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Impact of COVID-19 pandemic on mental health among general Bangladeshi population: A cross-sectional study

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Title: Impact of COVID-19 pandemic on mental health among general Bangladeshi population: A cross-sectional study

Running Title: COVID-19 pandemic and mental health issues

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Title: Impact of COVID-19 pandemic on mental health among general Bangladeshi population: A cross-sectional study

ABSTRACT

Objectives: Loneliness, depression, anxiety, and sleep problems are the major mental illness that significantly amplified worldwide during the coronavirus (COVID-19) pandemic. At the early stage of the outbreak, lockdown and quarantine approaches were imposed by the government of Bangladesh with potential consequences on people's daily life and their mental and physical health. Along with physical and mental health, economic status, healthcare facilities, and other lifestyle factors in Bangladesh are greatly impacted by COVID-19. Here we aimed to measure the impact of the COVID-19 pandemic on mental health among the Bangladeshi population.

Methods: A cross-sectional study was conducted among 672 general Bangladeshi people aged between 15 and 65 years all over the country from April 15 to May 10, 2020. After taking informed consent, we conducted an online survey measuring the socio-demographic profiles and using the UCLA loneliness scale (ULS-8), patient health questionnaire-9 (PHQ-9), generalized anxiety disorder 7-item (GAD-7) scale, Pittsburgh sleep quality index PSQI) for assessment of loneliness, depression, anxiety, and sleep problem, respectively.

Results: Estimates of loneliness, depression, anxiety, and sleep problems were 71%, 38%, 64%, and 74%, respectively, at any degree of severity. Statistically significant factors associated with depression were being females, low economic status, students or unemployed, and living without a family. Factors statistically foreseeing anxiety were female gender, obesity, students, or unemployed. The loneliness was observed among people who are living without their family members. Moreover, statistically significant inter-relationships among all four mental health disorders were observed.

Conclusions: A large portion of respondents reported mental health problems during the COVID-19 pandemic in Bangladesh. Based on the present findings, the longitudinal evaluations are recommended to measure the actual gravity of these issues during and after the pandemic. Appropriate supportive programs and interventional approaches would help to address mental health problems in Bangladesh during this COVID-19 pandemic.

Keywords: Coronavirus disease 2019; COVID-19; Mental health; Outburst; Bangladesh

Article Summary

Strengths and limitations of this study

- To the best of our knowledge, this is the first-ever study carried out in Bangladesh to evaluate the impact of COVID-19 on mental health among the general Bangladeshi population with such a large and homogeneous sample.
- The study provides valuable information about loneliness, depression, anxiety, and sleep problems of the Bangladeshi population during the COVID-19 pandemic.
- During the COVID-19 pandemic, the overall mental health issues of the Bangladeshi population might be recapitulated through the findings of the present study.
- All data were obtained from online self-reports assessments; therefore, recall bias was unavoidable and not representative for those who have no internet facilities.
- The cross-sectional nature of the study is not able to measure the impact of these mental illnesses over time and the present study didn't consider the altered lifestyle of the respondents due to the COVID-19 pandemic.

INTRODUCTION

The coronavirus 2019 (COVID-19) disease caused by the novel coronavirus strain SARS-CoV-2 was originated from Wuhan, China, at the end of 2019 and declared as pandemic on March 11, 2020, due to its uncontrolled spreading worldwide.[1] After spreading, till October 9, 2020, 36,804,776 COVID-19 affected cases were found where 1,067,560 died with 4% death vs. recovery. Currently, the spreading rate is highest from any previous time as daily new cases were found approximately 3.43 lacs on October 8, 2020.[2] Currently, more than a hundred vaccine candidates of COVID-19 are in the different developing stage but catastrophic conditions are not improved yet due to lack of proper treatment and medications.[3] Though some countries were succeeded to control the outbreak, most countries-imposed lockdown to limit widespread which eventually affects not only socioeconomic conditions but also the mental health of the population regardless of their age, gender, profession, etc.[4] COVID-19 is usually transmitted by the breathing of infected droplets or contact with infected droplets, then affects people psychologically, mentally, economically as well as collapses the health care system in nearly 200 infected countries.[5] About 52.1% of people felt horrified and apprehensive during the COVID-19 breakdown where 57.8-77.9% needed extra support from family and friends.[6]

Major epidemic and pandemic outbursts have several negative impacts on individual and collective mental health in society.[4] For example, in Taiwan, the severe acute respiratory syndrome (SARS) outbreak in 2003 severely impacted the mental health of healthcare professionals working in tertiary care hospitals (Chong et al., 2004). Another study in Canada reported that healthcare providers working at hospitals during the SARS outbreak experienced long-term occupational and psychological effects.[7] In the USA, a study was conducted among Capitol Hill staff workers to respond successfully to disaster-related mental health after the anthrax attacks in 2001. This study reported that 55% and 27% of the respondents were suffering from a post-traumatic stress disorder and post-anthrax psychiatric disorder.[8] The mental health of many individuals is potentially affected by COVID-19 in many ways. In addition to COVID-19 patients, close contacts, isolated suspected cases, families and friends of patients, and healthcare providers, and general people may also experience extra mental health burdens.[9] Therefore, understanding the impact of the COVID-19 pandemic on an individual's mental health may help to reduce many current and future mental health issues.

Bangladesh is a densely populated county with about 164 million population which is five times denser than any other mega country.[10] Many factors such as population density,

cultivation land saturation, poor economic background, climate change, disease burden affect mental health of general people.[11] The economic backbone of the general people of Bangladesh further affected after imposing the lockdown from 26th March 2020 due to the COVID-19 pandemic. In Bangladesh, the country's Institute of Epidemiology, Disease Control and Research (IEDCR) reported the first COVID-19 cases on March 8, 2020.[12] On October 8, 2020, total cases numbered 374,592, with 5,460 fatalities and 288,316 recoveries.[13] As the infection spread every corner of the country and the numbers of confirmed cases significantly increased over the last six months, mental health-related disorders may increase, particularly among susceptible people. Many hospitals weren't prepared well to treat COVID-19 patients and the testing facilities were limited at the initial time that greatly impacted the mental health of common people of Bangladesh, even the situation influenced some people's suicidal ideation who failed to cope with these extra mental burdens.[14-16] To date, not enough attention has been paid to reduce mental health problems due to COVID-19 rather identifying and treating new cases. This data would help to address the psychological issues that people are experiencing in Bangladesh during this COVID-19 pandemic. However, few studies have considered the mental health issues among the population of Bangladesh but extensive research on different mental parameters simultaneously was not evaluated yet.[17-20]

In this study, we aimed to estimate the extent to which general people of Bangladesh were prone to loneliness, depression, anxiety, and sleep problems due to the COVID-19 pandemic and to discover the relationship between the mental health problems and sociodemographic factors. Also, we explored the specific factors affecting the mental health of people and suggested the possible approaches to manage the situation during and after the pandemic.

METHODS

Participants and procedure

This cross-sectional and anonymous online survey enrolled 672 respondents (381 males, 291 females) aged between 15 to 65 years from all over Bangladesh. The questionnaire was circulated in both English and Bengali versions for the proper understanding of questions. Initially, 736 respondents were given feedback about the questions but the responses from 64 were excluded due to the partial information. All the respondents of this survey were of Bangladeshi ethnicity and living in Bangladesh at that time. Any Bangladeshi people aged between 15 to 65 years who understood the questions properly were included in this survey. Exclusion criteria included the history of other psychiatric disorders like delusions, mental

retardation, bipolar disorder, schizophrenia, personality disorder, mood-congruent or incongruent psychotic features, comorbid psychiatric illness, neurological disease, or patients with clinical evidence of dementia. Respondents having severe or acute medical illnesses, the presence of other acute or chronic diseases, history of addiction, or substance abuse were also excluded from this survey. We did not pay for participation.

Estimations

A self-reported structured questionnaire covering the informed consent, information about socio-demographics and biophysics, and psychometric assessment scales. The questionnaire was reached to participants via mail, hand to hand, or via transports that carry emergency things. Any doubt regarding the questionnaire was solved over the phone calls or video conferences. Illiterate or older respondents were helped by their educated family members. The data were collected from 15th April 2020 to 10th May 2020 using the google survey tool (Google Forms).

Socio-demographic and biophysical measures

Socio-demographic and biophysical data of respondents were recorded by using a predesigned questionnaire. The collected information was regarding their age, gender, body mass index (BMI), marital status, education level, occupation, economic status, residence, living status (with or without family), and smoking habit.

UCLA loneliness scale (ULS-8)

The ULS-8 is a short form of the UCLA loneliness scale containing 8 questions.[21] Each question has a 4-level score according to the chosen answer as 1 (never), 2 (rarely), 3 (sometimes), 4 (often). Two questions are positively worded, reverse marking from others ("I am an outgoing person," and "I can find companionship when I want it"). The total score ranges from 8 to 32 where a higher score suggested a higher degree of loneliness. We segmented the total score in 4 groups i.e. 8 to 16 suggested no loneliness, 17-21 depicts mild loneliness, 22-16 indicates moderate and finally, 27 or above is marked as severe loneliness.

Patient health questionnaire-9 (PHQ-9)

The self-assessment questionnaire PHQ-9 has 9 different questions for the evaluation of the depression status of respondents for the last 2 weeks. The total score ranges from 0 to 27 points where each question is scored 0-3 points based on the answers (0, not at all; 1, several days; 2, half of the days; 3, nearly every day). Below 10 points indicates no depressive symptoms where

10 or higher indicates the presence of depressive symptoms.[22] To determine the gravity of depression, we divided the total score into four levels. Total scores <10, 10-15, 16-21, and 22-27 for no depression, mild depression, moderate depression, and severe depression, respectively.

Generalized anxiety disorder 7-item (GAD-7) scale

The GAD-7 is a one-dimensional instrument consisting of 7 questions indicating how often, over the past 2 weeks, the respondents have been bothered by each of the seven key symptoms of GAD. Total score ranges from 0 to 21 where each question has 4 different scores according to responses like 0 (not at all), 1 (several days), 2 (more than half the days), and 3 (nearly every day). A higher score indicates a high degree of anxiety, divided into 4 different segments where <5, 5-9, 10-14, and 15-21 indicate no, mild, moderate, and severe anxiety, respectively.[23]

Pittsburgh sleep quality index (PSQI)

The PSQI questionnaire was used to determine the sleep quality of respondents over one month. This questionnaire consists of 19 specific questions in 7 different domains: (1) sleep quality (1 question), (2) sleep latency (2 questions), (3) sleep duration (1 question), (4) sleep efficiency (3 questions), (5) sleep disturbance (9 questions), (6) sleep medication (1 question), and (7) daily dysfunction (2 questions). Each domain score ranging from 0 to 3 and the total final score of seven domains is 0 to 21. The higher total scores represent the poor sleep quality, determining the severity. A total PSQI score below 5 shows no sleep problem and greater than 5 indicates poor sleep. Moreover, respondents having PSQI score greater than 10 are considered as bad sleepers.[24]

Statistical analysis

Microsoft Excel 2016 and statistical packages for social sciences (IBM SPSS, version 25.0) were used to perform statistical analysis. The data editing, sorting, coding, classification, and tabulation were performed by Microsoft Excel. Then the excel file was imported into IBM SPSS software. The descriptive statistics were applied to analyze the characteristics of the respondents. A chi-square test was performed to observe the differences in loneliness status (yes or no) with or without depression, anxiety, or sleep problem among the respondents. The correlations between risk factors and psychometric measures (loneliness, depression, anxiety, and sleep quality) were assessed with binary logistic regression analysis with a 95% confidence interval. Statistically significant results were considered at $p<0.05$.

Patient and public involvement

Patients and the public were not involved in this study.

RESULTS

The descriptive statistics for all variables of the respondents are presented in Table 1 and Table 2.

Table 1: Distribution of variables and their association with loneliness and depression among the respondents.

	Total N = 672		Loneliness N = 478					Depression N = 256				
			Yes		χ2	df	p-value	Yes		χ2	df	p-value
	n	%	n	%				n	%			
Age												
15 to 30 years	344	51	236	69	2.19	1	0.139	119	35	3.67	1	0.056
Above 30 years	328	49	242	74				137	42			
Gender												
Male	381	57	278	73	1.44	1	0.230	117	31	20.35	1	**<0.001**
Female	291	43	200	69				139	48			
BMI (kg/m²)												
Below 18.5	32	5	24	75	0.25	2	0.880	18	56	4.74	2	0.093
18.5–25	435	65	308	71				163	37			
Above 25	205	31	146	71				75	37			
Marital status												
Unmarried	289	43	210	73	0.58	1	0.446	107	37	0.25	1	0.619
Married	383	57	268	70				149	39			
Education												
Illiterate	26	4	21	81	7.53	4	0.110	15	58	6.00	4	0.199
Primary	85	13	59	69				35	41			
Secondary	61	9	48	79				23	38			
Higher Secondary	410	61	279	68				146	36			
Graduate/above	90	13	71	79				37	41			
Occupation												
Service	219	33	153	70	3.75	3	0.290	66	30	12.45	3	**0.006**
Business	28	4	20	71				7	25			
Student	208	31	158	76				88	42			
Unemployed	217	32	147	68				95	44			
Economic status												
Low	245	36	179	73	0.75	2	0.688	106	43	6.11	2	**0.047**
Medium	310	46	218	70				103	33			
High	117	17	81	69				47	40			
Residence												
Urban	255	38	184	72	0.21	1	0.646	109	43	3.79	1	0.052
Rural	417	62	194	47				147	35			
Living status												

With family	430	64	291	68	11.62	3	**0.009**	179	42	9.86	3	**0.020**
Without family	242	36	187	77				77	32			
Smoking habit												
Smoker	177	26	135	76	3.09	1	0.079	50	28	9.88	1	**0.002**
Non-smoker	495	74	343	69				206	42			
Loneliness												
Yes	478	71	478	100	-	-	-	228	48	64.75	1	**<0.001**
No	194	29	0	0				28	14			
Depression												
Yes	256	38	228	89	64.75	1	**<0.001**	256	100	-	-	-
No	416	62	250	60				0	0			

Table 2: Distribution of variables and their association with generalized anxiety and sleep problems among the respondents.

	Generalized anxiety N= 429					Sleep problem N = 494				
	Yes		$\chi 2$	df	p-value	Yes		$\chi 2$	df	p-value
	n	%				n	%			
Age										
15 to 30 years	213	62	1.12	1	0.289	242	70	3.62	1	0.051
Above 30 years	216	66				252	77			
Gender										
Male	223	59	10.74	1	**0.001**	271	71	2.57	1	0.109
Female	206	71				233	80			
BMI (kg/m^2)										
Below 18.5	28	88	8.16	2	**0.017**	26	81	1.08	2	0.584
18.5–25	272	63				317	73			
Above 25	129	63				151	74			
Marital status										
Unmarried	187	65	0.16	1	0.685	207	72	0.93	1	0.336
Married	242	63				287	75			
Education										
Illiterate	18	69	7.39	4	0.117	19	73	0.71	4	0.849
Primary	61	72				65	76			
Secondary	44	72				44	72			
Higher Secondary	246	60				302	74			
Graduate/above	60	67				64	71			
Occupation										
Service	125	57	9.28	3	**0.026**	158	72	0.56	3	0.906
Business	17	61				20	71			
Student	148	71				153	74			
Unemployed	139	64				163	75			
Economic status										
Low	163	67	1.39	2	0.499	177	72	2.60	2	0.273
Medium	195	63				224	72			
High	71	61				93	79			

Residence										
Urban	164	64	0.04	1	0.841	192	75	0.67	1	0.413
Rural	265	64				302	72			
Living status										
With family	274	64	1.56	3	0.665	323	75	4.82	3	0.185
Without family	155	64				171	71			
Smoking habit										
Smoker	105	59	2.12	1	0.145	129	73	0.05	1	0.825
Non-smoker	324	65				365	74			
Generalized anxiety										
Yes	429	100	-	-	-	366	85	84.86	1	**<0.001**
No	0	0				128	53			
Sleep problem										
Yes	366	75	84.88	1	**<0.001**	494	100	-	-	-
No	63	35				0	0			

BMI: Body mass index; df: Degrees of freedom; N: Number.

The total respondents were 672, among them, males and females were 57% and 43%, respectively. About half of the total respondents were above 30 years of age and half were below 30 years. Sixty-five percent of total respondents had normal BMI and 61% of respondents completed their higher secondary education. The majority of the respondents were married (57%), non-smoker (74%), and medium economic class (46%). We observed two-third of the total respondents are living with family (64%) in a rural area (62%).

The estimations of loneliness, depression, anxiety, and sleep problems were 71%, 38%, 64%, and 74%, respectively (Figure 1). The proportions of respondents having loneliness were higher in (i) individuals living without family members vs. with family members (77% vs. 68%, p=0.009), (ii) individuals with vs. without considerable depression (89% vs. 60%, p<0.001), anxiety (85% vs. 46%, p<0.001), and sleep problem (79% vs. 49%, p<0.001), respectively. The sizes of respondents with depression were higher in (i) females vs. males (48% vs. 31%, p < 0.001), (ii) unemployed vs. service (44% vs. 30%, p=0.006), (iii) non-smoker vs. smoker (42% vs. 28%, p=0.002), (iv) individuals with economic status lower vs. medium (43% vs. 33%, p=0.047), (v) respondents living with family members vs. without family members (42% vs. 33%, p = 0.020), (vi) individuals with vs. without considerable loneliness (48% vs. 14%, p<0.001), anxiety (57% vs. 5%, p<0.001), and sleep problem (45% vs. 19%, p<0.001), respectively. The extents of respondents with anxiety were higher in (i) females vs. males (71% vs. 69%, p=0.001), (ii) students vs. service (71% vs. 57%, p=0.026), (iii) individuals with BMI below 18.5 vs. above 25 kg/m^2 (88% vs. 63%, p=0.017), (iv) individuals with vs. without considerable loneliness (77% vs. 32%, p<0.001), depression (95% vs. 44%, p<0.001), and sleep problem (75% vs. 35%, p<0.001)), respectively. And, finally the

proportions of respondents with sleep problem were higher in individuals with vs. without considerable loneliness (82% vs. 53%, p < 0.001), depression (87% vs. 65%, p < 0.001), and anxiety (85% vs. 53%, p<0.001), respectively.

The binary logistic regression analysis was performed to measure the correlations between dependent and independent variables and demonstrated in Table 3 and Table 4.

Table 3: Regression analysis of variables by mental health problems (Loneliness and Depression) among respondents.

	Loneliness N = 478			Depression N = 256		
	OR	95% CI	p-value	OR	95% CI	p-value
Age						
15 to 30 years	0.606	0.359-1.023	0.061	0.653	0.386-1.105	0.112
Above 30 years	1			1		
Gender						
Male	0.666	0.411-1.080	0.099	1.624	1.000-2.637	**0.050**
Female	1			1		
BMI (kg/m²)						
Below 18.5	1.574	0.557-4.443	0.392	0.889	0.346-2.282	0.806
18.5–25	1.244	0.399-3.877	0.706	0.832	0.287-2.410	0.735
Above 25	1			1		
Marital status						
Unmarried	0.902	0.508-1.600	0.723	0.845	0.463-1.542	0.584
Married	1			1		
Education						
Illiterate	0.498	0.211-1.172	0.111	1.076	0.476-2.430	0.861
Primary	1.365	0.491-3.794	0.551	1.545	0.620-3.851	0.351
Secondary	1.123	0.293-4.309	0.866	1.813	0.507-6.485	0.360
Higher Secondary	0.518	0.204-1.314	0.166	1.006	0.430-2.351	0.989
Graduate/above	1			1		
Occupation						
Service	0.889	0.292-2.711	0.836	0.315	0.099-1.009	0.052
Business	1.476	0.895-2.434	0.127	1.760	1.037-2.994	0.036
Student	0.628	0.264-1.962	0.253	0.752	0.363-1.052	0.093
Unemployed	1			1		
Economic status						
Low	1.111	0.636-1.941	0.712	1.478	0.832-2.624	0.183
Medium	1.133	0.725-1.771	0.583	1.618	1.038-2.252	**0.033**
High	1			1		
Residence						
Urban	1.060	0.697-1.611	0.785	0.655	0.434-0.988	**0.044**
Rural	1			1		
Living status						
With family	0.457	0.278-0.751	**0.002**	1.797	1.126-2.867	**0.014**
Without family	1			1		
Smoking habit						

Smoker	0.637	0.376-1.078	0.093	1.441	0.849-2.447	0.176
Non-smoker	1			1		
Loneliness						
Yes	-	-	-	2.890	1.669-5.000	**<0.001**
No	-			1		
Depression						
Yes	2.958	1.733-5.050	**<0.001**	-	-	-
No	1			-		
Generalized anxiety						
Yes	3.952	2.506-6.211	**<0.001**	18.518	9.523-35.714	**<0.001**
No	1			1		
Sleep problem						
Yes	2.638	1.718-4.048	**<0.001**	1.385	0.814-2.352	0.229
No	1			1		

Table 4: Regression analysis of variables by mental health problems (Generalized anxiety and Sleep problem) among respondents.

	Generalized anxiety N= 429			Sleep disorder N = 494		
	OR	95% CI	p-value	OR	95% CI	p-value
Age						
15 to 30 years	0.857	0.490-1.501	0.590	0.834	0.499-1.394	0.489
Above 30 years	1			1		
Gender						
Male	1.453	0.869-2.431	0.154	1.036	0.648-1.658	0.882
Female	1			1		
BMI (kg/m^2)						
Below 18.5	0.270	0.072-1.011	0.052	0.818	0.289-2.319	0.706
18.5–25	0.347	0.085-1.411	0.139	0.877	0.281-2.737	0.821
Above 25	1			1		
Marital status						
Unmarried	1.097	0.599-2.011	0.763	1.009	0.578-1.764	0.974
Married	1			1		
Education						
Illiterate	0.511	0.215-1.211	0.127	1.346	0.617-2.935	0.455
Primary	0.566	0.210-1.525	0.260	0.855	0.350-2.090	0.732
Secondary	0.244	0.059-1.006	0.051	0.829	0.249-2.763	0.761
Higher Secondary	0.788	0.311-2.000	0.616	1.396	0.589-3.310	0.449
Graduate/above	1			1		
Occupation						
Service	0.855	0.296-2.481	0.774	0.894	0.318-2.515	0.831
Business	1.300	0.754-2.237	0.344	1.161	0.702-1.923	0.559
Student	0.548	0.362-0.952	0.452	0.524	0.241-1.183	0.263
Unemployed	1					
Economic status						
Low	0.562	0.312-1.011	0.054	1.588	0.893-2.824	0.115

Medium	0.981	0.613-1.572	0.938	0.852	0.558-1.300	0.458
High	1			1		
Residence						
Urban	1.146	0.737-1.781	0.545	0.929	0.618-1.397	0.724
Rural	1			1		
Living status						
With family	0.842	0.511-1.388	0.501	1.344	0.844-2.140	0.213
Without family	1			1		
Smoking habit						
Smoker	1.032	0.611-1.743	0.906	0.925	0.567-1.509	0.755
Non-smoker	1			1		
Loneliness						
Yes	3.952	2.500-6.211	**<0.001**	2.525	1.647-3.875	**<0.001**
No	1			1		
Depression						
Yes	18.518	9.615-35.714	**<0.001**	1.344	0.800-2.257	0.263
No	1			1		
Generalized anxiety						
Yes	-	-	-	3.367	2.127-3.519	**<0.001**
No	-			1		
Sleep problem						
Yes	3.558	2.237-5.649	**<0.001**	-	-	-
No	1			-		

BMI: Body mass index; CI: Confidence interval; N: Number; OR: Odds ratio.

Respondents living with family members were 0.46 times less likely than the respondents living away from family members to have loneliness (OR = 0.46; 95% CI = 0.28-0.75, p=0.002). Respondents having business occupations were 1.76 times more likely than the unemployed group to have depression (OR = 1.76; 95% CI = 1.04–2.99, p=0.036). Respondents from the medium economic class were 1.62 times more likely than those who were from high economic impression to have depression (OR = 1.62; 95% CI = 1.04–2.25, p=0.033). Urban respondents were 0.66 times less likely to have depression than rural respondents (OR = 0.66; 95% CI = 0.43-0.99, p=0.044). Respondents who are living with family members were 1.80 times more likely to have depression than those of the respondents who are living away from the family members (OR = 1.80; 95% CI = 1.13-2.87, p=0.014). The probabilities of having loneliness were 2.96 times higher in respondents who already have depression (OR = 2.96; 95% CI = 1.73-5.05, p<0.001), 3.95 times higher in respondents with anxiety (OR = 3.95; 95% CI = 2.51-6.21, p<0.001), and 2.64 times higher in respondents suffering from sleep problem (OR = 2.64; 95% CI = 1.72-4.05, p<0.001), respectively. The chances of having depression were 18.51 times higher in respondents with anxiety (OR = 18.51; 95% CI = 9.52-35.71, p<0.001), and 1.36 times higher in respondents suffering from sleep problem (OR = 1.36; 95% CI = 0.81-2.35, p<0.001), respectively. The likelihoods of

having anxiety were 3.60 times higher in respondents suffering from sleep problems (OR = 3.60; 95% CI = 2.24-5.65, p<0.001).

DISCUSSION

The present prospective study demonstrates the impact of pandemic COVID-19 on the mental health status among the general population of Bangladesh. The spreading of COVID-19 is spiraling out of control worldwide; the general population around the world is dreadfully frazzled currently.[25] The psychological reactions of the population toward any outbreak of infectious diseases play an important role in controlling both the spreading of the disease and the occurrence of emotional disturbances and in the regulation of social disorder during and after the pandemic.[26] The general population is always under stressful conditions because of the unpredictability of the situations, when to control the spreading of the disease, and the seriousness of the risk factors associated with COVID-19.[27] Experiences from past similar epidemics and pandemics, serious concerns such as fear of death arise among the patients, and feelings of loneliness, anger, depression, sleep disturbance can develop among people who are quarantined or self-isolated.[9] It can be inferred that the general population who are in lockdown might develop several mental health problems.

The government-imposed lockdown situation or stay home orders has interrupted the normal life of general people that ultimately impacted the individual's mental health.[28 29] General people are living a monotonous, unusual, helpless life in their locked home, blaming others to be responsible that slowly developing mental breakdown.[30] Patients of COVID-19 or suspected isolated people are more vulnerable to experience trauma due to fear of death. Suspected patients who are staying in quarantine can feel loneliness, depression, anxiety, sleep problems, bored, and panic that may lead to emotional disturbance, self-harm, substance abuse, and suicidal thoughts.[31 32] A rapid review found that stress factor indefinite lockdown conditions, fear of infection, frustration, monotonous life, insufficient supplies, inadequate information, financial loss, and fear of an uncertain future have led to developing long-lasting posttraumatic stress symptoms, loneliness, anxiety, confusion, anger, depression among the general population.[33]

The present study found that about three in every four people in Bangladesh are suffering from loneliness and sleep problems at any level of gravity during the lockdown period (Figure 1). People with considerable loneliness are prone to have sleep problems than without loneliness. On the other hand, people living without family during lockdown are more prone to develop

loneliness than people living with family. Following the current findings, one study conducted in the United Kingdom and observed 36% of the respondents feel lonely during the COVID-19 pandemic which is quite higher than any normal times.[34] Another two studies also reported higher loneliness scores among general people during COVID-19 than past normal times.[35 36] We also found that depression is higher in females than males like previous findings.[37-40] The prevalence of depression and generalized anxiety among the Bangladeshi population during the early lockdown period was 38% and 64%, respectively. The increased rate of depression was observed in several recent studies in Spain, China, and Hong Kong due to the COVID-19 pandemic.[41-43] Also, the high prevalence anxiety disorder was observed among respondents from many countries in the COVID-19 pandemic than previous times.[3 37 38] The extent of anxiety among Bangladeshi students found about 71% in the present study. Final year students of different education levels are more anxious about their uncertain exams and the job market. The present study shows that respondents having loneliness, depression, or anxiety are more likely to have sleep problems than healthy individuals. Similar findings were reported in many recent studies. During the COVID-19 pandemic, 29.2% for insomnia, 27.9% for depression, and 31.6% anxiety was observed in China.[44] During COVID-19 lockdown, 42.2% sleep disturbances, 17.4% moderate or severe insomnia, 24.7%, and 23.2% depression and anxiety symptom was observed in Italy.[45]

To prevent the quick spread of COVID-19 infection, the Bangladesh government postponed all educational institutions since March 18, 2020, and imposed a countrywide lockdown to limit public movement and to inspire staying at home since March 26, 2020.[14] The nationwide lockdown, restriction on movement or stay home orders have a profound impact on the economy in the markets, offices, business organizations, and transport systems.[46 47] Most of the Bangladeshi population mainly depends on a regular income but they are uncertain about returning to the workplace due to indefinite lockdown, these are producing a confounding impact on their mental health status.[30] Several suicide cases are reported in Bangladesh due to getting infected and lost economic opportunities during the lockdown period informing socioeconomic challenges of marginalized people that reflect the mental health status of Bangladeshi wage-earners.[48 49] An Indian case study suggested that COVID-19 may significantly impact the mental health status and influence suicidal ideation, suicide attempts among the affected people; other comorbid diseases may aggravate the situation.[50] We found that 44% of unemployed and 30% of service-holders were suffering from depression. About

43% of people belonging to the lower economic class are facing depression during the lockdown period.

National Institute of Mental Health (NIMH) of Bangladesh have announced some recommendations such as psychotropics, avoid COVID-19 news multiple times in a day or news scrolling, one or two authenticate source of information, less social media, simple relaxation technique like breathing exercise, etc. regarding the management of mental health during COVID-19 pandemic.[51] In agreement with the above suggestions, several studies also recommended online response, counseling, social support, training on mental health for the patients, health care professionals, public service holders, youth, students, elderly populations to manage mental health problems during and after the pandemic.[32 52 53] Worldwide, the COVID-19 pandemic unveiled the actual setup of unpreparedness of the healthcare systems and the scarcity of resources (PPE, testing kits, etc.) to combat the situation.[54]

Strengths and limitations of this study

The present study has a few potential limitations, which should be considered. First, compared to face-face interviews, online self-reporting surveys have multiple biases and are not representative for those who have no internet facilities. Secondly, the cross-sectional nature of the study is not able to measure the impact of these mental illnesses over time. Additionally, the present study didn't consider the altered life-style of the respondents due to the COVID-19 pandemic. Besides the limitations, the present study has some strong advantages. This is the first-ever study carried out in Bangladesh intending to identify four important mental health problems (loneliness, depression, anxiety, and sleep problems) during this pandemic time. This study will provide an idea about the potential mental health situation among the general Bangladeshi population during the COVID-19 pandemic.

Future research

This study highlights the need for mental health assessment and proper management of these issues during COVID-19 pandemic. Further research among the healthcare professionals to explore their actual mental health status in this pandemic situation.

CONCLUSION

In summary, our finding reflects the gravity of mental health problems during the COVID-19 pandemic where a large portion of general people in Bangladesh affected mentally with different levels of severity. Loneliness, depression, generalized anxiety, and sleep problems

were linked with specific factors and we suggest intensive mental healthcare services for the Bangladeshi people would support them to reduce these mental health problems during and after the COVID-19 pandemic. Therefore, the government, non-government, and community activities should be integrated to ensure individual and collective physical and mental health. In addition to medical care, social security, economic efficiency, the resilience of affected groups, strengthening healthcare facilities should be the top priority to grow confidence among the general population of Bangladesh after the COVID-19 pandemic.

Declarations

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Author contributions

RD conceived the idea, designed the study, collected the data, and prepared the initial draft of the manuscript. MRH and SD contributed to the development of the study design, collected the data, and edited the manuscript. MRI conceived and designed the study, analyzed and interpreted the data, reviewed the manuscript for important intellectual content, and supervised the whole work. All the authors approved the final version of the manuscript for this submission.

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Competing interests

The authors do not have any competing interests to declare.

Patient consent for publication

Not applicable.

Data availability statement

Data supporting the present study findings are within this article. All the relevant data and information can be obtained from the corresponding author upon reasonable request.

Table Legends

Table 1 Distribution of variables and their association with loneliness and depression among the respondents.

BMI: Body mass index; df: Degrees of freedom; N: Number.

Table 2 Distribution of variables and their association with generalized anxiety and sleep problems among the respondents.

BMI: Body mass index; df: Degrees of freedom; N: Number.

Table 3 Regression analysis of variables by loneliness and depression among the study population.

BMI: Body mass index; CI: Confidence interval; N: Number; OR: Odds ratio.

Table 4 Regression analysis of variables by generalized anxiety and sleep problems among the study population.

BMI: Body mass index; CI: Confidence interval; N: Number; OR: Odds ratio.

Figure Legends

Figure 1: Mental health problems among the respondents based on their distribution and gravity.

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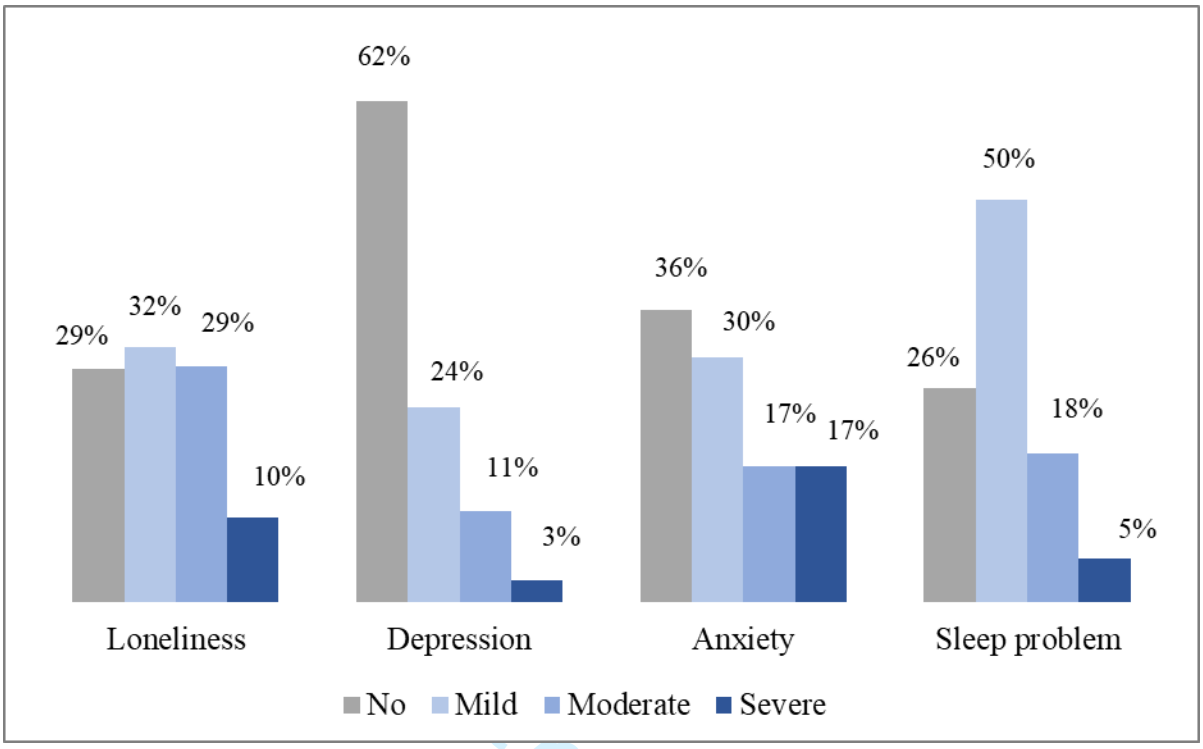

Figure 1: Mental health problems among the respondents based on their distribution and gravity

Title: Impact of COVID-19 pandemic on mental health among general Bangladeshi population: A cross-sectional study

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Section/Paragraph
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Title
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Abstract
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction Paragraphs 1-3
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction Paragraphs 4
Methods			
Study design	4	Present key elements of study design early in the paper	Methods Paragraphs 1
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Methods Paragraphs 1
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	Methods Paragraphs 1
		(*b*) For matched studies, give matching criteria and the number of controls per case	Methods Paragraphs 1
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Methods Paragraphs 1
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods Paragraphs 2-3
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	Methods Paragraphs 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Methods Paragraphs 1
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Methods Paragraphs 8
		(*b*) Describe any methods used to examine subgroups and interactions	Methods Paragraphs 8
		(*c*) Explain how missing data were addressed	Methods Paragraphs 4
		(*d*) If applicable, explain how matching of cases and controls was addressed	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed	Results Paragraphs 1

		eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Results Paragraphs 1 and Table 1
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers in each exposure category, or summary measures of exposure	Results Paragraphs 2-4 and Table 2

Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Results Paragraphs 2-4 and Table 2
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	Discussion Paragraph 1
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Discussion Paragraph 5
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion Paragraph 2-4
Generalisability	21	Discuss the generalisability (external validity) of the study results	Discussion Paragraph 2-4
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	A small seed fund for students was available.

*Give information separately for cases and controls.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

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Impact of COVID-19 pandemic on mental health among general Bangladeshi population: A cross-sectional study

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Title: Impact of COVID-19 pandemic on mental health among general Bangladeshi population: A cross-sectional study

Running Title: COVID-19 pandemic and mental health issues

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(From the introduction to conclusion excluding abstract, references, declarations, etc.)

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Title: Impact of COVID-19 pandemic on mental health among general Bangladeshi population: A cross-sectional study

ABSTRACT

Objectives: The mental health problems are significantly amplified worldwide during the coronavirus (COVID-19) pandemic. At the early stage of the outbreak, the government of Bangladesh imposed lockdown and quarantine approaches to prevent virus spread that impacted people's daily life and health. COVID-19 pandemic also affected people's economic status, healthcare facilities, and other lifestyle factors in Bangladesh. We aimed to assess the impact of the COVID-19 pandemic on mental health among the Bangladeshi population.

Methods: We conducted an online cross-sectional survey among 672 Bangladeshi people aged between 15 and 65 years all over the country from April 15 to May 10, 2020. After taking electronic consent, we conducted our survey assessing the socio-demographic profiles and psychometric measures. We used the UCLA loneliness scale (ULS-8), patient health questionnaire-9 (PHQ-9), generalized anxiety disorder 7-item (GAD-7) scale, Pittsburgh sleep quality index PSQI) for assessment of loneliness, depression, anxiety, and sleep problem, respectively.

Results: Estimates of loneliness, depression, anxiety, and sleep problems were 71% (mild: 32%, moderate: 29%, severe: 10%), 38% (mild: 24%, moderate: 11%, severe: 3%), 64% (mild: 30%, moderate: 17%, severe: 17%), and 73% (mild: 50%, moderate: 18%, severe: 5%), respectively. In Bangladesh, the key factors associated with poor mental health during COVID-19 were female gender, unemployment, students, obesity, and living without a family. Also, the present study detected statistically significant inter-relationships among the measured mental health issues.

Conclusions: A large portion of respondents reported mental health problems during the COVID-19 pandemic in Bangladesh. The present study suggests longitudinal assessments of mental health among Bangladeshi people to know the gravity of this issue during and after the pandemic. Appropriate supportive programs and interventional approaches would address mental health problems in Bangladesh during this COVID-19 pandemic.

Keywords: COVID-19; Mental health; Depression; Anxiety; Loneliness; Pandemics; Bangladesh

Article Summary

Strengths and limitations of this study

- The present study assessed the four major mental health issues among the general Bangladeshi population during the COVID-19 pandemic.
- The present study ensures rapid data collection during public health emergencies and suitability to developing context-specific mental health programs.
- Online self-reporting surveys might have multiple biases and are not representative of those without internet facilities.
- The cross-sectional study is not able to measure the impact of these mental illnesses over time.

INTRODUCTION

The novel coronavirus strain SARS-CoV-2 causes COVID-19 originated from Wuhan, China. COVID-19 was declared a pandemic on March 11, 2020, due to its uncontrolled spreading worldwide.[1] After spreading, till December 29, 2020, over 79.2 million COVID-19 cases and over 1.7 million deaths were reported worldwide since the start of the pandemic.[2] In December 2020, we observed the highest weekly average of 4.3 million confirmed new cases than any previous time.[3] This devastating condition has not improved yet due to lack of proper treatment and medications though more than a hundred vaccine candidates are in the different developing stages.[4] Most countries-imposed lockdown to limit virus spread that eventually affects people's socioeconomic conditions and mental health regardless of age, gender, profession, etc.[5] Usually, the COVID-19 transmits through breathing droplets or contact with infected individuals. This fear of coronavirus infection impacted the lifestyle, psychology, and relationship status of people.[6] About 52.1% of people felt worried during the COVID-19 pandemic. Among them, 57.8-77.9% wanted mental support from family and friends.[7]

Major epidemic and pandemic outbursts have several negative impacts on individual and collective mental health in society.[5] Previous middle east respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS) severely impacted the local people's mental health.[8] [9] Healthcare providers experienced long-term occupational and psychological effects during the SARS outbreak.[10] In the USA, a study was conducted among Capitol Hill staff workers to respond successfully to disaster-related mental health after the anthrax attacks in 2001. This study reported the prevalence rates of post-traumatic stress disorder and post-anthrax psychiatric disorder among respondents were 55% and 27%, respectively.[11] The mental health of many individuals is potentially affected by COVID-19 in many ways. Family members and friends of COVID-19 patients, their close contacts, isolated or suspected population, healthcare providers, and general people experience extra mental health burdens during the COVID-19 pandemic.[12] Therefore, understanding the impact of the COVID-19 pandemic on an individual's mental health might reduce many current and future mental health issues.

Bangladesh is a densely populated county with a population size of about 164 million people. The population density is five times higher than any other mega country.[13] Several factors that affect mental health are population density, housing, economic status, employment, life experience, disease burden, etc.[14] The economic backbone of the Bangladeshi people squeezed

after imposing the lockdown from March 26, 2020. Institute of Epidemiology, Disease Control, and Research of Bangladesh reported the first COVID-19 cases on March 8, 2020.[15] Between March 8 and December 27, 2020, there were 509,148 confirmed cases with 7,452 fatalities reported in Bangladesh. It is the rank 27th country contributing 0.64% COVID-19 related disease burden to the world.[16] At the initial stage, many hospitals were not ready to treat COVID-19 even the testing facilities were limited. This situation impacted the mental health of many Bangladeshi people. Few people planned for suicide after failing to cope with these extra mental burdens.[17-19] The infection has reached every corner of the country. The number of confirmed cases significantly increased and, mental health-related disorders may increase, particularly among susceptible people. Therefore, more attention needs to pay to the mental health burden during and after the COVID-19 pandemic.[20-22] It is equally applicable for other low- and middle-income countries (LMICs) where resources are limited to tackle any pandemic situation and its associated mental health issues.[23-25] The present study aimed to assess the prevalence rates of loneliness, depression, anxiety, and sleep problems among the general Bangladeshi population during the COVID-19 pandemic. Besides, we expected to find the associated factors related to mental health problems during the COVID-19 pandemic.

METHODS

Participants and procedure

We carried out a nationwide cross-sectional online survey between 15th April 2020 to 10th May 2020 using the google survey tool (Google Forms). Here we used the purposive sampling technique to collect the primary data from the participants. We assumed the confidence interval, margin of error, and expected prevalence as 95%, 5%, and 30%, respectively. According to our assumption, the required sample size was 323. Initially, we thought the response rate might be 20% and invited 1,615 people to participate in the survey. However, the actual response rate was 46%, we received 736 responses. After screening, we excluded 64 responses due to partial or incomplete information. Finally, we included 672 respondents (381 males, 291 females) aged between 15 to 65 years in the analysis. Before participation in the survey, the participants reviewed and acknowledged a brief description of the survey, eligibility requirements, procedures, and e-consent form. We obtained electronic consent from all participants. All the respondents of this survey were of Bangladeshi ethnicity and living in Bangladesh at that time. People aged between 15 to 65 years who understood the questions included in this survey. Exclusion criteria included the history of other psychiatric disorders

like delusions, mental retardation, bipolar disorder, schizophrenia, personality disorder, mood-congruent or incongruent psychotic features, comorbid psychiatric illness, neurological disease, or patients with clinical evidence of dementia. Additional exclusion criteria were acute medical conditions, chronic diseases, history of addiction. We did not pay for participation.

Estimations

We used two sets of questionnaires for this survey. The first one was a structured questionnaire designed by the researchers that contained informed consent and socio-demographic information. The second set was a self-reported structured questionnaire from different psychometric assessment scales. We prepared both the questionnaire sets in English then translated them into Bangla. At first, all the questionnaires were translated into Bangla by a medical graduate and a general person who were native speakers of Bangla and fluent in English. An independent researcher compiled and addressed the discrepancies to make a single Bangla forward version. A professional translator having expertise in medical translation and a medical graduate who was not involved in forward-translation translated this Bangla version back into English. Again, an independent researcher compiled these back-translated versions in the same way.[26] We piloted the questionnaire in a randomly selected small group to confirm clarity and understanding. We circulated the questionnaire in both English and Bengali versions for the proper understanding of the questions. We sent the link of the designed google form to participants using email and social networking sites. The educated family members of illiterate or older respondents helped to collect their responses.

Socio-demographic and biophysical measures

We collected the most relevant socio-demographic information of the respondent. The collected data were regarding their age, gender, body mass index (BMI), marital status, education level, occupation, economic status, residence, living status (with or without family), and smoking habit.

UCLA loneliness scale (ULS-8)

The ULS-8 is a short form of the UCLA loneliness scale containing eight questions.[27] Each question has a 4-level score according to the chosen answer as 1 (never), 2 (rarely), 3 (sometimes), 4 (often). Two positively worded questions, reverse marking from others ("I am an outgoing person," and "I can find companionship when I want it"). The total score ranges from 8-32. A higher score suggested a higher degree of loneliness. We segmented the

cumulative score into four groups, no loneliness, 8-16; mild loneliness, 7-21; moderate loneliness, 22-16; severe loneliness, 27 or above.

Patient health questionnaire-9 (PHQ-9)

The PHQ-9 questionnaire has nine different questions for assessing the depressive symptoms of respondents. The total score ranges from 0 to 27 points where each question has 0-3 points based on the answers (0, not at all; 1, several days; 2, half of the days; 3, nearly every day). Below 10 points indicates no depressive symptoms. Ten or higher points indicate the presence of depressive symptoms.[28] To determine the gravity of depression, we divided the total score into four levels. The cumulative scores <10, 10-15, 16-21, and 22-27 for no depression, mild depression, moderate depression, and severe depression, respectively.

Generalized anxiety disorder 7-item (GAD-7) scale

The GAD-7 questionnaire consists of seven basic questions for evaluation of anxiety disorder of respondents. The total score ranges from 0-21. Each question has four different scores according to responses like 0 (not at all), 1 (several days), 2 (more than half the days), and 3 (nearly every day). A higher score indicates a high degree of anxiety, divided into four different segments where <5, 5-9, 10-14, and 15-21 indicating no, mild, moderate, and severe anxiety, respectively.[29]

Pittsburgh sleep quality index (PSQI)

We used the PSQI questionnaire to determine the sleep quality of respondents over one month. This questionnaire consists of nineteen specific questions in seven different domains: (1) sleep quality (1 question), (2) sleep latency (2 questions), (3) sleep duration (1 question), (4) sleep efficiency (3 questions), (5) sleep disturbance (9 questions), (6) sleep medication (1 question), and (7) daily dysfunction (2 questions). Each domain score ranging from 0-3. The cumulative score of seven domains ranging from 0-21. The higher total scores represent the poor sleep quality, determining the severity. A total PSQI score below five shows no sleep problem. A cumulative score of five or more indicates poor sleep. Respondents having a PSQI scores greater than ten are considered bad sleepers.[30]

Statistical analysis

We performed statistical analysis using Microsoft Excel 2016 and statistical packages for social sciences (IBM SPSS, version 25.0). We used Microsoft Excel for data editing, sorting, coding, classification, and tabulation. Then we imported the excel file into IBM SPSS software. We

used descriptive statistics to analyze the characteristics of the respondents. We applied a chi-square test to observe the differences in loneliness status (yes or no) with or without depression, anxiety, or sleep problem among the respondents. We assessed the correlations between risk factors and psychometric measures (loneliness, depression, anxiety, and sleep quality) using binary logistic regression analysis with a 95% confidence interval. Statistically significant results were considered at $p<0.05$.

Patient and public involvement

Patients and the public were not involved in this study.

RESULTS

We presented the descriptive statistics for all variables of the respondents in Table 1. Among the 672 respondents, males and females were 57% and 43%, respectively. Half of the respondents were above 30 years of age. Among all the respondents, 65% had normal BMI. About two-thirds of respondents completed their higher secondary education. The married, non-smoker, medium economic class respondents were 57%, 74%, and 46%, respectively. We observed two-third of the total respondents are living with family (64%) in a rural area (62%).

The estimations of loneliness, depression, anxiety, and sleep problems were 71%, 38%, 64%, and 73%, respectively (Figure 1). The proportions of respondents having loneliness were higher in (i) people living without family members vs. with family members (77% vs. 68%, p=0.009), (ii) people with vs. without much depression (89% vs. 60%, p<0.001), anxiety (85% vs. 46%, p<0.001), and sleep problem (79% vs. 49%, p<0.001), respectively. The sizes of respondents with depression were higher in (i) females vs. males (48% vs. 31%, p < 0.001), (ii) unemployed vs. service (44% vs. 30%, p=0.006), (iii) non-smoker vs. smoker (42% vs. 28%, p=0.002), (iv) people with economic status lower vs. medium (43% vs. 33%, p=0.047), (v) respondents living with family members vs. without family members (42% vs. 33%, p=0.020), (vi) people with vs. without much loneliness (48% vs. 14%, p<0.001), anxiety (57% vs. 5%, p<0.001), and sleep problem (45% vs. 19%, p<0.001), respectively. The extents of respondents with anxiety were higher in (i) females vs. males (71% vs. 69%, p=0.001), (ii) students vs. service (71% vs. 57%, p=0.026), (iii) people with BMI below 18.5 vs. above 25 kg/m2 (88% vs. 63%, p=0.017), (iv) people with vs. without much loneliness (77% vs. 32%, p<0.001), depression (95% vs. 44%, p<0.001), and sleep problem (75% vs. 35%, p<0.001), respectively. And, finally the proportions of respondents with sleep problem were higher in

people with vs. without much loneliness (82% vs. 53%, p<0.001), depression (87% vs. 65%, p < 0.001), and anxiety (85% vs. 53%, p<0.001), respectively.

We performed the binary logistic regression analysis to measure the correlations between dependent and independent variables (Table 2). Respondents living with family members were 0.46 times less likely than the respondents living away from family members to have loneliness (OR=0.46; 95% CI=0.28-0.75, p=0.002). Respondents having business occupations were 1.76 times more likely than the unemployed group to have depression (OR=1.76; 95% CI=1.04–2.99, p=0.036). Respondents from the medium economic class were 1.62 times more likely than those who were from high economic impression to have depression (OR=1.62; 95% CI=1.04–2.25, p=0.033). Urban respondents were 0.66 times less likely to have depression than rural respondents (OR=0.66; 95% CI=0.43-0.99, p=0.044). Respondents living with family members were 1.80 times more likely to have depression than the respondents living away from the family members (OR=1.80; 95% CI=1.13-2.87, p=0.014). The probabilities of having loneliness were 2.96 times higher in respondents who already have depression (OR=2.96; 95% CI=1.73-5.05, p<0.001), 3.95 times higher in respondents with anxiety (OR=3.95; 95% CI=2.51-6.21, p<0.001), and 2.64 times higher in respondents suffering from sleep problem (OR=2.64; 95% CI=1.72-4.05, p<0.001), respectively. The chances of having depression were 18.51 times higher in respondents with anxiety (OR=18.51; 95% CI=9.52-35.71, p<0.001), and 1.36 times higher in respondents suffering from sleep problem (OR=1.36; 95% CI=0.81-2.35, p<0.001), respectively. The likelihoods of having anxiety were 3.60 times higher in respondents suffering from sleep problems (OR=3.60; 95% CI=2.24-5.65, p<0.001).

DISCUSSION

This study examines the impact of the COVID-19 pandemic on the mental health of the general Bangladeshi population. We observed loneliness, depression, anxiety, and sleep problems among the general population were 71%, 38%, 64%, and 73%, respectively (Figure 1). We observed the associated factors behind the mental health issues are female gender, low economic status, students or unemployed, and living without a family. The present finding reporting a much higher rate of loneliness, depression, anxiety, sleep problems among Bangladeshi people during the COVID-19 pandemic. Consistent with our study findings, a cross-sectional epidemiological study reported the higher prevalence of stress (73.4%), depression (50.7%), anxiety (44.7%), and sleep problems (36.1%) among Chinese people at the early stage of the outbreak.[31] The higher rates of mental health problems in the present

study are consistent with the previous SARS and MERS outbreaks.[8 9] At the early time, people had little information about the virus, preventive measures and treatment procedures, fatality rate, etc. The little information and uncertainty about the COVID-19 might contribute to this higher rate of mental health problems.

The present study found that about three in every four people in Bangladesh suffering from loneliness at any level of gravity during the lockdown period. Among them, 39% were suffering from moderate to severe loneliness problems. People living without family during lockdown are more prone to develop loneliness than people living with family. The previous report suggested that social isolation during the COVID-19 pandemic was a risk factor for loneliness.[32] People with considerable loneliness are prone to develop other mental health problems, low well-being, and suicidal behavior.[33 34] Following the current findings, one study conducted in the United Kingdom and observed 36% of the respondents feel lonely during the COVID-19 pandemic that is higher than any previous times.[35] Another two studies also reported higher loneliness scores among general people during COVID-19 than past times.[36 37] We observed the high prevalence of loneliness among the people living without their family members. In agreement with the present finding, a recent study reported the increased loneliness levels among females, young people, singles, unemployed, and those who have other psychiatric illnesses.[38] Public communication regarding social distancing and mental well-being involving psychologists, social scientists, and mental health specialists can reduce the burden of lolenisess.[39]

Among the respondents, 38% experienced depressive symptoms, including mild (24%), moderate (11%), and severe (3%) levels. We also observed the higher prevalence of depressive symptoms among females, low economic class people, unemployed people, students, and people living without a family. Several previous studies also reported a higher rate of depressive symptoms among females than males during the COVID-19 pandemic.[40-43] Comparing with the present study results, the increased rate of depression reported in several recent studies in Spain, China, and Hong Kong due to the COVID-19 pandemic.[44-46] However, some previous studies reported depression symptoms among the general Chinese population was 16.5% and 11.4% among Japanese people.[47 48] These inconsistencies might be the result of developed socioeconomic status and healthcare facilities. Among the study participants, 64% reported anxiety symptoms where mid, moderate, and severe cases were 30%, 17%, and 17%, respectively. Similar to our finding, a study reported the prevalence rate of anxiety disorder was 28.8% ranging from moderate to severe symptoms in China.[49] Also, a high

prevalence of anxiety disorder was observed among respondents from many countries in the COVID-19 pandemic than previous times.4 40 The prevalence rate of anxiety among Bangladeshi students was 71% in the present study. The final year students of different education levels might contribute to this high rate due to their uncertain exams and the job market. We observed, 73% of general people were suffering from sleep problems during the COVID-19 pandemic. Among them, 50%, 18%, and 5% reported mild, moderate, and severe sleep problems. The present study also demonstrated that respondents having loneliness, depression, or anxiety are more likely to have sleep problems than healthy individuals. Many recent studies reported similar findings. A previous study in China observed 29.2% insomnia, 27.9% depressive symptoms, and 31.6% anxiety disorder among general people during the COVID-19 pandemic.[50] Similarly, another study observed 42.2% sleep disturbances, 17.4% moderate or severe insomnia, 24.7% depressive symptoms, and 23.2% anxiety symptoms among Italian people.[51]

To prevent the quick spread of COVID-19 infection, the Bangladesh government postponed all educational institutions since March 18, 2020. A countrywide lockdown was imposed to limit public movement since March 26, 2020, and inspired people to stay home.[17] The countrywide movement restriction and stay home order greatly impacted the economy in the markets, offices, business organizations, and transport systems.[52 53] Most of the Bangladeshi population depends on a regular income. They were uncertain about returning to the workplace due to indefinite lockdown. This situation created a confounding impact on their mental health status.[54] In Bangladesh, we observed several reported suicide cases during the COVID-19 pandemic for getting infected, economic loss, social security, job security, and the emotional breakdown of marginalized wage-earners. [55 56] An Indian case study suggested that COVID-19 may significantly impact the mental health status and influence suicidal ideation, suicide attempts among the affected people; other comorbid diseases may aggravate the situation.[57] We found that 44% of unemployed and 30% of service-holders were suffering from depression. About 43% of people belonging to the lower economic class are facing depression during the lockdown period.

The prevalence rates of mental health problems before the COVID-19 period varied from 6.5% to 31.0% among adults in Bangladesh.[58] The significant increase of prevalence rates of mental health issues during the COVID-19 pandemic (ranging from 38% to 73%) in the present study is a concern. Therefore, the National Institute of Mental Health of Bangladesh has announced some recommendations. These are psychotropics, avoid COVID-19 news multiple times in a

day or news scrolling, one or two authenticate sources of information, less social media, simple relaxation technique like breathing exercise, etc., regarding the management of mental health during the COVID-19 pandemic.[59] In agreement with the above suggestions, several studies also recommended online response, counseling, social support, training on mental health for the patients, health care professionals, public service holders, youth, students, elderly populations to manage mental health problems.[60-62] Worldwide, the COVID-19 pandemic unveiled the actual setup of unpreparedness of the healthcare systems and the scarcity of resources (PPE, testing kits, etc.) to combat the situation.[63]

Strengths and limitations of this study

The present study has some limitations. First, online self-reporting surveys might have multiple biases and are not representative of those without internet facilities. Second, this cross-sectional study is not able to measure the impact of these mental illnesses over time. Third, we didn't assess the altered life-style of the respondents during the COVID-19 pandemic. Besides the limitations, the present study has some advantages. Firstly, this is the first-ever study in Bangladesh assessing the four major mental health issues during the COVID-19 pandemic. This study provides an idea about the mental health of the Bangladeshi population during the COVID-19 pandemic.

Future research

This study highlights the need for mental health assessment and proper management of these issues during the COVID-19 pandemic and future research among healthcare professionals to explore their actual mental health status in this pandemic situation.

CONCLUSION

In summary, our findings reflect the gravity of mental health problems during the COVID-19 pandemic. A large portion of general people in Bangladesh affected mentally with different levels of severity. We suggest intensive mental healthcare services for the Bangladeshi people. Therefore, integrated government, non-government, and community activities can ensure individual and collective mental health. Besides mental health support, social security and economic stability should be the top priority to grow the confidence among general people.

Declarations

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Author contributions

RD conceived the idea, designed the study, collected the data, and prepared the initial draft of the manuscript. MRH and SD contributed to the development of the study design, collected the data, and edited the manuscript. MRI conceived and designed the study, analyzed and interpreted the data, reviewed the manuscript for important intellectual content, and supervised the whole work. All the authors approved the final version of the manuscript for this submission.

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Ethical statement

Our study did not require an ethical board approval because it did not contain human or animal trials.

Competing interests

The authors do not have any competing interests to declare.

Patient consent for publication

Not applicable.

Data availability statement

Data supporting the present study findings are within this article. All the relevant data and information can be obtained from the corresponding author upon reasonable request.

Table and Figure Legends

Table1 Distribution of variables and their association with different mental health problems among the respondents.

p-values are significant at 95% confidence interval ($p < 0.05$). Significant p-values are shown in bold.

BMI, Body Mass Index; df, Degrees of Freedom; N, Number.

Table 2 Regression analysis of variables by mental health problems among respondents. p-values are significant at 95% confidence interval ($p < 0.05$). Significant p-values are shown in bold. BMI, Body Mass Index; CI, Confidence Interval; N, Number; OR, Odds Ratio.

Figure 1 Mental health problems among the respondents based on their distribution and gravity.

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Table1 Distribution of variables and their association with different mental health problems among the respondents.

	Total N=672		Loneliness N=478					Depression N=256					Generalized anxiety N=429					Sleep problem N=494				
			Yes		χ2	df	p-value	Yes		χ2	df	p-value	Yes		χ2	df	p-value	Yes		χ2	df	p-value
	n	%	n	%				n	%				n	%					%			
Age																						
15 to 30 years	344	51	236	69	2.19	1	0.139	119	35	3.67	1	0.056	213	62	1.12	1	0.289	342	70	3.62	1	0.051
Above 30 years	328	49	242	74				137	42				216	66				382	77			
Gender																						
Male	381	57	278	73	1.44	1	0.230	117	31	20.35	1	**<0.001**	223	59	10.74	1	**0.001**	271	71	2.57	1	0.109
Female	291	43	200	69				139	48				206	71				223	80			
BMI (kg/m^2)																						
Below 18.5	32	5	24	75	0.25	2	0.880	18	56	4.74	2	0.093	28	88	8.16	2	**0.017**	26	81	1.08	2	0.584
18.5–25	435	65	308	71				163	37				272	63				317	73			
Above 25	205	31	146	71				75	37				129	63				151	74			
Marital status																						
Unmarried	289	43	210	73	0.58	1	0.446	107	37	0.25	1	0.619	187	65	0.16	1	0.689	207	72	0.93	1	0.336
Married	383	57	268	70				149	39				242	63				287	75			
Education																						
Illiterate	26	4	21	81	7.53	4	0.110	15	58	6.00	4	0.199	18	69	7.39	4	0.116	19	73	0.71	4	0.849
Primary	85	13	59	69				35	41				61	72				65	76			
Secondary	61	9	48	79				23	38				44	72				44	72			
Higher Secondary	410	61	279	68				146	36				246	60				302	74			
Graduate/above	90	13	71	79				37	41				60	67				64	71			
Occupation																						
Service	219	33	153	70	3.75	3	0.290	66	30	12.45	3	**0.006**	125	57	9.28	3	**0.026**	158	72	0.56	3	0.906
Business	28	4	20	71				7	25				17	61				21	71			
Student	208	31	158	76				88	42				148	71				153	74			
Unemployed	217	32	147	68				95	44				139	64				163	75			

Table 1 (Continued)

Economic status																						
Low	245	36	179	73	0.75	2	0.688	106	43	6.11	2	**0.047**	163	67	1.39	2	0.499	177	72	2.60	2	0.273
Medium	310	46	218	70				103	33				195	63				224	72			
High	117	17	81	69				47	40				71	61				79	79			
Residence																						
Urban	255	38	184	72	0.21	1	0.646	109	43	3.79	1	0.052	164	64	0.04	1	0.841	192	75	0.67	1	0.413
Rural	417	62	194	47				147	35				265	64				302	72			
Living status																						
With family	430	64	291	68	11.62	3	**0.009**	179	42	9.86	3	**0.020**	274	64	1.56	3	0.668	333	75	4.82	3	0.185
Without family	242	36	187	77				77	32				155	64				171	71			
Smoking habit																						
Smoker	177	26	135	76	3.09	1	0.079	50	28	9.88	1	**0.002**	105	59	2.12	1	0.145	159	73	0.05	1	0.825
Non-smoker	495	74	343	69				206	42				324	65				345	74			
Loneliness																						
Yes	478	71	478	100	-	-	-	228	48	64.75	1	**<0.001**	366	77	116.23	1	**<0.001**	391	82	58.40	1	**<0.001**
No	194	29	0	0				28	14				63	32				153	53			
Depression																						
Yes	256	38	228	89	64.75	1	**<0.001**	256	100	-	-	-	244	95	177.45	1	**<0.001**	222	87	37.04	1	**<0.001**
No	416	62	250	60				0	0				185	44				272	65			
Generalized anxiety																						
Yes	429	64	366	85	116.23	1	**<0.001**	244	57	177.45	1	**<0.001**	429	100	-	-	-	356	85	84.86	1	**<0.001**
No	243	36	112	46				12	5				0	0				128	53			
Sleep problem																						
Yes	494	75	391	79	58.40	1	**<0.001**	222	45	37.04	1	**<0.001**	366	75	84.88	1	**<0.001**	494	100	-	-	-
No	178	25	87	49				34	19				63	35				0	0			

p-values are significant at 95% confidence interval ($p<0.05$). Significant p-values are shown in bold.

BMI, Body Mass Index; df, Degrees of Freedom; N, Number.

Table 2 Regression analysis of variables by mental health problems among respondents.

	Loneliness N=478			Depression N=256			Generalized anxiety N=429			Sleep problem N=494		
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Age												
15 to 30 years	0.606	0.359-1.023	0.061	0.653	0.386-1.105	0.112	0.857	0.490-1.501	0.590	0.624	0.499-1.394	0.489
Above 30 years	1			1			1					
Gender												
Male	0.666	0.411-1.080	0.099	1.624	1.000-2.637	**0.050**	1.453	0.869-2.431	0.154	1.026	0.648-1.658	0.882
Female	1			1			1					
BMI (kg/m^2)												
Below 18.5	1.574	0.557-4.443	0.392	0.889	0.346-2.282	0.806	0.270	0.072-1.011	0.052	0.768	0.289-2.319	0.706
18.5-25	1.244	0.399-3.877	0.706	0.832	0.287-2.410	0.735	0.347	0.085-1.411	0.139	0.727	0.281-2.737	0.821
Above 25	1			1			1					
Marital status												
Unmarried	0.902	0.508-1.600	0.723	0.845	0.463-1.542	0.584	1.097	0.599-2.011	0.763	1.069	0.578-1.764	0.974
Married	1			1			1			1		
Education												
Illiterate	0.498	0.211-1.172	0.111	1.076	0.476-2.430	0.861	0.511	0.215-1.211	0.127	1.316	0.617-2.935	0.455
Primary	1.365	0.491-3.794	0.551	1.545	0.620-3.851	0.351	0.566	0.210-1.525	0.260	0.855	0.350-2.090	0.732
Secondary	1.123	0.293-4.309	0.866	1.813	0.507-6.485	0.360	0.244	0.059-1.006	0.051	0.809	0.249-2.763	0.761
Higher Secondary	0.518	0.204-1.314	0.166	1.006	0.430-2.351	0.989	0.788	0.311-2.000	0.616	1.396	0.589-3.310	0.449
Graduate/above	1			1			1			1		
Occupation												
Service	0.889	0.292-2.711	0.836	0.315	0.099-1.009	0.052	0.855	0.296-2.481	0.774	0.824	0.318-2.515	0.831
Business	1.476	0.895-2.434	0.127	1.760	1.037-2.994	0.036	1.300	0.754-2.237	0.344	1.221	0.702-1.923	0.559
Student	0.628	0.264-1.962	0.253	0.752	0.363-1.052	0.093	0.548	0.362-0.952	0.452	0.524	0.241-1.183	0.263
Unemployed	1			1			1					
Economic status												
Low	1.111	0.636-1.941	0.712	1.478	0.832-2.624	0.183	0.562	0.312-1.011	0.054	1.588	0.893-2.824	0.115
Medium	1.133	0.725-1.771	0.583	1.618	1.038-2.252	**0.033**	0.981	0.613-1.572	0.938	0.882	0.558-1.300	0.458
High	1			1			1			1		

Table 2 (Continued)

Residence												
Urban	1.06	0.697-1.611	0.785	0.655	0.434-0.988	**0.044**	1.146	0.737-1.781	0.545	0.529	0.618-1.397	0.724
Rural	1			1			1			1		
Living status												
With family	0.45	0.278-0.751	**0.002**	1.797	1.126-2.867	**0.014**	0.842	0.511-1.388	0.501	0.344	0.844-2.140	0.213
Without family	1			1			1					
Smoking habit												
Smoker	0.63	0.376-1.078	0.093	1.441	0.849-2.447	0.176	1.032	0.611-1.743	0.906	0.925	0.567-1.509	0.755
Non-smoker	1			1			1					
Loneliness												
Yes	-	-	-	2.890	1.669-5.000	**<0.001**	3.952	2.500-6.211	**<0.001**	2.525	1.647-3.875	**<0.001**
No	-			1			1					
Depression												
Yes	2.95	1.733-5.050	**<0.00**	-	-	-	18.518	9.615-	**<0.001**	1.344	0.800-2.257	0.263
No	1			-			1			1		
Generalized anxiety												
Yes	3.95	2.506-6.211	**<0.00**	18.518	9.523-35.714	**<0.001**	-	-	-	3.667	2.127-3.519	**<0.001**
No	1			1			-			1		
Sleep problem												
Yes	2.63	1.718-4.048	**<0.00**	1.385	0.814-2.352	0.229	3.558	2.237-5.649	**<0.001**	-	-	-
No	1			1			1			-		

p-values are significant at 95% confidence interval (p<0.05). Significant p-values are shown in bold.

BMI, Body Mass Index; CI, Confidence Interval; N, Number; OR, Odds Ratio.

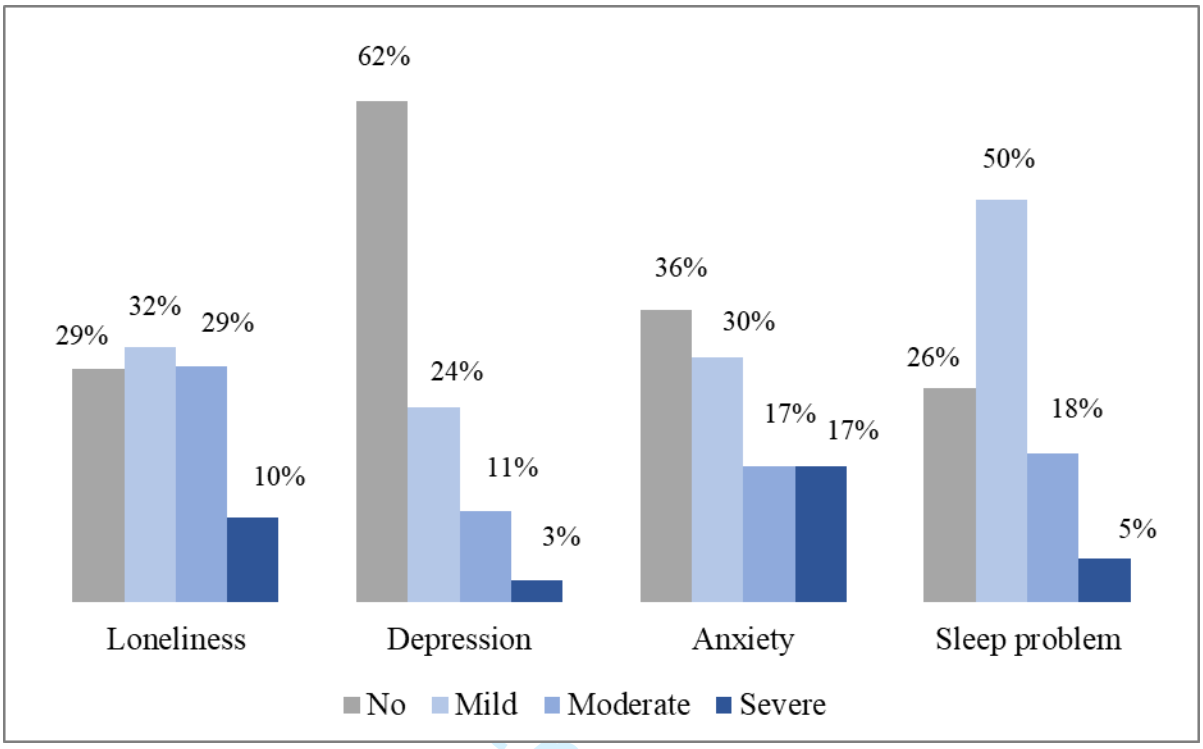

Figure 1: Mental health problems among the respondents based on their distribution and gravity

Title: Impact of COVID-19 pandemic on mental health among general Bangladeshi population: A cross-sectional study

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Section/Paragraph
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Title (page 1)
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Abstract (page 2)
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction Paragraphs 1-3 (Page 4-5)
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction Paragraphs 4 (Page 5)
Methods			
Study design	4	Present key elements of study design early in the paper	Methods Paragraphs 1 (Page 5)
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Methods Paragraphs 1 (Page 5)
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	Methods Paragraphs 1 (Page 5)
		(*b*) For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Methods Paragraphs 1 (Page 5)
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods Paragraphs 2-3 (Page 6)
Bias	9	Describe any efforts to address potential sources of bias	Methods Paragraphs 1 (Page 5)
Study size	10	Explain how the study size was arrived at	Methods Paragraphs 1 (Page 5)
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Methods Paragraphs 1 (Page 5)
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Methods Paragraphs 8 (Page 7-8)
		(*b*) Describe any methods used to examine subgroups and interactions	Methods Paragraphs 8 (Page 7-8)
		(*c*) Explain how missing data were addressed	Methods Paragraphs 1 (Page 5)
		(*d*) If applicable, explain how matching of cases and controls was addressed	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Results Paragraphs 1 (Page 8)
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Results Paragraphs 2 (Page 8)
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers in each exposure category, or summary measures of exposure	Results Paragraphs 2 (Page 9)
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Results Paragraphs 2 (Page 9) Table 1 and 2
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	Discussion Paragraph 1 (page 9-10)
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Strengths and limitations section (page 12)
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion Paragraph 2-4 (page 10-12)
Generalisability	21	Discuss the generalisability (external validity) of the study results	Discussion Paragraph 3-4 (page 11)
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Page 13

*Give information separately for cases and controls.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.