoL) in the domains of pain/discomfort and anxiety/depression highlight that individuals recovering from COVID-19 continue to experience significant challenges in their daily lives. These findings align with those of Malik et al 2021 in a systematic review of post-acute

COVID-19 syndrome and (HRQoL); they concluded that over fifty per cent of post-COVID-19 patients had poor quality of life in various domains, ultimately present challenges for patients, healthcare providers, and public health providers.[44]

The pooled prediction analysis identified marital status, exercise habits, duration of hospitalization, and oxygen therapy as significant independent factors affecting quality of life post-COVID-19. Single participants experienced a more disturbed quality of life than married participants. Family and social support in Arabian society is important, and most people live in homogenous close families and tribes; this may explain these significant relationships. Moreover, COVID-19 patients were more dependent on their relatives because of quarantine and preventive measures. Concurrently, Emrani et al 2020 studied the effect of sociodemographic characteristics on the quality of life in Iran, they found that increased age and marital status are associated with low quality of life.[45] Moreover, the quality of life was significantly affected by the level of activity/exercise and smoking history. A lack of exercise activities (eg, walking) has been related to poor quality of life after discharge, which may be related to muscular resilience after COVID-19. Smoking leads to poor quality of life because of the systemic effects of smoking, impaired oxygen supply, and accumulation of carbon monoxide. This suggests that preventing smoking and improving physical activity play crucial roles in recovery, indicating potential areas for therapeutic focus and intervention.

Among the long-COVID-19 symptoms, fatigue, persistent cough, dyspnea and sexual dysfunction were the independent factors that impacted the (HRQoL) post-COVID-19 after controlling for the background variables. The study findings complement prior evidence that shows a greater number of individuals who experienced various long-COVID symptoms experienced low quality of life in domains of pain/discomfort and anxiety/depression.[46] Moreover, our study findings validate that sexual dysfunction impacts HRQoL. Individuals experiencing this symptom may face challenges in intimacy, leading to feelings of isolation, anxiety, or frustration. This can create a cycle where stress aggravates both the sexual dysfunction and the individual's mental health, further degrading their overall quality of life.[47] The stigmatization surrounding sexual health issues often leads to patients being reluctant to discuss these problems with healthcare providers. This silence can delay accurate judgment and treatment protocol. Therefore, raising awareness about the prevalence of sexual dysfunction as a long-COVID symptom is important for encouraging open communication and facilitating access to appropriate support and treatment. Addressing sexual health in the context of long-COVID is essential not just for individual well-being but also for the broader discussion about rehabilitation and recovery programs. Integrating sexual health into post-COVID care pathways can ensure a more holistic approach to recovery, prioritizing not only physical recovery but also emotional and relational health. Considering the impact of long COVID symptoms on different aspects of life and the identified predictors of quality of life, there is a clear need for specific rehabilitation programs, such as targeted physiotherapy for fatigue to improve the HRQoL on domains of pain/discomfort. Moreover, mental health screenings should be carried out to identify at-risk individuals and ensure the provision of timely support to prevent aggravation of mental health symptoms.

Overall, the regression model demonstrates that a modest variation is explained by long-COVID symptoms on HRQoL among COVID-19 survivors. The results highlight that incorporating factors like socioeconomic status, mental health history, and social support can offer a more comprehensive understanding of the risk factors and outcomes linked to long COVID symptoms among COVID-19 survivors.

There are some limitations of the study, such as the absence of a control group precludes causal conclusions. Moreover, self-report tools were employed to assess long-COVID symptoms and (HRQOL), which may cause recall bias and should be considered while interpreting the study findings. The lack of objective clinical measures (eg, lung function tests) is another critical limitation of the study that needs to be incorporated in future research. Overall, the study provides valid evidence and robustness in study design, recruitment of participants, validated study tools and data analysis method.

Conclusion

The findings from the current study reinforce the idea that managing specific long-term symptoms should be an integral part of post-COVID care to improve the overall quality of life for these individuals. Considering the impact of long COVID symptoms on different aspects of life and the identified predictors of quality of life, there is a clear need for comprehensive rehabilitation programs that include several components, such as targeted physiotherapy for fatigue and

integrating psychosocial counseling services in existing healthcare to improve HRQoL in all domains. Given the multifaceted challenges posed by long COVID, future research should explore the impact of these targeted therapeutic interventions in alleviating these symptoms and enhance the (HRQOL) for affected individuals.

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