

Original Research Article

Health-Related Quality of Life Assessment in Post-Covid Patients A Cross-Sectional Online Survey

ABSTRACT:

Aims:

- To compare the impact of covid-19 infection and its associated factors among various domains of quality of life (general health (GH), physical health (PH), mental health, and pain).
- To determine the variation and its contributing factors to the quality of life (QoL).
- To identify the most common persisting symptoms after covid-19 infection.

Study design: Cross-sectional community based online survey

Place and Duration of Study: Community-based online survey done for a period of 6 months (March 2021- September 2021) among patients who recovered from covid-19.

Methodology: A validated self-made questionnaire with informed consent was used to gather information on the patient's demographics (age, gender, educational qualification, occupation, marital status, and risk factors) covid-19 details (vaccination, severity, and hospitalization details), persisting symptoms, and Health Related Quality of Life (HRQoL).

The HRQoL questions with scored options were framed under four domains general health, physical health, mental health, and pain. A convenient sample of 120 participants was included in our study.

Results: The median and inter-quartile ranges were used to describe the HRQoL score. For normal data, Multiple Linear Regression (MLR) was used to investigate the relationship between the dependent and independent variables. MLR results demonstrated that risk factors, severity, and length of hospital stay were negatively associated with QoL.

For non-normal data, the Kruskal Wallis test (KWT) and Mann Whitney U (MWU) test were used to compare the effect of covid-19 and its associated factors among various domains of HRQoL. KWT and MWT showed that the ability to perform physical activity was highly impaired in most post-covid patients. Cough, myalgia, arthralgia, and headache were the significant persisting symptoms of covid-19, reported by our participants. IBM SPSS software version 28.0 was used for statistical analysis.

Conclusion: We conclude that health care intervention is needed to manage persisting symptoms and to improve HRQoL.

Keywords: Covid-19, Post-covid, Health-related quality of life (HRQoL), Domains.

1. INTRODUCTION

The coronavirus disease 19 (COVID-19) is an infectious disease caused by the worldwide transmission of the severe acute respiratory coronavirus 2 (SARS-CoV-2) ^[1]. Coronavirus Disease 2019, which was originally found in Wuhan, China, in December 2019, has sparked a global public health crisis. Covid-19 was declared a pandemic by the World Health Organization (WHO) on March 11, 2020. More than 200 countries have been hit by the pandemic, which has had a significant impact on world health ^[2]. The clinical manifestations of covid-19 are fever, cough, shortness of breath, loss of taste or smell, diarrhea, nausea, vomiting, and fatigue ^[3]. Some of these symptoms can last even after a patient has recovered from the condition ^[4].

Post-acute covid-19 syndrome (PACS, or long COVID) is defined by persistent and debilitating symptoms that persist at least four weeks after infection ^[5]. Extreme fatigue, muscle, joint pain, shortness of breath, heart palpitations, loss or alteration of taste and smell, gastrointestinal distress, and problems with attention, memory, and cognition are the symptoms of post-covid-19 ^[6]. The patient's quality of life (QoL) has suffered as a result of the persistence of these symptoms. QoL is a commonly used parameter for assessing and evaluating one's health and well-being ^[4].

WHO defines Quality of Life as an individual's perception of their position in life in the context of the culture and value systems in which they live and about, expectations, standards, and concerns ^[7]. It is a broad concept that is influenced by a person's physical health, psychological state, personal beliefs, social relationships, and relationship to salient features of their environment in a complex way ^[8]. Health-related quality of life (HRQoL) is an individual's or a group's perceived physical and mental health over time ^[9]. There are at least 150 different instruments available to assess a person's quality of life. The SF-36, SF-12, EQ-5D-5L, and EQ-5D-3L are the most widely used in various settings around the world ^[4].

1.1 Background:

Understanding the impact of covid-19 on the quality of life (QoL) of infected patients is emerging as a global challenge. **Studies have reported post-covid patients have persistent symptoms and impaired QoL.** ^[10,11] So, it is important to ascertain persisting impact of covid-19 on the QoL of infected individuals to aid the healthcare workers to support them.

Despite the need for information, there is only limited data available. Considering this, we aim to perform this online survey to explore the consequences and its, associated factors of covid-19 on QoL of post-covid patients.

2. METHODOLOGY

2.1 Study Design & Participants:

Our study is a cross-sectional, community-based online survey done for a period of 6 months (March 21- September 21). The participants included in the study were those who recovered from covid-19 infection, since the day 1 of recovery up to 6 months. Our study was conducted in South-India (Tamil Nadu). We shared the google form link via online means to our known contacts. Respondents who met our inclusion criteria were selected among them. Only patients over the age of 18 and those who had recovered from covid-19 were included in our study. Our exclusion criteria include patients under the age of 18, pregnant women and lactating mothers, patients with psychiatric illnesses, and patients with chronic complex co-morbidities.

2.2 Sampling method:

Our sampling method is convenience sampling which comes under non -probability / non – random sampling

Convenience sampling is a type of non-probability sampling that involves the sample being drawn from the population that is close to hand. Our literature survey also forms the basis for this.

2.3 Study Tool (Questionnaire Development):

A self-made questionnaire was prepared to conduct the online survey which consists of 22 demographic questions and 20 questions about the quality of life. Demographics were inclusive of age, BMI, educational qualification, occupation, and marital status, past medical history, vaccination, the severity of covid-19 infection, hospitalization, and post-covid symptoms. Questions related to the quality of life were framed under four domains namely General Health (GH), Physical Health (PH), Mental health, and Pain. Each domain consists of 5 questions. A 5-point scoring scale (Likert scale) was used to grade the questionnaire.

2.4 Questionnaire Validation:

As our questionnaire is self-made, we followed the validation technique. This technique includes the following steps:

1. Establish face validity
2. Conduct a pilot test
3. Data entry and examination
4. Principal component analysis
5. Internal consistency – the reliability of our questionnaire was ensured by deriving the Cronbach's alpha value of 0.83 using SPSS statistical software

2.5 Data Collection:

The questionnaire was circulated using Google form through web and mobile-based social networks like WhatsApp & E-mail. Informed consent was also attached with the google form to know the will of the patient to participate or not.

2.6 Statistical Analysis:

IBM SPSS statistical software (version 28.0) was used for statistical analysis. Descriptive statistics were performed for all experimental data. Kolmogorov-Smirnov (KS) test was used to check if the data were normally distributed. Differences in the dependent variables among the various categories of independent variables were determined using the Kruskal Wallis test and Mann-Whitney U test. Multiple linear regression was used to examine if there is any relationship between dependent variables and independent variables by analysing how much is the TQoL predicted by demographics.

3. RESULTS

A total of 120 participants responded to our survey. In our self-made and validated questionnaire, 11 questions were included under patient demographic details, 17 questions emphasizing Covid-19 infection & post-covid syndrome, and 20 questions to assess their HRQoL under 4 domains namely GH (general health), PH (physical Health), Mental health and Pain, consisting of 5 questions under each domain.

The Kolmogorov-Smirnov (KS) test for normality in SPSS statistical software showed that ours is a non-normal distribution of variables. Hence, we have used non-parametric tests for hypothesis testing with the confidence interval (CI) being 95%.

Table 1 - Patient Descriptives

Groups	No. of Patients (n=120)	Frequency
AGE		
18-35	71	59.17%
36-55	34	28.33%
56-75	15	12.50%
GENDER		
Male	77	64.17%
Female	43	35.83%
RISK FACTORS (RF)		
Abnormal BMI	52	43.33%
Medical History (MH)	6	5 %
Social History (SH)	6	5 %
Abnormal BMI &MH	20	16.67 %
NONE	36	30 %
EDUCATIONAL QUALIFICATION		
School	11	9.17%
Diploma	8	6.67%
Undergraduate	55	45.83%
Postgraduate	46	38.33%
OCCUPATION		
Student	35	29.17%
Employed	66	55.00%
Unemployed	5	4.17%
Homemaker	10	8.33%
Retired	4	3.33%
MARITAL STATUS (MS)		
Married	63	52.50%
Unmarried	56	46.67%
Widow	1	0.83%

VACCINATION		
Covaxin 1	4	9.17%
Covaxin 2	2	6.67%
Covishield 1	21	45.83%
Covishield 2	8	38.33%
None	85	70.83%
SEVERITY		
Asymptomatic	16	13.33%
Mild	78	65.00%
Moderate	19	15.83%
Severe	7	5.83%
HOSPITALIZATION		
Hospitalized	51	42.50%
Not Hospitalized	69	57.50%
LOHS(length of hospital stay)		
1-7 days	14	11.67%
8- 14 days	35	29.17%
> 14 days	2	1.67%

3a. Gender:

The majority of our respondents were male.

3b. Age:

The respondents were categorized into 4 age groups such as 18-35 years, 36-55 years, 56-75 years, and above 75 years. The majority of our respondents were within the category of 18-35 years of age. Mean age = 34.41; SD = 14.66; Median age = 28.00

3c. Risk Factors: (RF)

A risk factor is a variable that increases the risk or susceptibility of an outcome usually unpleasant i.e., disease, disorder, or syndrome. Based on the response we received, we have categorized risk factors as abnormal BMI (including those who are underweight, overweight, and obese), medical history (HTN and T2DM mainly), social history (smoking and alcoholism), and abnormal BMI with medical history(**table-1**). The majority of the respondents were having abnormal BMI.A Kruskal Wallis test showed that risk factors significantly affect the HRQoL of post-covid patients. A decrease in HRQoL was reported in Physical health, Pain, and Mental health. For HRQoL domain PH post- covid patients with both risk factors BMI & MH had lower HRQoL. For domains, Pain and mental health, post-covid patients with risk factor MH had lower HRQoL.

A Kruskal Wallis test results shown in **table-2** showed that age significantly affects the HRQoL of post-covid patients. A decrease in HRQoL with an increase in age was found in PH and PAIN. As HRQoL decreases with an increase in age, patients in the age group of 56-75 years have less HRQoL compared to post-covid patients in the age group of 18-35 years and they would have higher HRQoL.

Table no. 2: Mean Rank Score and p-value for all the Variables and HRQoL Domains- KW test

Variables	GH		PH		Mental health		PAIN	
	MR	P	MR	P	MR	P	MR	P
AGE								
18-35	61.64	0.495	70.87	<0.001	63.58	0.374	67.15	0.040
36-55	55.25		46.09		58.54		50.54	
56-75	67.00		44.07		50.33		51.57	
RISK FACTORS								
Abnormal BMI	64.05	0.153	62.65	<0.001	64.36	0.003	69.27	0.039
MH	28.08		34.67		19.00		30.83	
SH	72.67		77.17		61.08		66.08	
Abnormal BMI &MH	59.08		33.73		55.85		38.85	
NONE	59.54		73.79		64.33		63.88	
EDUCATIONAL QUALIFICATION								
School	69.27	0.452	63.50	0.583	73.00	0.438	70.82	0.228
Diploma	45.94		58.38		46.75		46.25	
Undergraduate	58.53		56.08		60.52		56.06	
Postgraduate	63.29		65.43		59.88		65.82	
OCCUPATION								
Student	63.41	0.752	74.37	0.025	64.64	0.286	69.89	0.230
Employed	60.26		57.58		62.22		59.28	
Unemployed	59.90		60.00		51.70		52.30	
Homemaker	48.10		39.15		51.80		47.60	
Retired	70.75		41.25		28.63		41.00	

Variables	GH		PH		Mental health		PAIN	
	MR	P	MR	P	MR	P	MR	P
MARITAL STATUS								
Married	57.41	0.526	47.61	<0.001	55.03	0.153	52.62	0.011
Unmarried	64.20		75.21		66.13		70.11	
Widow	48.00		49.00		89.50		19.00	
VACCINATION								
Covaxin 1	54.50	0.776	64.00	0.153	52.38	0.403	54.25	0.360
Covaxin 2	37.75		35.75		21.50		19.50	
Covishield 1	65.76		57.50		64.60		64.81	
Covishield 2	53.94		34.50		49.31		48.50	
None	60.64		64.11		61.84		61.82	
SEVERITY								
Asymptomatic	74.91	0.002	90.06	<0.001	77.75	<0.001	84.28	<0.001
Mild	64.52		59.40		63.87		63.60	
Moderate	45.05		48.82		47.55		38.24	
Severe	24.71		36.93		18.71		32.07	
LOHS								
1-7 days	32.14	0.165	34.50	0.005	30.71	0.036	30.68	0.036
8- 14 days	23.96		23.99		25.47		25.53	
> 14 days	18.75		1.75		2.25		1.50	

3d. Educational Qualification:

The majority of the respondents were undergraduates.

3e. Occupation:

The majority of our respondents were employed.

A Kruskal Wallis test showed that occupation significantly affects the HRQoL of post-covid patients. A decrease in HRQoL was reported in physical health. Homemakers have lesser HRQoL compared to students.

3f. Marital Status: (MS)

The majority of our respondents were married.

A Kruskal Wallis test showed that marital status significantly affects the HRQoL of post-covid patients. A decrease in HRQoL was reported in Physical health and Pain. For the domain, PH married post-covid patients had lower HRQoL. For the domain of Pain, the widow post-covid patient had lower HRQoL.

Table no. 3: Mean Rank Score and p-value for all the Variables and HRQoL Domains- Mann Whitney test

Variables	GH		PH		Mental health		PAIN	
	MR	P	MR	P	MR	P	MR	P
GENDER								
Male	63.90	0.148	59.84	0.781	64.19	0.118	60.32	0.941
Female	54.42		61.67		53.90		60.81	
HOSPITALIZATION								
Hospitalized	54.86	0.123	53.36	0.052	53.35	0.052	49.25	0.002
Not Hospitalized	64.67		65.78		65.78		68.82	

3g. Vaccination:

It is observed that the majority of our respondents were not vaccinated.

3h. Severity:

Risk factors associated with the patients tend to pave way for severe infection. The majority of respondents had a mild infection.

A Kruskal Wallis test showed that severity significantly affects the HRQoL of post-covid patients. A decrease in HRQoL was reported in all domains with an increase in severity. Post-covid patients who had severe covid-19 infection were found to have reduced HRQoL in all domains.

3i. Hospitalization:

The majority of the respondents were not hospitalized. A Mann-Whitney U test indicated that this difference was statistically significant (**Table 3**). A decrease in the HRQoL Domain – PAIN was observed in post-covid patients, hospitalized during covid-19 infection. HRQoL was affected more in post-covid patients, who were hospitalized during covid-19 infection.

3j. Length of Hospital Stay (LOHS):

It generally depends upon the severity of infection in the patient. The majority of our respondents were not hospitalized. Mean LOHS = 4.00; SD = 4.996; Median LOHS = 0.00

A Kruskal Wallis test showed that length of hospital stay significantly affects the HRQoL of post-covid patients. A decrease in HRQoL was reported with an increase in length of hospital stay. Patients hospitalized for more than 14 days showed a decrease in HRQoL to a higher extent comparatively. A decrease in HRQoL was reported with an increase in length of hospital stay in PH, Mental health, and pain.

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3k. Kruskal Wallis Pairwise comparison:

The Post Hoc Dunn's test using a Bonferroni-adjusted alpha level was done to identify the difference in QoL among patients in each domain. It showed that there was a significant difference in each domain between the patients according to their independent variable.

The difference in QoL between the groups that have statistical significance is given in **table 4**. There was no significant difference between the other groups.

Table 4 - Kruskal Wallis Pairwise Comparison between Groups

Group 1 – Group 2	P
Pairwise Comparison of Age AND PH	
(56-75) - (18-35)	0.019
(36-55) - (18-35)	0.002
Pairwise Comparison of RF and PH	
Abnormal BMI & MH- Abnormal BMI	0.015
Abnormal BMI & MH-NONE	0.000
Pairwise Comparison of RF AND Mental Health	
MH-NONE	0.030
MH- Abnormal BMI	0.024
Pairwise Comparison of RF AND PAIN	
Abnormal BMI & MH-Abnormal BMI	0.008
Pairwise Comparison of MS AND PF	
Widow-Unmarried	0.000
Pairwise comparison of MS AND PAIN	
Married-Unmarried	0.018
Pairwise Comparison of SEVERITY AND GH	
Severe-Mild	0.020
Severe-Asymptomatic	0.008
Pairwise Comparison of SEVERITY AND PH	

Severe-Asymptomatic	0.004
Moderate-Asymptomatic	0.003
Mild-Asymptomatic	0.007
Pairwise Comparison of SEVERITY AND Mental Health	
Severe-Mild	0.006
Severe-Asymptomatic	0.001
Pairwise Comparison of SEVERITY AND PAIN	
Severe-Asymptomatic	0.005
Moderate-Mild	0.025
Moderate-Asymptomatic	0.001
Pairwise Comparison of LOHS AND PAIN	
Above 14- (1-7) Days	0.040
(8-14) - (1-7) Days	0.022

3I. Multiple Linear Regression:

Multiple linear regression revealed that several factors were predictors of TQoL. The test showed that Age, RF, MS, Severity of covid-19, hospitalization due to covid-19, and LOHS have a significant correlation with TQoL. Gender, Educational Qualification, occupation, and vaccination were not significant.

To summarize the MLR results from **table 5**:

- Severity of covid-19, LOHS, and Risk Factors are the main predictors of TQoL.
- TQoL was negatively correlated with independent variables such as Age 36- 55, Risk factors- MH, MH & abnormal BMI, Severity- moderate & severe covid-19, and LOHS of 7-14 days & above 14 days.
- TQoL was positively correlated with independent variables such as Hospitalization – NO, Marital status- Unmarried, and Severity- asymptomatic.
- Age 56-75 years, Risk factors – NONE and LOHS 1-7 days were negatively correlated to TQoL but not significant.
- Risk factors – Social history and Marital status – widow was (not significant) positively correlated to TQoL.

Table 5 - Multiple Linear Regression for Independent Variables and TQOL

Independent Variable	t	p	β	F	df	P	Adj. R ²
AGE							
Overall model				4.240	2	0.017	0.052
36-55 Years	-2.606	0.010	-0.240				
56-75 Years	-1.881	0.063	-0.173				
RISK FACTORS							
Overall model				6.218	4	0.000	0.149
MH	-3.505	0.001	-0.305				
SH	0.256	0.798	0.022				
MH & Abnormal BMI	-3.535	0.001	-0.321				
NONE	-0.036	0.971	-0.003				
MARITAL STATUS							
Overall model				6.769	2	0.002	0.088
Unmarried	3.672	0.000	0.323				
Widow	0.086	0.931	0.008				
SEVERITY							
Overall model				13.161	3	0.000	0.235
Asymptomatic	3.127	0.002	0.256				
Moderate	-2.773	0.006	-0.228				
Severe	-4.199	0.000	-0.341				
HOSPITALIZATION							
Overall model				8.745	1	0.004	0.061
No	2.957	0.004	0.263				
LOHS							
Overall model				9.653	3	0.000	0.179
1-7 days	-.210	0.834	-0.018				
8-14 days	-3.066	0.003	-0.263				
Above 14 days	-4.637	0.000	-0.387				
<i>The dependent variable for all regressions was TQoL.</i>							

3m. Post Covid Manifestations:

The sample consists of 120 respondents shown in **Figure 1**. The prominent 3 post-covid manifestations reported by the study participants in terms of descending frequency are:

- Cough – 50%
- Myalgia – 39.17%
- Arthralgia and Headache – 37.50%.

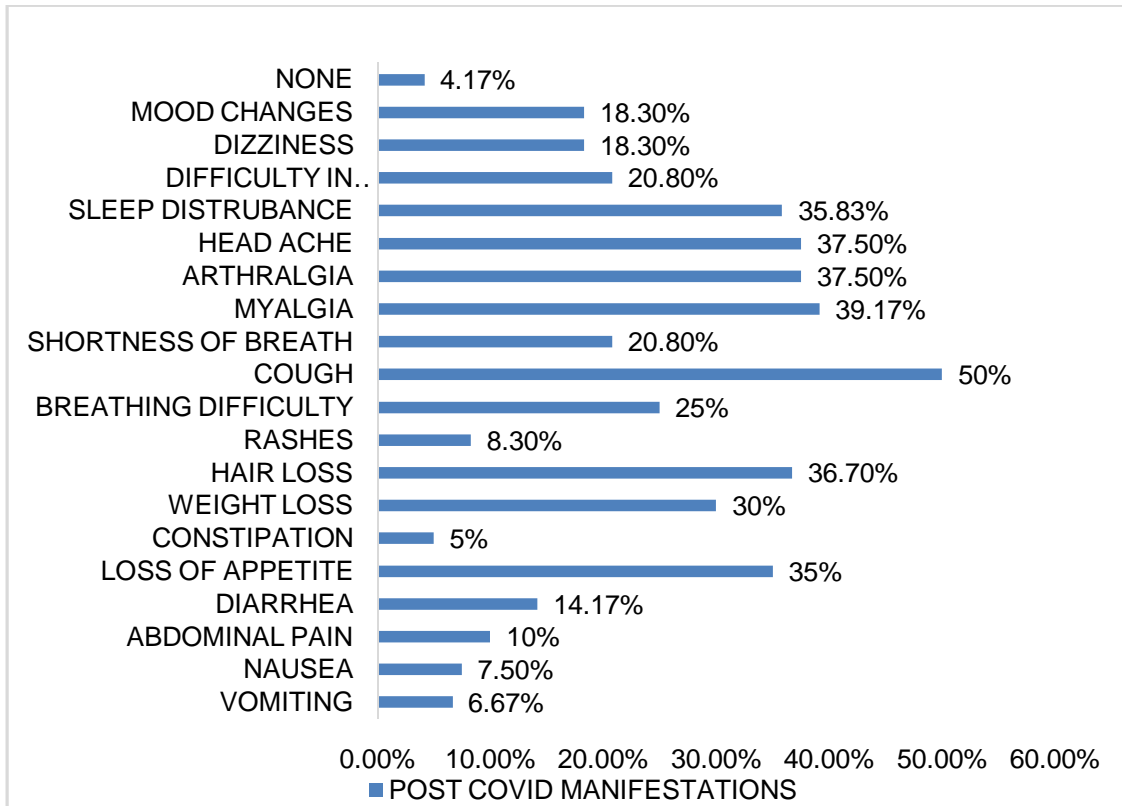


Figure 1: Distribution of Post- Covid Manifestations in 120 Respondents

4. DISCUSSION

Our study reflects the impact of covid-19 infection after recovery. We observed that ability to perform physical activity was highly impaired in post-covid patients. The severity of covid-19 infection, risk factors (Medical history, social history & abnormal BMI), and length of hospital stay due to covid-19 are found to be the factors that contribute to the impairment of health-related quality of life in patients.

4.1 Physical Health:

The mechanisms leading to impaired physical functioning are multifactorial and arise as a consequence of the infection, prolonged hospitalization, and/or immobility.^[12] The patients demonstrate decreased VO₂max independent of pulmonary and ventilatory function; leading to decreased cardiorespiratory fitness, which accounts for the reduction in physical functioning. Patients also experience significant muscle weakness, especially in the lower limb muscles which are involved in functional mobility. This acquired weakness may attribute to a decrease in muscle cross-sectional area and muscle fiber size or a reduction in type II muscle fibers. Lower levels of aerobic capacity and changes in muscle function are associated with decreased physical functioning in patients.

A physical impairment may also be explained by a higher burden of premorbid disease, frailty, and severity of covid-19 infection. In their study, a similar interpretation like this was concluded by Ke-Yang Chen et al.^[1]

Our study also reported that there has been a significant decrease in the QoL of post covid patients who were hospitalized. A similar interpretation was given by Jennifer K. Logue et al.,^[13] in their study.

Promoting recovery of physical function in people with SARS-CoV should be a key target of post-covid management since long-term physical function and quality of life was shown to be positively correlated in infected people.

4.2 Mental health:

Psychiatric ill-health was associated with severity of infection, attributable risk factors, and persistent physical symptoms such as myalgia, arthralgia, and headache.

This could be bidirectional: persistent physical symptoms may lead to psychiatric illness, and disturbed mental health could manifest as physical impairment. Additionally, the coronavirus may directly cause psychiatric complications through cerebral infection or hyperinflammation.^[1,12] Breakdown of social networks and physical isolation due to the alarming pandemic throughout the globe and fear of mortality increases the potential for the development of PTSD, anxiety, and depression.

Pain is believed to have a bidirectional relationship with such psychological factors. In the acute phase, it may be an inducer of the development of mental illness. This matches with the study done by Luca Carenzo, et al.^[14]

4.3 Pain:

Immobilization from hospitalization and bed rest and physical inactivity due to prolonged quarantine can reduce the organ system's ability to resist viral infection and raise the risk of musculoskeletal damage. The study conducted by Manuel Taboada, et al., also concluded the same.^[15]

Due to the breakdown of protein in muscle fibres, direct tissue infection and the inflammatory response of cytokines produced to resist the viral invasion most likely induce muscle soreness and bone fragility. Some individuals continue to have musculoskeletal problems like joint pain, backaches, sore muscles, fatigue, and joint stiffness even after they have recovered from covid-19. Multi-morbidity and advancing age are baseline patient characteristics associated with the development of severe COVID-19 that are similar to those associated with chronic pain following severe illness.

As per our study, decrease in QoL was reported with increase in severity of infection in post covid patients. Multiple linear regression also concluded that patients with moderate and severe Covid-19 infection corresponded to a significant decrease in their TQoL score.

In our study too, pain has been an influential domain in determining the HRQoL. The research study of Guangbo Qu, et al., also indicated a similar idea.^[3]

4.4 General Health:

Our study coincides with the study done by Matan Elkan et al., and Iqbal A, Iqbal K, Arshad Ali S, et al. in the aspect that patients affected with severe infection, exhibited impairment in their general health as a whole.^[10, 16]

Besides cough, myalgia and arthralgia and headache were the most prominent post-covid manifestations reported by our study participants. This seems to be corresponding to the interpretations given by Kamal, M, et al.^[17]

5. CONCLUSION

The purpose of our study is to evaluate the impact of covid-19 on HRQoL. Our study illustrates that covid-19 has a significant impact on the HRQoL of affected individuals. We found that poor HRQoL was associated with advanced age, severe covid-19 infection, and comorbidities. Although the factors that contribute to the impact of covid-19 on HRQoL have been established, it lacked a clear explanation of how these factors are linked to covid-19. This knowledge gap emphasizes the need for additional research to better understand the long-term consequences of covid-19. Furthermore, we propose proper therapeutic care should be given to assist the post-covid-19 patients' recovery.

9. CONSENT

All authors declare that electronic informed consent was obtained from the patients involved in this study.

10. REFERENCES

1. Chen K-Y, Li T, Gong F-H, Zhang J-S, Li X-K. Predictors of health-related quality of life and influencing factors for COVID-19 patients, a follow-up at one month. *Front Psychiatry* [Internet]. 2020;11:668. Available from: <http://dx.doi.org/10.3389/fpsy.2020.00668>
2. Algahtani FD, Hassan S-U-N, Alsaif B, Zrieq R. Assessment of the quality of life during COVID-19 pandemic: A cross-sectional survey from the kingdom of Saudi Arabia. *Int J Environ Res Public Health* [Internet]. 2021 [cited 2022 Jun 18];18(3):847. Available from: <https://www.mdpi.com/1660-4601/18/3/847/htm>
3. Qu G, Zhen Q, Wang W, Fan S, Wu Q, Zhang C, et al. Health-related quality of life of COVID-19 patients after discharge: A multicenter follow-up study. *J Clin Nurs* [Internet]. 2021;30(11–12):1742–50. Available from: <http://dx.doi.org/10.1111/jocn.15733>
4. Nandasena HMRKG, Pathirathna ML, Atapattu AMMP, Prasanga PTS. Quality of life of COVID 19 patients after discharge: Systematic review. *PLoS One* [Internet]. 2022;17(2):e0263941. Available from: <http://dx.doi.org/10.1371/journal.pone.0263941>
5. Tabacof L, Tosto-Mancuso J, Wood J, Cortes M, Kontorovich A, McCarthy D, et al. Post-acute COVID-19 syndrome negatively impact physical function, cognitive function, health-related quality of life, and participation. *Am J Phys Med Rehabil* [Internet]. 2022 [cited 2022 Jun 18];101(1):48–52. Available from: https://journals.lww.com/ajpmr/Fulltext/2022/01000/Post_acute_COVID_19_Syndrom_Negatively_Impacts.8.aspx
6. Jandhyala R. Design, validation and implementation of the post-acute (long) COVID-19 quality of life (PAC-19QoL) instrument. *Health Qual Life Outcomes* [Internet]. 2021;19(1):229. Available from: <http://dx.doi.org/10.1186/s12955-021-01862-1>
7. WHOQOL - Measuring Quality of life [Internet]. Who.int. [cited 2022 Jun 18]. Available from: <https://www.who.int/tools/whoqol>
8. Cesnales NI, Thyer BA. Health-related quality of life measures. In: *Encyclopedia of Quality of Life and Well-Being Research*. Dordrecht: Springer Netherlands; 2014. p. 2809–14.
9. Health-related quality of life (HRQOL) [Internet]. Cdc.gov. 2021 [cited 2022 Jun 18]. Available from: <https://www.cdc.gov/hrqol/index.htm>
10. Elkan M, Dvir A, Zaidenstein R, Keller M, Kagansky D, Hochman C, Koren R. Patient-Reported Outcome Measures After Hospitalization During the COVID-19 Pandemic: A Survey Among COVID-19 and non-COVID-19 Patients. *Int J Gen Med*. 2021 Aug 26;14:4829-4836. doi: 10.2147/IJGM.S323316.

11. Vaes AW, Goërtz YMJ, Van Herck M, Machado FVC, Meys R, Delbressine JM, Houben-Wilke S, Gaffron S, Maier D, Burtin C, Posthuma R, van Loon NPH, Franssen FME, Hajian B, Simons SO, van Boven JFM, Klok FA, Spaetgens B, Pinxt CMH, Liu LYL, Wesseling G, Spies Y, Vijlbrief H, van 't Hul AJ, Janssen DJA, Spruit MA. Recovery from COVID-19: a sprint or marathon? 6-month follow-up data from online long COVID-19 support group members. *ERJ Open Res.* 2021 May 24;7(2):00141-2021. doi: 10.1183/23120541.00141-2021
12. Shanbehzadeh S, Tavahomi M, Zanjari N, Ebrahimi-Takamjani I, Amiri-Arimi S. Physical and mental health complications post-COVID-19: Scoping review. *J Psychosom Res.* 2021 Aug;147:110525. doi: 10.1016/j.jpsychores.2021.110525. Epub 2021 May 20.
13. Logue, J. K., Franko, N. M., McCulloch, D. J., McDonald, D., Magedson, A., Wolf, C. R., & Chu, H. Y. (2021). Sequelae in Adults at 6 Months After COVID-19 Infection. *JAMA network open*, 4(2), e210830.
<https://doi.org/10.1001/jamanetworkopen.2021.0830>
14. Carenzo L, Protti A, Dalla Corte F, Aceto R, Iapichino G, Milani A, et al. Short-term health-related quality of life, physical function and psychological consequences of severe COVID-19. *Ann Intensive Care* [Internet]. 2021;11(1):91. Available from: <http://dx.doi.org/10.1186/s13613-021-00881-x>
15. Taboada M, Moreno E, Cariñena A, Rey T, Pita-Romero R, Leal S, et al. Quality of life, functional status, and persistent symptoms after intensive care of COVID-19 patients. *Br J Anaesth* [Internet]. 2021;126(3): e110–3. Available from: <http://dx.doi.org/10.1016/j.bja.2020.12.007>
16. Iqbal A, Iqbal K, Arshad Ali S, Azim D, Farid E, Baig MD, et al. The COVID-19 sequelae: A cross-sectional evaluation of post-recovery symptoms and the need for rehabilitation of COVID-19 survivors. *Cureus* [Internet]. 2021;13(2): e13080. Available from: <http://dx.doi.org/10.7759/cureus.13080>
17. Kamal, M., Abo Omirah, M., Hussein, A., & Saeed, H. (2021). Assessment and characterisation of post-COVID-19 manifestations. *International journal of clinical practice*, 75(3), e13746. <https://doi.org/10.1111/ijcp.13746>

List of Abbreviations and their expansions

ABBREVIATIONS	EXPANSIONS
BMI	Body Mass Index
CI	Confidence Interval
COVID -19	Corona virus disease
E- Mail	Electronic Mail
EQ- 5D- 3L	Euro Quality of life 5-dimension 3 level
EQ- 5D- 5L	Euro Quality of life 5-dimension 5 level
GH	General Health
HRQOL	Health Related Quality Of Life
HTN	Hypertension
KS Test	Kolmogorov – Smirnov test
KWT	Kruskal Wallis Test
LOHS	Length Of Hospital Stay
MH	Medical History
MLR	Multiple Linear Regression
MWU	Mann Whitney U
PACS	Post-Acute Covid-19 Syndrome
PH	Physical Health
PTSD	Post-Traumatic Stress Disorder
QOL	Quality Of Life
RF	Risk Factors
SARS CoV 2	Severe Acute Respiratory Corona Virus 2
SF	Short Form
SH	Social History
SPSS	Statistical Package for Social Science
T2DM	Type II Diabetes Mellitus
TQOL	Total Quality of Life
VO2 max	Maximal oxygen consumption
WHO	World Health Organization

QUESTIONNAIRE

DEMOGRAPHICS OF PATIENTS

1. Name
2. Gender:
 Male Female Others
3. Age: _____ years
4. Are you pregnant women or lactating mother? If male choose not applicable.
 Pregnant women Lactating mother Not applicable
5. Height (in cm/inches/feet): _____
6. Weight (in Kg): _____
7. Medical history (Others if any describe):
 Hypertension (BP) Diabetes mellitus (Sugar)

- Hyperlipidemia (Cholesterol) AIDS
 - Cancer Organ transplantation
 - None Others
8. Social history (Others if any describe):
- Smoking Alcoholic
 - None Others
9. Educational Qualification:
- School Diploma
 - Under graduate Post graduate
10. Occupation:
- Student Employed
 - Unemployed Home maker
 - Retired
11. Marital status:
- Married Unmarried
 - Widow Divorcee

COVID-19 INFECTION & POST COVID-19 INFECTION DETAILS

12. Did you get vaccinated before getting covid-19? If yes, select the dose of vaccine? If no, select none for all three
- Covaxin Dose 1 Covaxin Dose 2
 - Covishield Dose 1 Covishield Dose 2
 - Sputnik V Dose 1 Sputnik V Dose 2
 - None
13. Date of covid-19 diagnosis: DD/MM/YYYY
14. Date of covid-19 recovery: DD/MM/YYYY
15. By which test did you get diagnosed?
- RT-PCR CT-Scan
 - Chest X-Ray Pulmonary ultrasound None
16. Severity assessment of covid-19 infection:
- Which of the following category do you think you would fall into?
- Asymptomatic (Tested positive for covid-19 but had no symptoms)
 - Mild (Fever, sore throat, malaise, head ache, muscle pain, without breathing difficulty and abnormal imaging)
 - Moderate (Abnormal imaging tests, breathing difficulty, respiratory rate greater than or equal to 24 breaths/minute, blood oxygen level 90-94%)
 - Severe (Abnormal imaging tests, shortness of breath, chest discomfort, loss of speech or movement, respiratory rate greater than 30 breaths/minute, blood oxygen level less than 90%)

17. Did you get hospitalized due to covid-19 infection?

Yes

No

Hospitalization details:

18. How many days were you hospitalized due to covid-19 infection?

19. In which ward were you hospitalized during covid-19 infection?

ICU (Intensive Care Unit)

General ward

Others

20. How low was your oxygen level when you got hospitalized?

Greater than 95%

94%-90%

Less than

90%

21. Did you require oxygen support?

Yes

No

22. Which of the following symptoms do you have since COVID-19 recovery?

(Can choose multiple options)

A. Gastrointestinal symptoms:

Vomiting sensation

Vomiting

Abdominal

pain

Diarrhea

Constipation

Weight loss

Loss of appetite

None

B. Respiratory symptoms:

Breathing difficulty

Cough

Shortness of breath

None

C. Nervous symptoms & Psychological symptoms:

Headache

Fever

Sleep disturbances

Difficulty in concentration

Dizziness

Mood changes

None

D. Musculoskeletal symptoms:

Muscle pain

Joint pain

None

E. Sensory symptoms:

Loss of smell

Loss of taste

None

F. Integumentary symptoms:

Hair loss

Rashes

None

G. Others: _____

QUALITY OF LIFE QUESTIONS

GENERAL HEALTH:

1. In general, how would you rate your health?

<input type="checkbox"/> Excellent	20	<input type="checkbox"/> Good	15	<input type="checkbox"/> Neither good nor bad	10
<input type="checkbox"/> Poor	5	<input type="checkbox"/> Very poor	0		
2. Compared before getting covid-19, how would you rate your health now?

<input type="checkbox"/> Much better now after covid-19	20
<input type="checkbox"/> Somewhat better after getting covid-19	15
<input type="checkbox"/> About the same	10
<input type="checkbox"/> Somewhat worse after getting covid-19	5
<input type="checkbox"/> Much worse after getting covid-19	0
3. Can you able to do everyday activities as usual?

<input type="checkbox"/> Not at all	0	<input type="checkbox"/> A little	5	<input type="checkbox"/> Moderately	10
<input type="checkbox"/> Very much	15	<input type="checkbox"/> Extremely	20		
4. How often have you felt full of energy?

<input type="checkbox"/> Never	0	<input type="checkbox"/> Rarely	5	<input type="checkbox"/> Sometimes	10
<input type="checkbox"/> Often	15	<input type="checkbox"/> Always	20		
5. How often have you been feeling tired?

<input type="checkbox"/> Never	20	<input type="checkbox"/> Rarely	15	<input type="checkbox"/> Sometimes	10
<input type="checkbox"/> Often	5	<input type="checkbox"/> Always	0		

PHYSICAL HEALTH:

Do you have any limitations in performing the following activities?

6. Moving/lifting heavy objects and playing (cricket, badminton, etc..)

<input type="checkbox"/> Not at all	20	<input type="checkbox"/> A little	15	<input type="checkbox"/> A moderate amount	10
<input type="checkbox"/> Very much	5	<input type="checkbox"/> An extreme amount	0		
7. Lifting/carrying groceries

<input type="checkbox"/> Not at all	20	<input type="checkbox"/> A little	15	<input type="checkbox"/> A moderate amount	10
<input type="checkbox"/> Very much	5	<input type="checkbox"/> An extreme amount	0		
8. Walking up/down stairs

<input type="checkbox"/> Not at all	20	<input type="checkbox"/> A little	15	<input type="checkbox"/> A moderate amount	10
<input type="checkbox"/> Very much	5	<input type="checkbox"/> An extreme amount	0		
9. Walking huge distances

<input type="checkbox"/> Not at all	20	<input type="checkbox"/> A little	15	<input type="checkbox"/> A moderate amount	10
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- Very much 5 An extreme amount 0
10. Bathing/dressing yourself
- Not at all 20 A little 15 A moderate amount 10
- Very much 5 An extreme amount 0

MENTAL HEALTH:

11. How often you have been feeling calm/ peaceful?
- Never 0 Rarely 5 Sometimes 10
- Often 15 Always 20
12. How often have you been feeling nervous/anxious/on edge?
- Never 20 Rarely 15 Sometimes 10
- Often 5 Always 0
13. How often have you been feeling down/depressed/hopeless?
- Never 20 Rarely 15 Sometimes 10
- Often 5 Always 0
14. Do you feel that you were limited in daily activities due to emotional problems?
- Not at all 20 A little 15 Moderately 10
- Very much 5 Extremely 0
15. Do you feel that you were limited in participating in social activities?
- Not at all 20 Not much 15 Moderately 10
- A great deal 5 Completely 0

PAIN:

16. Choose one that describes your current status
- I have no pain 20 I have slight pain 15 I have moderate pain 10
- I have severe pain 5 I have extreme pain 0
17. After covid-19 recovery how much did pain interfere with your normal work?
- Not at all 20 Little bit 15 Moderately 10
- Very much 5 Completely 0

18. Have you had difficulty in performing everyday activities?
 Not at all 20 Not much 15 Moderately 10
 A great deal 5 Completely 0
19. Do you feel that physical pain prevents you from doing what you need to do?
 Not at all 20 Not much 15 Moderately 10
 A great deal 5 Completely 0
20. Do you feel that you were limited in everyday activities due to physical pain?
 Not at all 20 Not much 15 Moderately 10
 A great deal 5 Completely 0

SCORING:

For every participant, domain wise score (mean score of all the questions under each domain) and total QOL score (mean score of all the questions) was calculated for statistical analysis. [A 5-point scoring scale (Likert scale) was used to grade the questionnaire.]

VALIDATION SCHEME:

We followed this five-step validation method which include:

(1) **Step One: Check the Questionnaire by Face validation:** This is a two-step process involving two groups of experts. The first group checked and determined whether the questions are relevant to capture the intended research topic of the survey. The second group of experts checked for common errors, including leading, confusing, and repeated questions. The following are few changes we made as per their suggestions.

- The options in severity assessment question were defined (please refer our questionnaire).
- Some questions were removed as they found it similar to already existing questions.

(2) **Step Two: Pilot Test of the Questionnaire:** pilot test of the survey was conducted using the developed questionnaire for a small group of 20 respondents. Based on their response, we removed few words (e.g., Stooping) as most of them couldn't understand it. Also, we removed few unimportant questions as they felt our questionnaire is lengthy.

(3) **Step Three: Clean Collected Data:** we transformed the data collected from the pilot study on a spreadsheet. Then we compared the scores of individuals on positive phrased questions and negative phrased questions for checking consistency. The scores of positively phrased questions were consistent with negatively phrased question.

(4) **Step Four: Use Principal Component Analysis (PCA):** We did Principal component analysis using SPSS. The range of factor loading scale is usually between -1.0 to +1.0 and commonly accepted value is above ± 0.6 . Our result is given below

Communalities

	Initial	Extraction
Q1	1.000	.652
Q2	1.000	.509
Q3	1.000	.601
Q4	1.000	.720
Q5	1.000	.566
Q6	1.000	.873
Q7	1.000	.883
Q8	1.000	.786
Q9	1.000	.755
Q10	1.000	.708
Q11	1.000	.561
Q12	1.000	.668
Q13	1.000	.531
Q14	1.000	.623
Q15	1.000	.517
Q16	1.000	.702
Q17	1.000	.606
Q18	1.000	.770
Q19	1.000	.780
Q20	1.000	.770

Extraction Method: Principal Component Analysis.

(5) **Step Five: Check Internal Consistency using Cronbach’s Alpha**

The reliability of our questionnaire was ensured by the Cronbach’s alpha value of 0.83 using SPSS statistical software.

Reliability Statistics

Cronbach's Alpha	N of Items
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UNDER PEER REVIEW