

Evaluating the Health Related Quality of Life (HRQOL) of the General Population amid Covid-19 in Bangladesh: A Cross-sectional Investigation

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Abstract: The COVID-19 pandemic has profoundly impacted billions worldwide, significantly affecting both physical and mental health. This study attempts to evaluate the health-related quality of life of the general population in Bangladesh amid the pandemic. Conducted during the pandemic's second phase, a cross-sectional survey collected data from 1810 participants aged 18 to 78 years (mean age: 31 years). The sample composition included 50.55% females, 56.08% urban residents, and 63.43% with post-secondary education. Utilizing the SF-12v2 Bangla questionnaire, the study assessed various factors influencing physical and mental health through multivariate regression analyses. Findings reveal significant correlations between physical health and age, gender, family size, income, COVID-19 exposure, sleep patterns, satisfaction with sleep, regular exercise, and major illnesses. Similarly, mental health correlates with age, gender, family size, income, COVID-19 exposure, sleep satisfaction, smoking, illnesses, and exercise, highlighting the pandemic's complex effects. Recommendations include promoting regular exercise, enhancing mental health support services, managing chronic diseases effectively, and implementing policies that support economic stability and healthy living environments. Implementing these recommendations is crucial to safeguard public health, promote resilience, and ensure sustained well-being in Bangladesh amidst ongoing and future health challenges. This proactive approach will contribute to building a healthier and more resilient population, capable of effectively navigating and mitigating the impacts of infectious diseases similar to COVID-19.

Keywords: Health related quality of life; COVID-19; SF-12v2; general population; Bangladesh.

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1. Introduction

The COVID-19 pandemic, declared a global health emergency in March 2020, has precipitated widespread health and socioeconomic challenges globally. This unprecedented crisis has profoundly impacted individuals' satisfaction with life and overall well-being, exacerbating both physical and mental health adversities. Primarily affecting the respiratory system, the virus manifests with symptoms such as fever, coughing, and dyspnea. Severe cases can lead to multi-organ failure, pneumonia, and “Acute Respiratory Distress Syndrome (ARDS)” (Kamboj & Sepkowitz, 2020). Moreover, COVID-19 has been associated with neurological complications including encephalitis and seizures, as well as cardiovascular manifestations such as myocardial infarctions and strokes (Kamboj & Sepkowitz, 2020). Angarita-Fonseca et al. (2023) documented dyspnea, breathing difficulties, chest pain, and insomnia among COVID-19 patients in a multinational study across 16 countries in Latin America.

Besides, social isolation and economic disruption as a result of the virus have led to major mental health problems. The pandemic was contributing to increased rates of anxiety, depression, and other mental health problems in a large number of people. Numerous investigations examined the impact of COVID-19 on psychological symptoms, stress, anxiety, and other facets of mental health (Qiu et al., 2020; Cuiyan et al., 2020; Zhang Y & Ma Z, 2020). Stress and anxiety levels have increased as a result of the social distancing measures and extended isolation, especially for those who already had mental health issues (Holmes et al., 2020). The main contributing factors were found to be age, financial uncertainty, low resilience, poor sleep, isolation, and a history of mental illness. Although older people are more susceptible to the virus, younger populations seem to be more prone to this kind of psychological distress (Varma et al., 2021). As a consequence, the general population's quality of life (QOL) has deteriorated significantly. Several studies have shown that COVID-19, like other illnesses, affects the quality of life of both patients and the general public (Nguyen et al., 2020).

The World Health Organization (WHO, 1998) defined “quality of life (QOL)” as an individual's assessment of how they are doing in life regarding their goals, requirements, expectations, and concerns, as well as their culture and value systems. The QOL now includes additional factors related to patients' quality of life, and represents a subjective opinion rather than an objective, quantifiable reality. Qu et al. (2021) have noted that “the impact of illness and treatment on patients' function and overall life satisfaction”, also called “health-related quality of life (HRQOL)”, has sparked interest in social progress and the reform of insurance and healthcare systems. The present study attempts to evaluate the HRQOL of the general population amid the COVID-19 pandemic, and Bangladesh is included as the study area in this regard.

After the first COVID-19 infection case was identified in Bangladesh on March 8, 2020, the virus began to spread throughout the nation day by day. From March 23, 2020, to May 30, 2020, the Bangladeshi government had implemented restrictive measures like lockdowns across the country. The associated lockdown measures and prolonged isolation have resulted in increased levels of depression, stress, anxiety, insomnia, domestic violence, and suicidal ideation in Bangladesh (Islam et al., 2020; Sakib et al., 2020; Sayeed et al., 2020; Mamun et al., 2021; Rayhan & Akter, 2021; Al-Mamun et al.,

2023; Mamun et al., 2023). In addition, the pandemic's economic disruption has raised food insecurity and poverty rates, which can further exacerbate mental illness and other negative health outcomes (Hossain et al., 2020; Sultana et al., 2023). While many studies look into the pandemic's effects on the mental health of Bangladeshis in general, very few examine how the country's population's overall health-related quality of life is assessed. In light of this, the current study aims to assess the overall health-related quality of life of Bangladeshis and demonstrate the variables responsible for deteriorating mental and physical health.

2. Literature Review

Some studies conducted worldwide have looked into how COVID-19 affects people's quality of life. For instance, Al Rasheed et al. (2023) has conducted a cross-sectional study on a number of Arab countries by using the SF-36 which is a HRQOL assessment scale and reported that the COVID-19 infection notably affects the role physical, role emotional, general health, and mental components the scale. Additionally, participants who are infected experience higher levels of fatigue, which negatively impacts both mental and physical components. Furthermore, individuals infected with COVID-19 have reported experiencing “weakness, muscle pain, respiratory symptoms, voice disorders, imbalance, loss of taste and smell, and menstrual issues” more frequently. Similar findings were also reported in the study of Raman et al.(2021).

The long-term effects of the COVID-19 virus on physical health are still not well understood, and ongoing research is needed to assess the potential long-term impact on individuals who have recovered from the virus. However, a review on clinical conditions of Long-Covid and Post-Covid health complications has traced hypercytokinemia caused by COVID-19, to be the reason for “endothelial inflammation, microvascular thrombosis, and multiple organ failures” (Silva Andrade et al., 2021). Incidentally, a study in Netherlands has discovered that long term health status for the non-hospitalized Covid patients with mild infection, when compared to that of the hospitalized ones with severe condition, has been significantly aggravated according to various domains of SF-36 such as functional impairment, quality of life and fatigue (van den Borst et al., 2021). Furthermore, multiple studies have established the association of lower health-related quality of life with female gender and older age (AlRasheed et al., 2023; Figueiredo et al., 2022; Nandasena et al., 2022; Perlis et al., 2022), while some of these researches have identified factors such as comorbidity, ICU admission, mechanical ventilation, high body mass index, smoking and unemployment to be significantly contributing as well. Previously, studies on the older population of Poland and Brazil (Guedes et al., 2012) had found that physical activity impacts health-related quality of life positively, whilst the conclusion was generalized for the adult population in a systematic review of various cross-sectional studies (Bize et al., 2007).

In Bangladesh, the virus has been associated with a range of other physical health problems, including gastrointestinal symptoms, such as diarrhea and vomiting (Hossain et al., 2020). The country's healthcare system has been under significant pressure due to the pandemic, with a shortage of medical supplies, hospital beds, and medical professionals. This has led to delays in testing, treatment, and care for COVID-19 patients, as well as individuals with other health conditions (Hossain et al., 2020).

A study upon the imposition of Covid lockdown, conducted in Austria, has found that the pandemic, coupled with the lockdown, has adversely affected the mental well-being of the population, especially in terms of anxiety and depression. Moreover, the situation is exacerbated for the following groups – young adults (aged less than 35 years), women, people with little or no income, and people who are less active physically (Pieh et al., 2020). In that regard, evidence from Norway (Ernstsen & Havnen, 2021) and Brazil (Puccinelli et al., 2021) have demonstrated that symptoms of anxiety and depression are substantially lower among the physically active adults. Additionally, the internet-based survey in Brazil has found a significant association of higher anxiety and depression with predictors such as lower monthly family income and younger age (Puccinelli et al., 2021). A study on the Indian population has confirmed worsened psychological conditions brought forth due to COVID-19, identifying subpopulations such as female, religious minority, self-employed, unmarried, people with poor health status and sleep-deprived to be more exposed to such conditions (Absar Ahmad et al., 2020). A study conducted in the United Kingdom found that the pandemic had led to a significant increase in depression and anxiety, with one in five individuals reporting symptoms of depression and anxiety (Pierce et al., 2020). Another nationwide survey in the UK has confirmed the negative impact of COVID-19 on overall mental health conditions, identifying women, young people and people with preschool-aged children to be the most affected subpopulations (Pierce et al., 2020).

Evidence from Iran support the hypothesis that women and the younger population are more susceptible to anxiety (Moghanibashi-Mansourieh, 2020). Additionally, people connected closely with at least one Covid-infected patient are more prone to anxiety (Moghanibashi-Mansourieh, 2020). In a separate Italian study, it revealed that the pandemic had significantly increased psychological distress, with people expressing higher levels of anxiety and depression than they had before the pandemic (Mazza et al., 2020). Similarly, a study conducted in China found that the pandemic had a significant impact on the mental health of individuals, with high levels of anxiety and depression reported (Qiu et al., 2020). Furthermore, millions of people have seen a major decrease in income or loss of employment as a result of the pandemic, which has had a substantial effect on people's financial well-being. This has culminated in financial stress and increased levels of poverty. As per the International Labour Organization (ILO) report of 2020, the COVID-19 pandemic has resulted in the loss of 255 million jobs worldwide. The amount of working hours lost in the first half of 2020 was equivalent to the loss of 400 million full-time jobs. The pandemic has had a particularly negative economic impact on low-income nations, where a large number of people already live in poverty. People have reported feeling more isolated and less supported by their social networks as a result of the pandemic. The social distancing measures have made it difficult for people to maintain their social relationships, particularly with older adults and those with underlying health conditions who are at a higher risk of severe illness from COVID-19. A study conducted in the United States found that social distancing measures had led to a significant increase in loneliness, particularly among older adults (Killgore et al., 2020).

3. Methods and Materials

3.1 Study Design

A cross-sectional investigation was conducted in this study to assess the general Bangladeshi population's quality of life during the COVID-19 pandemic. The research population consisted of adult Bangladeshi residents who were at least eighteen years old, encompassing both rural and urban areas, as well as male and female residents. This research aimed to capture a comprehensive snapshot of the entire population of Bangladesh by purposively gathering data from various regions across the country. The

inclusive approach ensured a diverse and representative sample, providing valuable insights into the quality of life experienced by different segments of the population during the pandemic.

3.2 Sampling and Data Collection Procedure

In this study, convenience sampling was employed to gather data from various locations across Bangladesh. Initially, a draft of the questionnaire was created and refined based on insights gained from a pilot study. Data collection utilized both interviewer-administered surveys and online surveys to ensure broad participation. Written consent forms were attached to the questionnaire, and verbal or written consent was obtained from each respondent during the data collection process.

The questionnaire used in this study was semi-structured, incorporating both closed-ended and open-ended questions. These questions covered topics related to socioeconomic status, demographics, COVID-19 experiences, and quality of life. A total of 1810 respondents participated in the study, comprising 915 (50.55%) females and 895 (49.45%) males. This approach aimed to provide a comprehensive understanding of the quality of life among different segments of the Bangladeshi population during the COVID-19 pandemic.

3.3 Socio-demographic, COVID-19 and Life-style related variables

The current study encompassed various socio-demographic factors, including age, sex, residential location, educational achievement, marital status, employment status, and monthly household income. Additionally, the investigation addressed several lifestyle and COVID-19-related variables, such as nightly sleep duration, satisfaction with sleep quality, impact of sleep on daily functioning, exercise habits, smoking behavior, and experiences related to COVID-19 infection.

3.4 Quality of Life measurement instrument

A standardized survey tool called the SF-12v2 Bangla is used in this study to evaluate people's quality of life in Bangladesh. It is a shortened version of the SF-36 Health Survey, a popular instrument for gauging the quality of life in relation to health. The 12 questions that make up the SF-12v2 Bangla are intended to give a general overview of a person's physical and mental health.

There are eight questions on the SF-12v2 Bangla that gauge a person's physical health. Many facets of physical functioning are covered by these questions, including restrictions on engaging in physical activities, restrictions on engaging in moderate activities, restrictions on climbing stairs, restrictions on bending or stooping, restrictions on walking, restrictions on lifting or carrying groceries, restrictions on walking several blocks, and restrictions on bathing or dressing oneself. These questions are meant to yield a physical component summary (PCS) score, which is a number between 0 and 100. A better state of physical health is indicated by a higher PCS score.

Four additional questions on the SF-12v2 Bangla measure a person's mental health. These inquiries address a range of mental health topics, including emotional stability, social interaction, and limitations in day-to-day activities as a result of emotional issues. These

questions are meant to yield a mental component summary (MCS) score, which is a number between 0 and 100. A better state of mental health is indicated by a higher MCS score. According to Sultana et al. (2023), the SF-12v2 Bangla is a valid and dependable tool for evaluating the state of people's physical and mental health in Bangladesh. Its psychometric qualities have been found to be good after it was translated and culturally adjusted for use with the Bangladeshi population.

3.5 Data Analysis

Microsoft Office Excel 2016 was used to arrange and process the data, and STATA version 17.0 was used for statistical analysis. Initially, calculations were made for descriptive statistics, including mean, standard deviation, and frequencies. The value of quality of life was then determined upon calculating the distinct aspects of the Quality of Life scale score. Multivariate regression was utilized to investigate the associated factors of HRQOL in Bangladesh amid the pandemic.

3.6 Ethical Issues

Prior to conducting the survey interviews, informed consent was obtained from each participant to ensure ethical compliance and respect for their autonomy. The survey questionnaire was meticulously designed to avoid any provocative or sensitive questions that might cause discomfort or distress to the respondents. To maintain confidentiality and protect privacy, no personal information of the respondents was disclosed or recorded in the study. The research protocol strictly adhered to the ethical principles outlined in the 1975 Helsinki Declaration, ensuring that the rights, safety, and well-being of all participants were safeguarded throughout the study. Additionally, all data collected were anonymized and used solely for the purposes of this research, ensuring that participants' identities remained confidential. This adherence to ethical guidelines underscores the commitment to conducting research with integrity and respect for the individuals involved.

4. Results

Table 1 reports the descriptive statistics of the variables. The first variable in Table 1 details the gender composition of the respondents, with 915 (50.55%) females and 895 (49.45%) males among the 1810 respondents. The second variable addresses the residency of the participants, indicating that 1015 (56.08%) reside in urban areas, 503 (27.79%) in semi-urban areas, and 292 (16.13%) in rural areas. Education levels of the respondents are categorized into five sub-groups: 52 (2.87%) received no formal education, 82 (4.53%) completed primary education, 131 (7.24%) completed secondary education, 397 (21.93%) completed higher secondary education, and 1148 (63.43%) attained above higher secondary education. The table further details the marital status of the participants, with 1048 (57.9%) never married, 686 (37.9%) married, and 76 (4.2%) divorced or separated.

Table 1. Distribution of the Variables

Variables	Total	Percent (%)
Gender		
Female	915	50.55
Male	895	49.45
Present Residence		
Rural Area	292	16.13
Semi-urban Area	503	27.79
Urban Area	1015	56.08
Education Level		
No formal education	52	2.87
Primary	82	4.53
Secondary	131	7.24
Higher secondary	397	21.93
Above higher secondary	1148	63.43
Marital Status		
Never married	1048	57.9
Married	686	37.9
Divorced/Separated/others	76	4.2
Occupation		
Student	990	54.7
Service holder	339	18.73
Businessman	102	5.64
Farmer	41	2.27
Housewife	267	14.75
Retired	58	3.2
Others	13	0.72
Monthly Family Income		
Less than 15000 BDT	200	11.05
15000-30000 BDT	402	22.21
30000-45000 BDT	374	20.66
45000-60000 BDT	348	19.23
Greater than 60000 BDT	486	26.85
Sleep Satisfaction		
Highly satisfied	224	12.38
Satisfied	499	27.57
Moderately satisfied	777	42.93
Dissatisfied	245	13.54

Variables	Total	Percent (%)
Highly dissatisfied	65	3.59
Sleep Impact		
Not at all	193	10.66
Slightly	408	22.54
Somewhat	376	20.77
Moderate	627	34.64
Highly	206	11.38
Regular Exercise		
No	1063	58.73
Yes	747	41.27
Smoking Status		
No	1524	84.2
Yes	286	15.8
Diseases		
No	745	41.16
At Least One	1065	58.84
COVID-19 Affected		
Yes, tested Positive	289	15.97
No, tested Negative	372	20.55
Not Sure, not tested	1149	63.48
Sleeping Hour (Daily)		
Less than 6 hours	208	11.49
6 to 9 hours	1506	83.2
Greater than 9 hours	96	5.3

Among the 1810 respondents, the occupations were distributed as follows: 54.7% students (990), 18.73% service holders (339), 14.75% housewives (267), 5.64% businessmen (102), 3.2% retired (58), 2.27% farmers (41), and less than 1% (0.72%) in other occupations. The monthly family income of the respondents was categorized into five sub-groups: 11.05% (200 individuals) had an income of less than BDT 15,000, 22.21% (402 individuals) had an income between BDT 15,000 and BDT 30,000, 20.66% (374 individuals) had an income between BDT 30,000 and BDT 45,000, 19.2% (348 individuals) had an income between BDT 45,000 and BDT 60,000, and 26.85% (486 individuals) had an income exceeding BDT 60,000.

The variable Sleep Satisfaction reflects the participants' contentment with their sleep, with 65 (3.95%) respondents being highly dissatisfied, 245 (13.54%) dissatisfied, 777 (42.93%) moderately satisfied, 499 (27.57%) satisfied, and 224 (12.38%) highly satisfied. Additionally, the data indicates the perceived impact of sleep on daily chores: 192 (10.66%) felt no impact, 408 (22.54%) noted a slight impact, 367 (20.77%) believed sleep somewhat affected their work, 627 (34.64%) reported a moderate impact, and 206 (11.38%) believed sleep had a significant impact on their daily activities.

The table then denotes the exercising habits of the participants, revealing that 1063 (58.73%) do not exercise regularly, while 747 (41.24%) do. Among the 1810 respondents, 286 (15.8%) have a smoking habit, whereas the majority (84.2%) do not smoke. Regarding major diseases, 745 (41.16%) participants reported having none, while 1065 (58.84%) suffer from at least one major disease. In terms of COVID-19 testing, 289 (15.97%) participants tested positive, 372 (20.55%) tested negative, and 1149 (63.48%) were uncertain of their status as they had not taken the test. The last portion of the table identifies the sleeping behavior of the participants: 208 (11.49%) sleep for less than 6 hours, 1506 (83.21%) sleep for 6 to 9 hours daily, and 96 (5.3%) sleep for more than 9 hours daily.

Table 2. Component Summary

Variables	Mean	Std. Dev.	Min	Max
Age	31.93757	14.32691	18	78
Family Members	4.639227	1.642009	1	12
Physical Component Summary (PCS)				
Physical Functioning (PF)	45.72185	11.03555	22.10831	56.46563
Role-Physical (RP)	40.60992	6.849746	20.32328	47.96259
Bodily Pain (BP)	45.81085	11.38071	16.67773	57.44383
General Health (GH)	37.06284	10.02579	18.86732	61.9886
Mental Component Summary (MCS)				
Vitality (VT)	51.69689	10.20234	27.62383	67.87533
Social Functioning (SF)	42.82687	11.5273	16.17636	56.56775
Role Emotional (RE)	34.28441	9.005149	11.34697	44.89587
Mental Health (MH)	43.26305	10.82843	15.77476	64.54105
Aggregated				
Aggregated Mental Health Component Score	41.12947	10.1373	0.4286474	67.14181
Aggregated Physical Health Component score	44.93766	9.209929	12.49837	70.62391

Table-2 presents a summary of different mental and physical health components among the participants of this study. The first row details the distribution of age, with participants having a mean age of 31.94 years and a standard deviation of 14.33. The age range spans from 18 to 78 years.

The second row of Table-2 displays the distribution of family members among the respondents. On average, participants reported having 4.64 family members, with a standard deviation of 1.64. The number of family members ranges from a minimum of 1 to a maximum of 12.

Physical Component Summary (PCS)

The mean value of Physical Functioning (PF_T) is 45.72 with a standard deviation of 11.04. The component Role Physical (RF_T) has a slightly lower mean value than the physical functioning component, with a mean of 40.61 and a standard deviation of 6.85.

According to this study, the component Bodily Pain (BP_T) has an average value of 45.81, with a standard deviation of 11.38. The mean value of General Health (GH_T) is 37.06, with 10.03 as standard deviation.

Mental Component Summary (MCS)

The component Vitality (VT_T) has a mean value of 51.70 and a standard deviation of 10.20. Social Functioning (SF_T) exhibits a mean value of 42.83 with a standard deviation of 11.53. The findings of this study reveal that, among the other two mental components, Role Emotional (RE_T) has the lowest mean value, which is 34.28, coupled with a standard deviation of 9.01. Mental health (MH_T) has a mean value of 43.26 and a standard deviation of 10.83.

The findings of this study reveal that the Aggregated Mental Health Component Score has a mean value of 41.13, with a standard deviation of 10.14. In contrast, the Aggregated Physical Health Component Score shows a mean value of 44.94, with a standard deviation of 9.21.

Table 3. Multivariate Linear Regression for Physical Component Score

Variables	Coefficient	Std. Err.	p-value	95% CI Lower Limit	95% CI Upper Limit
Age	-0.288488***	0.0139362	0	-0.3158211	-0.261155
Gender	Ref. Female				
Male	3.309443***	0.3728708	0	2.578134	4.040752
Present Residence	Ref. Rural Area				
Semi-urban	-0.5681933	0.5642208	0.314	-1.674796	0.5384096
Urban area	-0.2781658	0.5528825	0.615	-1.362531	0.8061993
Education Level	Ref. No Formal education				
Primary	-0.2785737	1.274492	0.827	-2.778227	2.22108
Secondary	-1.168027	1.200922	0.331	-3.523388	1.187333
Higher secondary	0.1117022	1.133374	0.922	-2.111177	2.334582
Above higher secondary	-0.430359	1.097848	0.695	-2.583561	1.722843
Family Members	-0.2815205***	0.1056277	0.008	-0.4886875	-0.0743535
Monthly Family Income	Ref. Less than 15000 BDT				

Variables	Coefficient	Std. Err.	p-value	95% CI Lower Limit	95% CI Upper Limit
15000-30000 BDT	1.113177*	0.6319968	0.078	-0.1263548	2.352708
30000-45000 BDT	1.209645*	0.6510343	0.063	-0.0672247	2.486514
45000-60000 BDT	2.813647***	0.6791554	0	1.481624	4.14567
Greater than 60000 BDT	2.124798***	0.6621608	0.001	0.8261066	3.42349
Covid Affected Ref. Tested Negative					
Tested Positive	-1.291359**	0.5659049	0.023	-2.401265	-0.1814529
Not Tested	-0.5237545	0.4338216	0.227	-1.374606	0.3270971
Sleeping Hours Ref. 6 to 9 hours					
Less than 6 hours	-0.0102891	0.5640757	0.985	-1.116607	1.096029
Greater than 9 hours	-1.737686**	0.7612911	0.023	-3.230801	-0.24457
Sleep Satisfaction Ref. Highly dissatisfied					
Highly satisfied	4.930276***	1.02805	0	2.913968	6.946583
Satisfied	5.485232***	0.963711	0	3.595111	7.375352
Moderately satisfied	3.495762***	0.934102	0	1.663713	5.32781
Dissatisfied	2.440143**	1.000566	0.015	0.4777398	4.402547
Regular Exercise Ref. No					
Yes	1.715054***	0.3488285	0	1.030899	2.399209
Smoking Ref. No					
Yes	0.5485912	0.502986	0.276	-0.4379121	1.535094
Any major Diseases Ref. No					
Yes	-3.856997***	0.3772047	0	-4.596806	-3.117188

***represents significance at 1% level, **represents significance at 5% level and *represents significance at 10% level."

Table 3 summarizes the findings of the multivariate regression analysis for the physical component score. The analysis indicates that variables including age, gender, number of family members, habit of regular exercise, presence of at least one major disease, and sleep satisfaction exert significant effects on the physical component score. These results underscore the multifaceted influences that demographic factors, health behaviors, and medical conditions can have on individuals' physical health as assessed in this study.

Table 4. Multivariate Linear Regression for Mental Health Components

Variables	Coefficient	Std. Err.	p-value	95% CI Lower Limit	95% CI Upper Limit
Age	0.1659316***	0.0182182	0	0.1302004	0.2016628
Gender	Ref. Female				
Male	1.471351***	0.4874372	0.003	0.5153431	2.427358
Present Residence	Ref. Rural				
Semi-urban Area	0.3533489	0.7375805	0.632	-1.093263	1.799961
Urban Area	0.1433081	0.7227584	0.843	-1.274233	1.56085
Education Level	Ref. No Formal Education				
Primary	-0.6026608	1.666086	0.718	-3.870345	2.665023
Secondary	-1.178118	1.569911	0.453	-4.257175	1.900939
Higher secondary	-2.262132	1.481609	0.127	-5.168002	0.643738
Above higher secondary	-0.8727901	1.435167	0.543	-3.687574	1.941994
Family Members	-0.2649056*	0.1380824	0.055	-0.5357257	0.0059144
Monthly Family Income	Ref. Less than 15000 BDT				
15000-30000 BDT	1.008009	0.8261809	0.223	-0.6123745	2.628393
30000-45000 BDT	2.07446**	0.8510677	0.015	0.4052664	3.743654
45000-60000 BDT	2.148304**	0.8878293	0.016	0.4070098	3.889598
Greater than 60000 BDT	2.571779***	0.8656129	0.003	0.8740578	4.2695
Covid Affected	Ref. Tested Negative				
Tested Positive	-1.662418**	0.739782	0.025	-3.113348	-0.2114882
Not Tested	-0.5885498	0.5671154	0.300	-1.70083	0.52373
Sleeping Hours	Ref. 6 to 9 hours				
Less than 6 hours	-1.1228	0.7373908	0.128	-2.56904	0.3234402

Variables	Coefficient	Std. Err.	p-value	95% CI Lower Limit	95% CI Upper Limit
Greater than 9 hours	-0.9361676	0.9952015	0.347	-2.88805	1.015715
Sleep Satisfaction Ref. Highly dissatisfied					
Highly satisfied	9.311002***	1.343923	0	6.675175	11.94683
Satisfied	7.269626***	1.259816	0	4.798757	9.740495
Moderately satisfied	4.721152***	1.221109	0	2.326198	7.116106
Dissatisfied	1.118121	1.307994	0.393	-1.44724	3.683483
Regular Exercise Ref. No					
Yes	1.93634***	0.4560077	0	1.041975	2.830706
Smoking Ref. No					
Yes	-1.426832**	0.6575309	0.03	-2.716444	-0.137221
Diseases Ref. No					
Yes	-2.425075***	0.4931027	0	-3.392194	-1.457956

*** represents significance at 1% level, ** represents significance at 5% level and * represents significance at 10% level."

The findings of the multivariate regression analysis for the component score of mental health are summarized in Table 4. According to the analysis, variables including age, gender, number of family members, monthly family income, testing positive for COVID-19, satisfaction with sleep, regular exercise habits, smoking status, and presence of at least one chronic disease demonstrate statistically significant impacts on the Mental Component Score (MCS). These results underscore the diverse range of factors that influence individuals' mental health outcomes as assessed in this study.

5. Discussion

Age is a statistically significant variable that is inversely related to physical well-being. The quality-of-life and the state of well-being decline with age (Rayhan et al., 2022), which is consistent with the theoretical framework currently in place. The result supports the findings of other similar works who claimed the physical health to be negatively related with age in absence of regular exercise (Godfrey et al., 2014; McPhee et al., 2016). Additionally, according to the study, there is a statistically significant difference between the mean physical component score for males and females. According to the study, men score 3.31 units better on the PCS on average than women do. This observation supports the finding of other related studies (Carta et al., 2012). Blair (2007) showed in their study that there are marked and significant differences between men and women in their physiological function and in the expression of diseases. Sialino et al. (2022) found in their study that women scored 6.55 lower than men on average in terms of physical functioning. Another study found a mean difference of 6.67 between men and women in physical functioning (von Bonsdorff et al., 2011).

Additionally, the study discovered that the physical quality of life is not significantly correlated with current residence or educational level. This finding is contradicted by some other studies. A study on the Malaysian population showed a small but significant positive relationship between the housing condition and quality of life (Zainal et al., 2012). Another study found small positive correlation between men's quality of life and Urban/ Rural residence (Carta et al., 2012). It should be noted that quality of life depends on many variables, and it is very difficult to isolate the effect of residence on the aforementioned variable. This in turn might result in contradictory findings of the studies that reflected positive but quite small correlation between quality of life and residence.

According to the study, family size has a statistically significant impact on quality of life, with a larger family having a lower quality of life. Evidently, with an increase in family size, cost increases and with a fixed level of income, exacerbates the quality of life. Additionally, the study notes that a statistically significant and positive relationship exists between monthly family income and physical well-being. In comparison to the baseline category of monthly income less than 15000 BDT, the mean PCS score is 1.11 units higher for those whose family income is between 15000 and 30000 BDT, 1.21 units higher for between 30000 and 45000 BDT, 2.81 units higher for between 45000 and 60000 BDT, and 2.12 units higher for over 60000 BDT. This result endorses the findings of other studies in the relevant field. A panel data analysis study showed a positive reciprocated relationship between income and well-being (Montano, 2021). Another study on the adult population of Finland showed that higher income increases the amount of self-reported physical activities, which in turn helps to maintain physical well-being (Kari et al., 2015). Killingsworth and Matthew showed in their study that wellbeing increases linearly with the log of income (2021).

The physical state of life suffered after the exposure to COVID-19. Those who tested positive for Covid-19 had a mean PCS score that was 1.29 units lower than that of the unaffected. This result endorses the findings of Puccinelli et al. (2021) and Rasheed et al. (2023). The study of Puccinelli indicated that due to the obligation of social distancing and lockdown, people had to limit their physical activities, as a result of which anxiety

and depression increased among people (Puccinelli et al., 2021). Another controlled experiment study, conducted using the SF-36 method, illustrated that COVID-19 patients scored lower in the SF-36 index across different dimensions (Al Rasheed et al., 2023).

According to the study, people who sleep for more than 9 hours per day have a mean PCS score that is 1.73 units lower than people who sleep between 6 and 9 hours. National Sleep Foundation recommends 7 to 9 hours of sleep for adults and 7 to 8 hours for old aged adults (Hirshkowitz et al., 2015). Hence, any deviation from this recommended time frame will have adverse effect on the physical quality of life. This claim can be further verified by the study of Matsui (2020), who found that sleep disturbances and physical QOL were worse in the group of people who sleep for less than 7 or more than 9 hours.

In this study, sleep satisfaction was found to be statistically significant as well. High levels of satisfaction with sleep quality were associated with higher quality of life. In comparison to those who were extremely dissatisfied, the mean PCS score for those who were dissatisfied was 2.44 units higher while for those with moderate satisfaction was 3.49 units higher. In addition, people who are satisfied and highly satisfied with their sleep experience PCSs that are 5.48 and 4.93 units higher than that of the base category. This result aligns with the findings of Michaela Kudrnáčová, who used the longitudinal data from Czech household survey and showed that the quality of sleep is a strong predictor of the variables which determine the quality of life (Kudrnáčová & Kudrnáč, 2023). Another study on Polish and German older adult population postulated that, older people tend to feel less anxious and less threatened during the COVID-19 (Bidzan-Bluma et al., 2020). Incidentally, it was shown in their study that older people reported higher sleep satisfaction than the younger adults.

The study found that smoking was a statistically insignificant factor for physical well-being. This finding may seem contradictory with some of the other related studies. A longitudinal study on young adults disclosed that resume smokers are 39% more likely to have a significant reduction in health than the non-smokers or quitters (Tian et al., 2016). Another study on Saudi adolescences during the COVID-19 pandemic showed that high level of smoking is correlated with low level of quality of life (Al Kalif et al., 2021). However, in this study, smoking does not exhibit the expected relationship. This can be due to the fact that the proportion of smokers in the sample was relatively small (15.8 percent of the respondents), and comprising students and young adults, who tend to have higher PCS (Fleishman & Lawrence, 2003). Other statistically significant factors include engaging in regular exercise and having at least one serious illness. A regular exerciser has a mean PCS score that is 1.72 units higher than that of a non-regular exerciser. Studies on the relevant topic confirm this result, concluding that regular physical exercise is significantly correlated with higher quality of life (Ribeiro et al., 2018; Wu et al., 2017). Finally, a person with any major disease has a 3.86 unit lower mean PCS score than a person without any major diseases. This result is expected, as any major disease tends to deteriorate the physical wellbeing. An experiment on the US adult population reveals that people with a major disease (CVID) have significantly lower SF-12 score (Rider et al., 2017).

The findings show that age is a statistically significant factor that is positively correlated with mental health. As the lifespan of an individual increases, various events and experiences make that individual more resistant to mental unrests and breakdowns. A

person's mental strength increases with age, making them better able to handle stress. A study on mental health during the COVID-19 pandemic among the Italian population indicated that, depression, anxiety and perceived stress are associated with younger age (Rossi et al., 2020). On the contrary, another study found a curvilinear relationship between age and mental health, which found age to be negatively related with mental anxiety up until 45 years, and positively related with people older than 70 years (Chen et al., 2022).

The study also notes a statistically significant difference between the mean mental health component scores for males and females. Males have a 1.47 unit higher mean MCS score than females, according to the study. This outcome is in line with some of the pertinent research. A study on Italian population during COVID-19 showed higher prevalence of anxiety and depression among women (Rossi et al., 2020). Another study on women's mental health during the COVID-19 period illustrated that women are more vulnerable to mental depression and anxiety due to various social contract and constraints (Almeida et al., 2020). In addition, the study discovered that current residence, educational attainment, and sleeping patterns have no discernible correlation with mental health.

According to the study, having a large family has statistically significant negative effects on mental health. The mean score of mental health is higher in families with smaller sizes. However, this result is contradictory with the finding of a cross sectional study on China's population, which identified family functioning as the key factor determining the mental wellbeing, instead of family size (Cheng et al., 2017).

Additionally, the study notes a positive correlation that exists between monthly family income and mental health. The mental health score rises as income rises. In comparison to the baseline category of monthly income of less than 15000 BDT, the mean MCS score is 2.07 units higher for families with monthly incomes between 30000 and 45000 BDT, 2.14 units higher for families with monthly incomes between 45000 and 60000 BDT, and 2.57 units higher for families with monthly incomes over 60000 BDT. This inference is supported by several studies, which exhibit the existence of positive association between income and health related quality of life (Godfrey et al., 2014; Robinson et al., 2021; Zhang & Xiang, 2019).

The COVID-19 exposure caused a decline in mental health. In comparison to those who were unaffected, those who tested positive had a 1.66-unit lower MCS mean score. This observation coincide with the finding of Islam who implied that mental distress were significantly higher in the people showing COVID-19 symptoms (Islam et al., 2023). Reasons such as fears of losing one's loved ones during the pandemic and insufficient availability of healthcare can be the cause of such findings (Choi et al., 2021). Diseases like COVID-19 negatively affects the daily life of patients and recovered patients (Arab-Zozani et al., 2020) in the form of several variables which affect mental health, namely post-traumatic stress (Wang, Pan, Wan, Tan, Xu, Ho, et al., 2020), anxiety (Tan et al., 2020) and depression (Wang, Pan, Wan, Tan, Xu, McIntyre, et al., 2020).

In this study, it was also discovered that sleep satisfaction is statistically significant. High levels of satisfaction with sleep quality were associated with higher quality of life. In comparison to those who were highly dissatisfied, the mean MCS scores for moderately satisfied, satisfied and highly satisfied respondents are 4.72, 7.27 and 9.31 units higher

respectively. Thus, it is discovered that a key component of mental health is the quantity and quality of sleep. These findings are in line with the illustration of similar studies which show that good sleep is associated with higher quality of life (García-Garro et al., 2022; Roeser et al., 2012). However, some argue that excessive sleeping is associated with poorer quality of life (Cho et al., 2020).

In this study, smoking and the presence of any serious illness were found to be statistically significant predictors of poor mental health. A person with any major disease has a 2.43 unit lower mean MCS score than a person who does not have any major diseases. In addition, smokers' MCS mean scores are 1.42 units lower than that of non-smokers'. A study on the Miami adults support these findings, which demonstrates that smokers and patients tended to experience higher level of stress during the COVID-19 pandemic (Diaz-Martinez et al., 2022).

Finally, regular exercise is discovered to be a statistically significant and positive contributor. A regular exerciser has a 1.94-unit higher mean MCS score than a non-regular exerciser. It aligns with a finding that a person who is mentally distressed, tends to reduce his or her physical activity (Marashi et al., 2021). The reasoning can be derived from a different viewpoint as well. Physical activity can ensure better quality of sleep (Kredlow et al., 2015) which in turn ensures better mental well-being. Several studies on mental wellbeing have found significantly positive association of physical activity and mental health (Marconcin et al., 2022; O'Brien & Forster, 2021; Zalewska et al., 2021).

6. Conclusions

The primary goal of the current study was to evaluate the health related quality of life (HRQOL) amid COVID-19 pandemic in Bangladesh, and to estimate the quality of life, the study has utilized the SF-12v2 Bangla scale. The study has collected and analyzed the data of 1810 participants, of whom 50.55% were female, 56.08% residents of urban area and where the mean age within the sample was 31 years (ranging from 18 to 78 years). The multivariate regression analysis for the physical component score reported that age is inversely related to physical health, with a connotation that the physical quality of life declines with age. Additionally, according to the study, there is a statistically significant difference between the mean physical component scores for males and females, where the mean score of the males is significantly higher. Family size is found significant in the sense that having a larger family means a lower physical quality of life. Additionally, the study notes a significant relationship between monthly family income and physical health, where the physical quality of life increases with income. The physical state of life suffered after the exposure to COVID-19. According to the study, people who sleep for more than 9 hours per day have a mean score that is 1.73 units lower than people who sleep between 6 and 9 hours. In this study, sleep satisfaction was also found to be statistically significant, demonstrating that high levels of satisfaction with sleep quality were associated with higher quality of life. Furthermore, statistically significant factors included engaging in regular exercise and having any chronic diseases. A regular

exerciser has a mean PCS score that is 1.72 units higher than that of a non-regular exerciser. Finally, a person with any major disease has a 3.86 unit lower mean PCS score than a person without any major diseases. In addition, the study discovered that the physical quality of life is not significantly correlated with current residence, educational level, and smoking habits.

The findings of the multivariate regression analysis for the component score for mental health reveals that age is positively correlated with mental health. A person's mental strength increases with age, making them better able to handle stress. The study also notes a significant difference between the mean mental health component scores for males and females. Males have a 1.47-unit higher mean MCS score than females, according to the study. Furthermore, having a large family has statistically significant negative effects on mental health. The study also notes that a positive correlation exists between monthly family income and mental health. The COVID-19 exposure caused a decline in mental health. In comparison to those who were unaffected, those who tested positive had a 1.66 unit lower MCS mean score. In this study, it was also discovered that high levels of satisfaction with sleep quality were associated with higher quality of life. Smoking and the presence of any serious illness were found to be statistically significant predictors of poor mental health. A person with any major disease has a 2.43 unit lower mean score than a person who does not have any major diseases. In addition, smokers' mean scores are 1.42 units lower than non-smokers'. Regular exercise is discovered to be statistically significant and a positive contributor. A regular exerciser has a 1.94 unit higher mean score than a non-regular exerciser. In addition, the study discovered that current residence, educational attainment, and sleeping patterns have no discernible correlation with mental health.

Based on the findings of this study assessing the health-related quality of life among the Bangladeshi population during the COVID-19 pandemic, several key conclusions and recommendations emerge. The study highlighted significant factors influencing both physical and mental health components. Factors such as age, gender, family size, monthly income, COVID-19 exposure, sleep satisfaction, regular exercise, smoking habits, and presence of major diseases were found to play pivotal roles in determining health outcomes. Specifically, age showed varying impacts on physical and mental health, with older individuals exhibiting better mental resilience but declining physical health. Recommendations include promoting regular exercise, enhancing mental health support services, managing chronic diseases effectively, and implementing policies that support economic stability and healthy living environments. These measures aim to mitigate the adverse impacts of infectious diseases similar to COVID-19 and enhance the overall health and well-being of the Bangladeshi population, fostering resilience in the face of ongoing health challenges.

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