Vaccination, Compliance with Preventive Measures and Mental Health during COVID-19 among Adults in Bangladesh: Do Vaccination and Compliance with Preventive Measures Improve Mental Health?

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Abstract: *Background and Objective*: In addition to the reduction of risk of COVID-19 transmission and mortality, vaccination and compliance with the preventive measures of COVID-19 may have important additional benefits for the improvement of mental health. This study examined the levels and determinants of vaccination, compliance with preventive measures, and anxiety, depression and stress among Bangladeshi adults. It also examined the effects of vaccination and compliance with preventive measures on mental health status among Bangladeshi adults.

Methods: Data for the study come from an online survey conducted during November and December 2021 among Bangladeshi adults. A total of 615 adults participated in the survey. A 21-item Depression, Anxiety, and Stress scale (DASS 21) were used for collecting data on mental health. Both descriptive and inferential statistical methods including multiple logistic regression were used for data analysis.

Results: About 69% of Bangladeshi adults were vaccinated with at least one dose; 87% of adults believed that vaccines are moderate to highly effective in reducing COVID-19 infection. Among the preventive measures during a pandemic, the level of complete compliance with wearing masks and hand washing was almost universal, while the compliance level with other preventive measures was moderate. Vaccinated people had a 55% (OR=0.45; 95%CI:0.26-0.82), 67% (OR=0.33; 95%CI:0.12-0.91), and 44% (OR=0.56; 95%CI:0.27-0.97) lower chance of suffering from depression, anxiety, and stress, respectively than non-vaccinated people. People with complete compliance had 64% (OR= 0.36; 95%CI:0.18-0.72), 71% (OR=0.29; 95%CI:0.15-0.58), and 74% (OR=0.26; 95%CI:0.13-0.50) lower risk of suffering from depression, anxiety, and stress, respectively, than respondents with irregular preventive behaviors.

Conclusion: This study documents the important psychological benefits of vaccination and compliance with preventive measures of COVID-19.

Keywords: Vaccination, Mental health, Anxiety, COVID-19, Depression, Preventive measures, Stress, Bangladesh.

1. INTRODUCTION

The outbreak of the novel coronavirus 2019 (COVID-19) in China in late 2019 has emerged as a major public health problem all over the world. Millions of people around the world have been infected and died due to recurring waves of different variants of COVID-19, and it has affected all spheres of the lives of billions of people worldwide. The critical illness manifested by COVID-19 includes acute respiratory distress syndrome (ARDS), cardiovascular disorders, multiple organ failure, septic shock, and death [1]. Studies have shown that the pandemic created new stressors including fear of infections, frustration, anxiety, stress, sleeping disorder, boredom, inadequate, financial loss, and stigma [2-6].

The emergence of the global pandemic coupled with a high transmission rate and mortality has created a state of emergency worldwide. At the beginning of the pandemic there was no vaccine and effective treatment for COVID-19 infection. Therefore, for controlling the rapid transmission of the disease, many non-clinical interventions were suggested by the World Health Organization (WHO) such as social distancing, cleanliness, regular hand washing, use of face masks in public, lock-down, restriction on travel, closure of

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local and international flights, bans on large gatherings, social distancing, shutdown of educational institutions, stay-at-home orders, and even curfews [7-11]. Simultaneously, the overburden of information, rumors, and misinformation further irritate the general population's mental health status [12]. Stress, anxiety, fear, sorrow, and loneliness have made the situation more difficult and people become more addicted to alcohol or drug use as the coping mechanisms to reduce pandemic anxiety and stress [13-16].

The pandemic and its controlling measures also increased many social problems. Studies have shown that during COVID-19 pandemic, domestic abuse, aggressions, hate crimes, verbal attacks, and violence against ethnic minorities has increased in many societies [17,18]. The changes in lifestyles such as exercise, nutrition, smoking, sleep, and screening time contributed to the change in COVID-19 risk distribution besides the practice of social distancing, mask-wearing, and alcohol use [19-22]. Nonetheless, some studies have indicated that better compliance with precautionary public health measures is linked with reduced anxiety and stress levels [23, 24].

By the end of 2020, a series of vaccines have been developed successfully and prescribed for use all over the world. Over 287 potential vaccines were developed and more than 100 clinical trials were reported [25, 26]. Even though vaccination against COVID-19 is a major public health measure for preventing the spread of the virus, recent reviews have reported high rates of vaccine hesitancy in different populations [27-29].

There is a consistent body of evidence supporting the efficacy of COVID-19 vaccines and good compliance with preventive measures in preventing infection, serious illness, and death [30-32]. Few recent studies documented that in addition to preventing infection, vaccination significantly improves mental health status [33-35]. On the contrary, one recent study on employees in Japan observed no significant association between vaccination and mental Health [36]. Thus, there is still a gap in information on whether vaccination and compliance with preventive measures improve mental health status by reducing COVID-19 related anticipatory fears. To fill this gap, in this study an attempt has been made to examine the potential role of vaccinations and preventive behaviors on mental health using data from Bangladesh. Thus the aim of this study is to examine the levels and determinants of vaccination, compliance with preventive measures, and depression, anxiety and stress, as well as to examine the association between vaccination and compliance with preventive measures and mental health status among Bangladeshi adults.

2. MATERIALS AND METHODS

2.1. Study Design

A cross-sectional study was conducted among the adult people of Bangladesh through a web-based online survey. The survey was conducted during November and December 2021. Adults with various occupations such as health professionals, teachers, students, employees, and self-employed were the participants in this study. A complete response from 615 respondents was received, of whom 425 were vaccinated with at least one dose of the COVID-19 vaccine and 190 were non-vaccinated.

2.2. Data Collection Methods

To circulate our online questionnaire, we used the most popular social media platforms, including Facebook, WhatsApp, and e-mails. Respondents living in Bangladesh at the time of survey, and were 18 years old or older at the time of data collection were considered to be eligible for inclusion in the study. An information sheet and a consent form were available on the first page of the questionnaire. On receiving and clicking the link the participants got auto-directed to the information about the study and informed consent. After they accepted to take the survey, they filled up the questionnaire. Participats were free to withdraw from the survey at any time without giving explanations and no personal identification was requested so as to retain information confidentiality. This study was conducted online in accordance with the Helsinki Declaration on Human Subjects Research.

Our questionnaire included questions on socioeconomic and demographic variables such as age, gender, employment status, smoking status, disease status, and vaccination status. The questionnaire also included questions on beliefs about vaccine effectiveness, family members and colleagues' vaccination status, and compliance with preventive measures such as washing hands, wearing mask, avoiding gatherings, workouts, etc. The compliance levels with preventive measures were assessed using a 6-item question, each with responses of never, sometimes, and always. A score of 1 was assigned for a response always and 0 otherwise.

The Depression, Anxiety, and Stress scale 21 (DASS-21) were used to collect data on the mental

health status of the participants. DASS-21 is a compilation of three self-report measures designed specially to assess depression, anxiety, and emotional stress states, which are frequently used in clinical and non-clinical samples [37-39]. Each of the three subscales of mental health status (depression, anxiety and stress) contained 7 items/questions, measured by a 4-point scale (0 = never, 1 = sometimes, 2 = often, and 3 = almost always). The score for each of the subscales was summed up and then categorized as "normal", "mild", "moderate", and "severe" according to the DASS manual [37].

2.3. Statistical Analysis

Vaccination, compliance with preventive measures, and mental health status were considered outcome variables, while socioeconomic and demographic characteristics of the respondents were considered explanatory variables. Descriptive statistics were used to describe the level of vaccination, compliance with preventive measures, and mental health status. The Chi-square test was used to analyze the differentials of the prevalence of vaccination, compliance with preventive measures, depression, anxiety, and stress across the socio-demographic and COVID-19-related factors. To identify the significant predictors of vaccination, compliance with preventive measures, depression, anxiety, and stress, multiple logistic regression techniques were employed. Depression, anxiety, and stress levels were dichotomized as normal (coding as 0) and mild-severe (coding as 1).

3. RESULTS

The prevalence of vaccination and the adjusted odds ratios (AOR) of vaccination with 95% CI according to socio-demographic characteristics were presented in Table **1**. Overall, more than two-thirds (69%) of the respondents were reported to be vaccinated. Bivariate analysis indicates that age, employment status, gender, disease status, beliefs in vaccine efficacy, family members' vaccination status, and colleagues' vaccination status have a significant differential effect on the prevalence of vaccination.

Results of multiple logistic regression analysis indicate that the prevalence of vaccination increases with age. Respondents aged 60 or more had 2.5 times higher odds of vaccination than the respondents with age 18-29 years (AOR=2.54; 95% CI: 1.28 - 5.24, p <0.001). Health professionals and government service holders were more likely to be vaccinated, while students were the least vaccinated. Males were more likely to be vaccinated than females (73% vs 65%), but after adjusting for other factors the difference appeared to be insignificant. The vaccination rate appeared to be higher among adults suffering from single or multiple diseases. Logistic regression identified disease status as a significant predictor of vaccination as respondents with multiple diseases had 1.3 times higher odds of vaccination (AOR=1.30, 95% CI: 1.30 1.11 - 2.55, p<0.001). Respondents with colleagues not vaccinated had a 99.6% lower risk of being vaccinated (AOR=0.004, 95% CI: 0.001 -0.016, p<0.001).

More than eighty percent (87%) of the respondents reported that vaccines have moderate to high efficacy in preventing infection. Figure **1** also showed that among those who have been vaccinated, 59 percent have a strong faith in the efficacy of vaccination, 31 percent have moderate confidence, and 10 percent have a low belief. On the other hand, 25 percent of non-vaccinated people have a firm belief in vaccination, while 63 percent have a moderate belief.

The percentage of respondents according to the level of compliance with different preventive measures are presented in Figure **2**. The results indicate that most of the respondents reported that they always used to wash their hands when they get back home (93%) and 91% reported that they always wear a mask to protect themselves from COVID-19. However, complete compliance with other types of preventive measures was poor among the respondents. For example, 36.42% of the respondent reported that they keep social distance always, while 28.46% reported that they always stay away from public gathering, and only 13% reported that they always eat healthy food. The majority of the respondent reported infrequent compliance about staying away from public gatherings (66%) and eating healthy food (62.4%).

The factors that influence strong compliance with preventive measures were reported in Table **2**. Bankers have the highest level of strong compliance (91%), followed by health professionals (88%), and teachers (87%). Compliance level was found to be very poor among the students (17%). Participants with multiple diseases have a higher level of compliance with preventive measures (85%) than the respondents with no diseases (68.8%). The last two columns of Table **2** show the results of multiple logistic regression analysis of strong compliance with preventive measures. According to the findings, respondents aged 30-44 years had 8.38 times higher odds of strong compliance with preventive measures than their

Table 1: Prevalence of Vaccination according to Socio-Demographic Characteristics, and Factors Associated with Vaccination

Variables	Vaccination status		p-value	Logistic regression analysis of vaccination	
	Vaccinated n (%)	Not-vaccinated n (%)			
Total	425 (69.11)	190 (30.89)		AOR (95% CI)	p-value
Age group					
18-29 (ref)	41.3	58.7	<0.001	1.00	
30-44	66.4	33.6		1.69 (1.12, 3.24)	0.007
45-59	93.7	6.3		1.94 (1.22, 4.56)	<0.001
60 or more	100	0		2.54 (1.28, 5.24)	<0.001
Employment Status					
Health professionals (ref)	100	0	<0.001	1.00	
Govt. services	71	29		1.01 (1.03, 2.14)	0.049
Teacher	43.4	56.6		0.94 (0.96, 2.07)	0.054
Student	28.3	71.7		0.89 (0.42, 1.87)	0.235
Banker	88.8	11.3		0.98 (0.48, 1.98)	0.315
Self-employed	29.6	70.4		0.84 (1.01, 1.99)	0.047
Gender					
Male (ref)	73.2	26.8	0.029	1.00	
Female	65	35		0.90 (0.31, 2.60)	0.851
Disease status					
No disease (ref)	63.2	36.8	<0.001	1.00	
Single disease	69.4	30.6		1.04 (0.12, 1.40)	0.154
Multiple diseases	82.6	17.4		1.30 (1.11, 2.55)	<0.001
Beliefs in the vaccine's efficacy					
Low (ref)	43.8	56.3	<0.001	1.00	
Moderate	58.8	41.2		1.05 (0.42, 2.18)	0.358
High	85.3	14.7		1.27 (0.71, 2.65)	0.154
Family member vaccinated					
Yes (ref)	86	14	<0.001	1.00	
No	40.4	59.6		0.71 (0.27, 1.92)	0.506
Colleagues vaccinated					
Yes (ref)	94.1	5.9	<0.001	1.00	
No	14.1	85.9		0.004 (0.001, 0.016)	<0.001

younger counterparts aged 18 – 29 years (AOR=8.38, 95% CI: 3.79 - 18.53, p<0.001). When compared to health professionals, other occupations have lower levels of compliance with preventive behavior. Respondents with multiple diseases had a 1.4 times higher likelihood of strong compliance with preventive measures compared to respondents with no disease (AOR= 1.41, 95% CI: 1.08 -3.79, p=0.008).

Table **3** presents the prevalence of depression, anxiety, and stress. Among the respondents, 56 % suffer from mild-to-severe depression, 63 % from anxiety, and 50 % from mild-severe stress. Table **4** shows the results of multiple logistic regression analysis for mild to severe depression, anxiety, and stress, considering vaccination status, compliance with preventive measures, and other socio-demographic variables as explanatory variables. Vaccinated people had a 55%, 67%, and 44% lower chance of suffering from depression (AOR=0.45, 95% CI:0.26 – 0.82), anxiety (AOR=0.33, 0.12 – 0.91), and stress

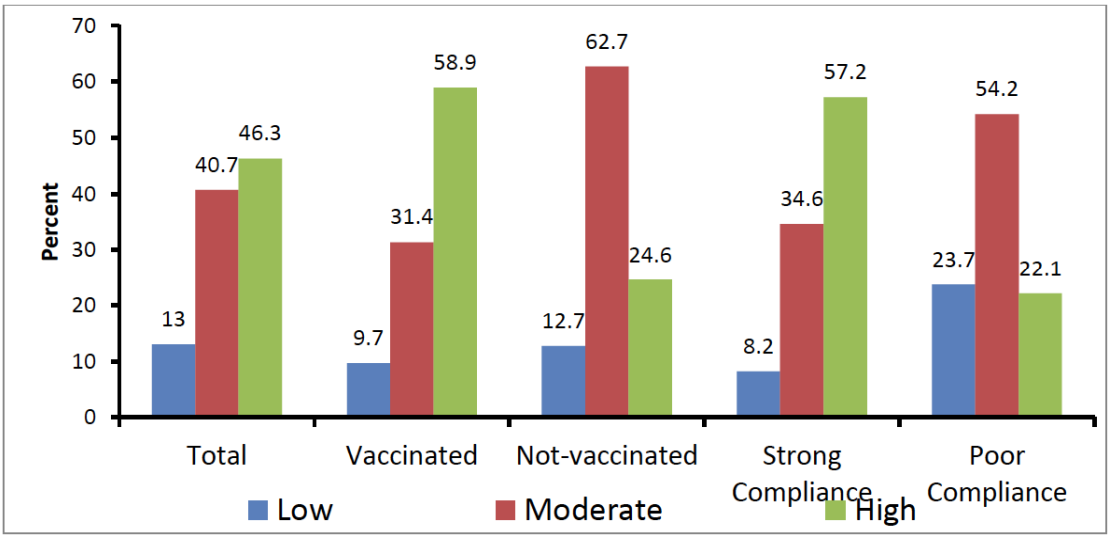

Figure 1: Beliefs in vaccine's efficacy by vaccination status and level of compliance with preventive measures.

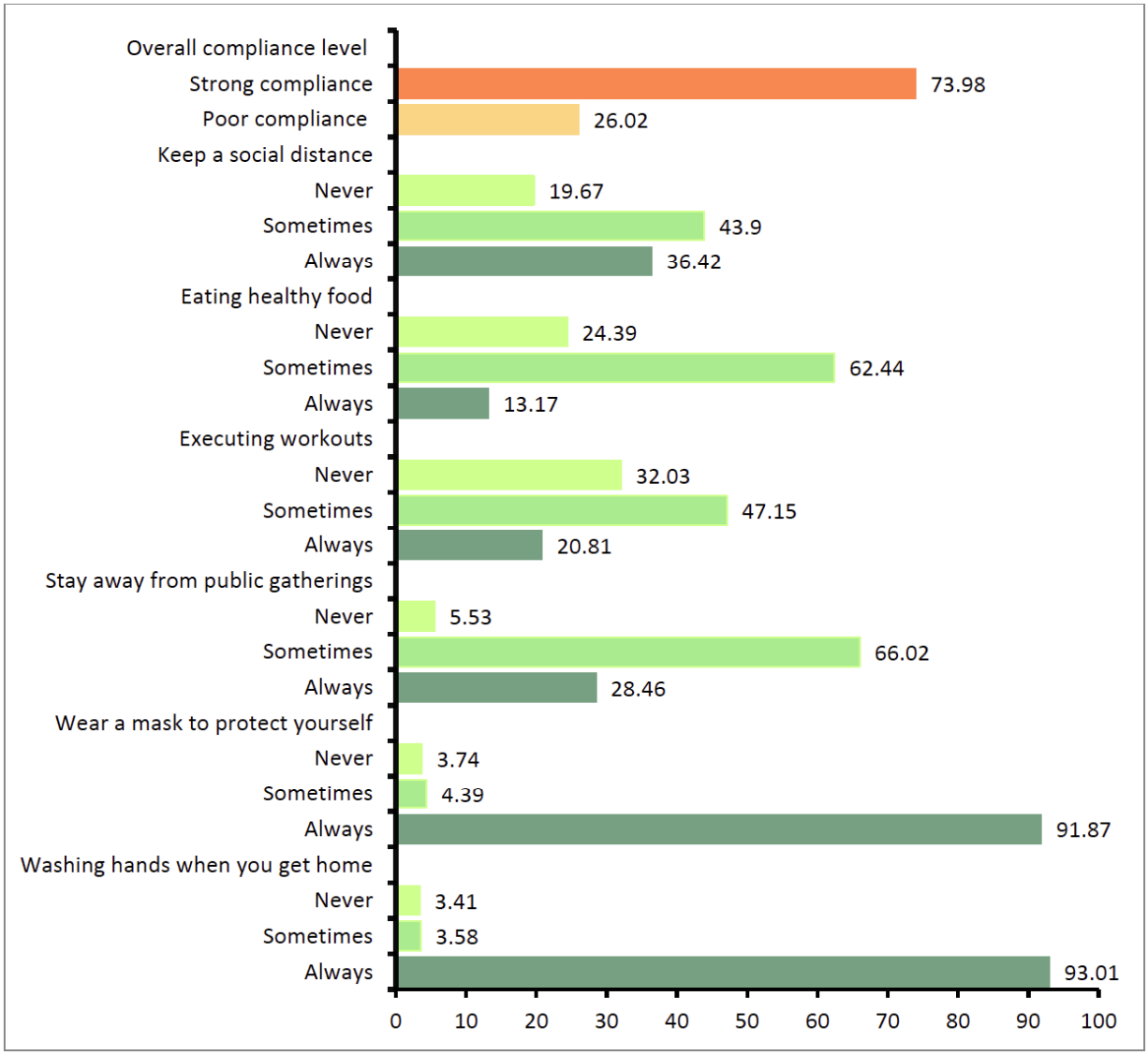

Figure 2: Percentage distribution of respondents according to the level of compliance with different preventive measures.

Table 2: Factors Affecting Compliance with Preventive Measures

Variables	Compliance with preventive measures			Logistic regression analysis of strong compliance with preventive measure	
	Strong	poor	p-value		
Total	74.0	26.0		AOR (95% CI)	p-value
Age group					
18-29 (ref)	44.6	55.4	<0.001	1.00	
30-44	68.6	31.4		8.38 (3.79, 18.53)	<0.001
45-59	71	29		2.10 (1.01, 4.36)	0.046
60 or more	81.8	18.2		12.67 (2.09, 76.84)	0.006
Employment Status					
Health professionals (ref)	88.3	11.7	<0.001	1.00	
Govt. services	66.7	33.3		0.26 (0.12, 0.57)	0.001
Teacher	86.7	13.3		0.80 (0.33, 1.93)	0.618
Student	17	83		0.03 (0.007, 0.085)	<.001
Banker	91.3	8.8		1.22 (0.46, 3.24)	0.688
Self-employed	73.5	26.5		0.32 (0.13, 0.82)	0.018
Gender					
Male (ref)	73.2	26.8	0.660		
Female	74.8	25.2			
Smoking status					
Yes (ref)	77.3	22.7	0.357		
No	73.2	26.8			
Disease status					
No disease (ref)	68.8	31.2	0.002	1.00	
Single disease	82.4	17.6		1.08 (0.62, 1.88)	0.775
Multiple diseases	85.1	14.9		1.41 (1.08, 3.79)	0.008
Beliefs in the vaccine's efficacy					
Low (ref)	71.3	28.7	0.001	1.00	
Moderate	66.8	33.2		0.84 (0.39, 1.80)	0.660
High	81.1	18.9		0.64 (0.25, 1.63)	0.354
Family member vaccinated					
Yes (ref)	73.1	26.9	0.528		
No	75.4	24.6			
Colleagues vaccinate					
Yes (ref)	74.7	25.3	0.545		
No	72.4	27.6			

(AOR=0.56, 95%CI: 0.27 – 0.97), respectively than non-vaccinated people. In terms of compliance with preventive measures, respondents having strong compliance with preventive measures had a 64%, 71%, and 74% lower risk of suffering from depression (AOR= 0.36, 95% CI:0.18 - 0.72), anxiety (AOR=0.29, 95% CI: 0.15 - 0.58), and stress (AOR=0.26, 95% CI: 0.13 - 0.50), respectively than the respondents with poor compliance.

4. DISCUSSIONS

The invention of the SARS-CoV-2 vaccine is a massive international scientific and political initiative

Table 3: Prevalence of Depression, Anxiety, and Stress

Level	Depression		Anxiety		Stress	
	Number	%	Number	%	Number	%
Normal	272	44.23	230	37.40	310	50.41
Mild	208	33.82	203	33.01	93	15.12
Moderate	119	19.35	130	21.14	85	13.82
Severe	16	2.60	52	8.46	127	20.65
Total	615	100.00	615	100.00	615	100.00
Mild-to-severe	343	55.77	385	62.60	305	49.59

Table 4: Multiple Logistic Regression Analysis Showing the Adjusted Odds Ratios (AORs) of the Mild-to-Severe Level of Depression, Anxiety, and Stress with a 95% Confidence Interval (95% CI)

Factors	Depression	Anxiety (CI)	Stress (CI)
	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)
Vaccination status			
Not-vaccinated (ref)	1.00	1.00	1.00
Vaccinated	0.45 (0.26, 0.82)	0.33 (0.12, 0.91)	0.56 (0.27, 0.97)
Compliance with preventive measures			
Poor compliance (ref)	1.00	1.00	1.00
Strong compliance	0.36 (0.18, 0.72)	0.29 (0.15, 0.58)	0.26 (0.13, 0.50)
Age group			
18-29 (ref)	1.00	1.00	1.00
30-44	0.29 (0.12, 0.73)	0.80 (0.33, 1.93)	0.26 (0.09, 0.79)
45-59	0.50 (0.18, 1.35)	1.13 (0.44, 2.86)	0.44 (0.15, 1.32)
60 or more	0.03 (0.003, 0.292)	1.94 (0.28, 13.57)	1.39 (0.16, 11.79)
Employment Status			
Health professionals (ref)	1.00	1.00	1.00
Govt. services	0.10 (0.03, 0.30)	0.09 (0.03, 0.25)	1.05 (0.38, 2.85)
Teacher	0.25 (0.08, 0.77)	0.53 (0.21, 1.37)	1.56 (0.95, 2.77)
Student	0.43 (0.08, 2.28)	0.63 (0.36, 1.41)	0.87 (0.68, 2.28)
Banker	0.23 (0.09, 0.58)	0.67 (0.32, 1.40)	3.24 (1.36, 7.72)
Self-employed	0.13 (0.04, 0.45)	0.33 (0.10, 1.02)	0.17 (0.04, 0.86)
Gender			
Male (ref)	1.00	1.00	1.00
Female	1.87 (0.95, 3.66)	2.18 (1.21, 3.92)	0.91 (0.49, 1.69)
Smoking status			
Yes (ref)	1.00	1.00	1.00
No	0.41 (0.19, 0.89)	0.42 (0.21, 0.84)	1.68 (0.75, 3.80)
Disease status			
No disease (ref)	1.00	1.00	1.00
Single disease	1.48 (0.83, 2.64)	1.99 (1.18, 3.35)	2.63 (1.39, 4.97)
Multiple diseases	5.15 (3.24, 16.02)	8.38 (2.98, 23.56)	5.32 (2.07, 13.68)

(Table 4). Continued.

Factors	Depression	Anxiety (CI)	Stress (CI)
	AOR (95%CI)	**AOR (95%CI)**	**AOR (95%CI)**
Beliefs in the vaccine's efficacy			
Low (ref)	1.00	1.00	1.00
Moderate	0.80 (0.28, 2.25)	0.57 (0.20, 1.59)	0.36 (0.12, 1.04)
High	0.41 (0.13, 1.27)	0.70 (0.24, 2.05)	0.96 (0.30, 3.06)
Family member vaccinated			
Yes (ref)	1.00	1.00	1.00
No	1.59 (0.76, 3.36)	2.05 (1.06, 3.98)	1.38 (0.67, 2.86)
Colleagues vaccinate			
Yes (ref)	1.00	1.00	1.00
No	3.37 (1.21, 9.42)	3.15 (1.08, 9.18)	1.81 (0.60, 5.46)

The confidence interval (CI) is displayed in parenthesis.

[40]. This article investigated the most recent SARS-CoV-2 vaccination status in Bangladesh, as well as its relationship to various sociodemographic factors, mental health issues, and level of compliance with preventive measures. The results indicate a strong association between COVID-19 vaccination and mental health outcomes. When compared to non-vaccinated people, vaccinated people were less prone to suffer from depression, anxiety, and stress. The findings were consistent with the findings of recent studies that vaccination boosts mental health along with the direct benefits of reducing COVID-19 infection risk [34, 35, 41].

The findings of this study specified that even after receiving the COVID vaccine, healthcare workers suffered a high level of stress, anxiety, and depression during the COVID-19 pandemic. Studies conducted in the past have shown that health workers are at greater risk of acquiring adverse psychological effects, particularly those employed in emergency departments, intensive care groups, and communicable disease wards [42-44].

The prevalence of depression, anxiety, and stress were found to be higher among the people with teaching profession, and lower with the students. However, this finding contradicts the findings of other studies reporting a higher prevalence of depression, anxiety, and stress among students [45-48]. Respondents having at least one disease had a higher risk of depression, anxiety, and stress than those who did not have any disease. Previous studies found that COVID-19 infection and related death were associated with age and having multiple diseases for example diabetes; severe asthma; and various other medical conditions [49].

This study demonstrates that an overwhelming majority (87%) of the respondents believe that the vaccianes are highly effective in preventing COVID-19 infection. Our findings also indicate that a strong belief in the efficacy of vaccines also boosts complete compliance with preventive measures for COVID-19 which was supported by the study where personal beliefs had a significant and robust effect on the practice of complete compliance with preventive measures of COVID-19 [50].

This study documented a quite high rate of complete compliance with most of the preventive measures for COVID-19. About 90% of respondents reported that they wear musk and wash their hands always during the COVID-19 pandemic. However, compliance with social distancing was relatively low (36%). This may reflect that individuals' capacity to socially distance is constrained by the behavior of others and the environment (for instance, high population density). Overall, 74% of the adults in Bangladesh had strong compliance behavior. A study in China reported that up to 71% of the participants 'embraced protective behaviors' [22], whereas Cori *et al*. [51] stated that although some people adhere to the regulations, 'others ignore or delay adhering to the government's restrictions.

According to the findings related to compliance with preventive measures and mental health issues, individuals having strong compliance with preventive measures were found to be less likely to suffer from

depression, anxiety, and stress. Our findings are in line with the findings of previous studies [34, 35, 52].

The study is not free from limitations. As the data was collected through an online survey, which usually involved coverage problems (many potential respondents do not have easy access to the internet or many declined to participate in the survey) and lack of proper sampling design, resulting in sampling bias, and thus could limit the representativeness of the study findings. Another limitation is the subjectivity of the respondents in providing information about mental health through a self-administered questionnaire. This study did not cover many important socio-demographic variables such as level of education, types of family, income, and marital status, which may help determine relationships between outcomes. Despite these shortcomings, our findings deliver important evidence regarding vaccination status, the beliefs and physiological effects related to vaccines, and their association with mental health concerns.

5. CONCLUSION

The purpose of this research was to investigate the impact of vaccination, and preventive behaviors on mental health in Bangladesh, as well as people's perceptions of its efficacy. The findings of this study strongly support that vaccination and complete compliance with preventive measures improve mental health status. Vaccinated people had a 55%, 67%, and 46% lower chance of suffering from depression, anxiety, and stress, respectively than non-vaccinated people. In terms of preventive behavior compliance, respondents who engage in always preventive behavior have a 64%, 71%, and 74% lower risk of suffering from depression, anxiety, and stress, respectively, than respondents who engage in sometimes/never preventive behaviors. The majority of people who were vaccinated had a high belief in vaccine effectiveness. Special attention should be given to those identified sub-groups of adults who were at high risk of psychological distress, and to those not vaccinated and less likely to comply with the preventive measures of COVID-19. In the context of our findings, it is recommended that Bangladesh's government should extend COVID vaccine coverage to the entire population to prevent them from any further mental illness.

ETHICS AND CONSENT TO PARTICIPATE

All the participants willingly participated by giving their consent. The survey invitation indicated explicitly that participants had the option of declining to participate in the survey. The participants were told that their names and any other identifying information would remain anonymous. This study was conducted entirely online following the Helsinki Declaration on Human Subjects Research.

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CONFLICT INTEREST

The authors declare that they have no competing interests.

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