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, physical functioning, mental well-being, and pain).
- To determine the variation and it's contributing factors to the quality of life.
- 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 HRQoL.
The HRQoL questions with scored options were framed under four domains general health, physical functioning, mental well-being, 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 to have persistent symptoms and impaired QoL. 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) among patients who recovered from covid-19. 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 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 Functioning (PF), Mental Well-being (MWB), and Pain. Each domain consists of 5 questions. A 5 -point scoring scale (Likert scale) was used to grade the questionnaire.

2.3 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 0.82 using SPSS statistical software

2.4 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.

2.5 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), PF (physical functioning), MWB (mental well-being) 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		
Abnormal BMI	52	43.33%
MH	6	5 %
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		
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		
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. 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 Functioning, Pain, and Mental Well Being. For HRQoL domain PF post- covid patients with both risk factors BMI & MH had lower HRQoL. For domains, Pain and MWB post-covid patients with risk factor MH had lower HRQoL.

Table 2 - Mean Rank Score and *P*-value for all Variables and HRQoL Domains-KW test

Variables	GH		PF		MWB		PAIN	
	MR	*P*	MR	*P*	MR	*P*	MR	*P*
AGE								
18-35	61.64		70.87		63.58		67.15	
36-55	55.25	0.495	46.09	<0.001	58.54	0.374	50.54	0.040
56-75	67.00		44.07		50.33		51.57	

RISK FACTORS								
Abnormal BMI	64.05		62.65		64.36		69.27	
MH	28.08		34.67		19.00		30.83	
SH	72.67	0.153	77.17	<0.001	61.08	0.003	66.08	0.039
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		63.50		73.00		70.82	
Diploma	45.94	0.452	58.38	0.583	46.75	0.438	46.25	0.228
Undergraduate	58.53		56.08		60.52		56.06	
Postgraduat-e	63.29		65.43		59.88		65.82	
OCCUPATION								
Student	63.41		74.37		64.64		69.89	
Employed	60.26		57.58		62.22		59.28	
Unemployed	59.90	0.752	60.00	0.025	51.70	0.286	52.30	0.230
Homemaker	48.10		39.15		51.80		47.60	
Retired	70.75		41.25		28.63		41.00	
MARITAL STATUS								
Married	57.41		47.61		55.03		52.62	
Unmarried	64.20	0.526	75.21	<0.001	66.13	0.153	70.11	0.011
Widow	48.00		49.00		89.50		19.00	
VACCINATION								
Covaxin 1	54.50		64.00		52.38		54.25	
Covaxin 2	37.75		35.75		21.50		19.50	
Covishield 1	65.76	0.776	57.50	0.153	64.60	0.403	64.81	0.360
Covishield 2	53.94		34.50		49.31		48.50	
None	60.64		64.11		61.84		61.82	

SEVERITY								
Asymptomatic	74.91		90.06		77.75		84.28	
Mild	64.52	0.002	59.40	<0.001	63.87	<0.001	63.60	<0.001
Moderate	45.05		48.82		47.55		38.24	
Severe	24.71		36.93		18.71		32.07	
LOHS								
1-7 days	32.14		34.50		30.71		30.68	
8- 14 days	23.96	0.165	23.99	0.005	25.47	0.036	25.53	0.036
> 14 days	18.75		1.75		2.25		1.50	

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 PF and PAIN. As HRQoL decreases with an increase in age, patients in the age group of

	GH	PF	MWB	PAIN

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.

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 Functioning. 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 functioning and Pain. For the domain, PF married post-covid patients had lower HRQoL. For the domain of Pain, the widow post-covid patient had lower HRQoL.

3g. Vaccination:

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

	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	

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.

Table 3 - Mean Rank Score and *P*value for All Variables and HRQoL Domains- Mann Whitney U

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 PF, MWB, and pain.

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 PF	
(56-75) - (18-35)	**0.019**
(36-55) - (18-35)	**0.002**
Pairwise Comparison of RF and PF	
Abnormal BMI & MH- Abnormal BMI	**0.015**
Abnormal BMI & MH-NONE	**0.000**
Pairwise Comparison of RF AND MWB	
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 PF	
Severe-Asymptomatic	**0.004**
Moderate-Asymptomatic	**0.003**
Mild-Asymptomatic	**0.007**
Pairwise Comparison of SEVERITY AND MWB	
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**

3l. 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.

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				
The dependent variable for all regressions was TQoL.							

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 were (not significant) positively correlated to TQoL.

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%.

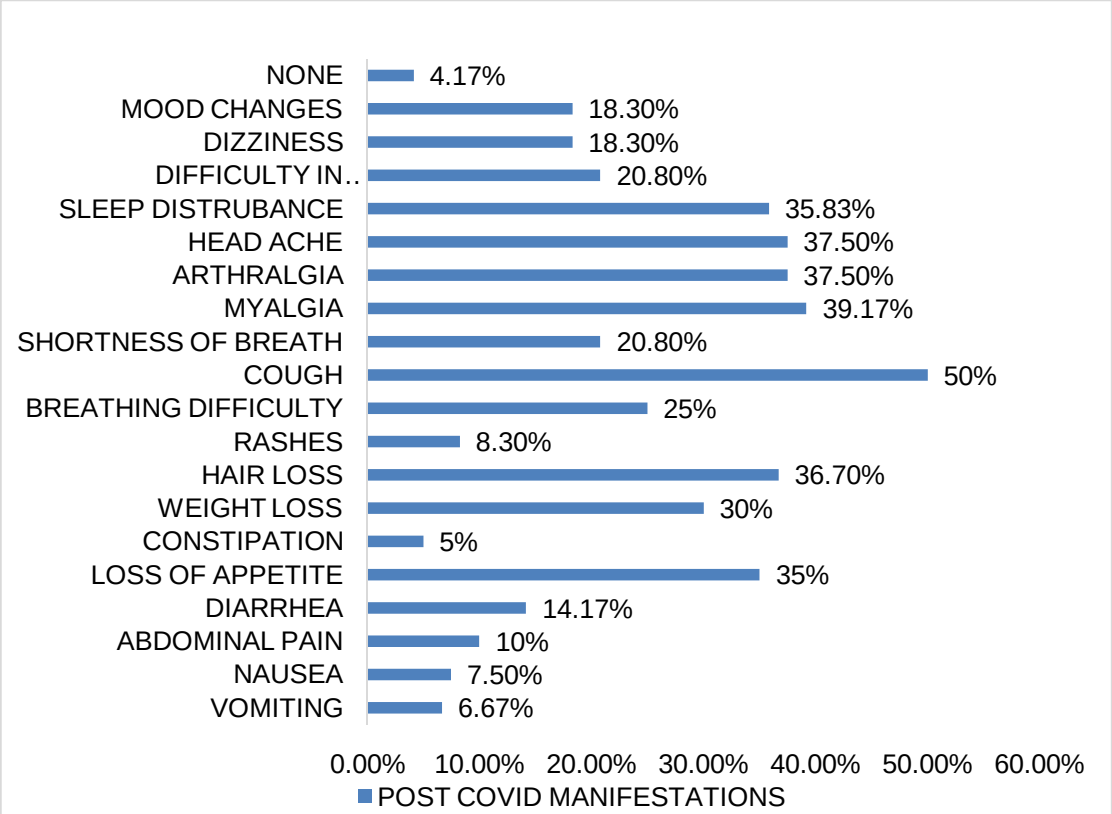

Figure 1: Distribution of Post- Covid Manifestations in 120 Respondents

4. DISCUSSION

Our study has assessed the HRQoL in post-covid patients. It reflects the impact of 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. The majority of our respondents reported cough, myalgia, arthralgia, and headache as persisting symptoms.

4.1 Physical Functioning:

Our study reveals that the independent variables (demographics) such as the age of the patient, risk factors associated with the patient, occupation and marital status of the patient, hospitalization, and length of hospital stay have played an important role in decreasing their quality of life concerning physical functioning.

The mechanisms leading to impaired physical functioning are multifactorial and arise as a consequence of the infection, prolonged hospitalization, and/or immobility. 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.[9]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 Well-being:

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. 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. [10]

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.[11]

Direct tissue infection and the inflammatory response of cytokines generated to fight the viral invasion most likely cause muscle soreness and bone fragility, due to the breakdown of protein in muscle fibers. Even after recovering from covid-19, some patients continue to experience musculoskeletal issues such as joint pain, backache, muscle discomfort, fatigue, and stiffness in joints.

Baseline patient features related to the development of severe covid-19, such as multi-morbidity and increasing age, align with those associated with chronic pain following critical illness. Those with pre-existing multi-morbidity were also more likely to experience chronic pain before infection, which could predispose them to worsen current pain or promote new pain.

In our study too, the pain has been an influential domain in determining the HRQoL. The research study of Guangbo Qu, et al., also indicated a similar idea. [12]

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. [13, 14]

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.

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