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Psychological benefits of the COVID-19 vaccination: A Bangladeshi comparative study

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Abstract

Background and Aims: Despite evidence that COVID-19 vaccination can strengthen mental health, there is limited evidence about this in Bangladesh. Thus, this comparative study assessed the prevalence and factors associated with mental health problems between vaccine receivers and nonreceivers.

Methods: Using a snowball sampling technique, a web-based cross-sectional study was conducted among a total of 459 participants. The survey questionnaire included sociodemographic information, the Patient Health Questionnaire (PHQ—9), the Generalized Anxiety Disorder (GAD—7), and the Trauma Screening Questionnaire (TSQ—10).

Results: The study found that mental health problems were nonsignificantly prevalent in the vaccine nonreceivers than those who received it (i.e., 24.79% vs. 20.60% for depression, 21.20% vs. 16.60% for anxiety, and 15.30% vs. 12.60% for posttraumatic stress disorder). Female gender, chronic condition, smoking status, and alcohol consumption were the risk factors for mental health problems.

Conclusion: This study's findings suggest that the COVID-19 vaccination necessarily improves mental health outcomes. However, the study had limitations in terms of its design and sampling technique, and further research is needed to establish a cause-effect relationship between vaccination and mental health problems.

KEYWORDS
anxiety, COVID-19, depression, mental health, PTSD, vaccine

1 | INTRODUCTION

After the COVID-19 pandemic, the world has been pressured by its deleterious outcomes, including the collapse of the healthcare system, massive infection with the virus, and uncertainty about returning to normal lives. To tackle this emergency situation, several nonpharmacological measures, such as quarantine, lockdown, and closure of public places, have been implemented in Bangladesh.[1] However, vaccination can help to get back to normal lives. It has been said that two-thirds of individuals need to be vaccinated to grow herd immunity which can halt virus transmission.[2] On February 7, 2021, the COVID-19 vaccination was inaugurated in Bangladesh, and as of

August 2022, the first dose has been shotted more than 130 million individuals, whereas over 120 and 40 million people had a second dose and booster dose, respectively.[3]

The evidence supports SARS-CoV-2 vaccination for preventing long COVID–19 and recommends adherence to vaccination schedules for long COVID– patients.[4] Certain factors, such as being students in informal relationships, having mental work experience, previous psychological or psychiatric services, and medical studies, increase the willingness to vaccinate, while cultural differences contribute to vaccine hesitancy.[5] Healthcare workers are highly willing to vaccinate (over 95%), driven by their perception of the pandemic's severity, confidence in the vaccine's safety, fewer financial concerns, reduced stigma, pro-social mindset, and trust in health authorities.[6] People with depression or anxiety are significantly more willing to pay for the COVID-19 vaccine compared to healthy controls (64.5% vs. 38.1%).[7] Among pregnant women, 60.4% accept the vaccine, with 82.6% willing to pay for it. Safety concerns (66.9%) and a perceived low preventive effect (45.2%) are common reasons for vaccine refusal.[8] Addressing the inconsistency between high acceptance and low willingness to pay is crucial for effective and sustainable COVID-19 vaccination programs, requiring vaccine information, public trust, and collaboration with health professionals through social media and social listening.[9]

Evidence suggests that people with mental health problems are at higher risk of infection with COVID-19 and its severe complications, which can finally lead to a higher mortality rate than non-COVID-19-infected individuals.[10] Achieving mass COVID-19 vaccination means reducing the number of cases and unwanted deaths, which also can intensify people's psychological well-being by terminating worry, fear, and insecurity related to the COVID-19 pandemic. In the United States, those states scheduled for later vaccination reported greater COVID-19-related worry and other psychological impacts.[11] Similarly, a study conducted in Peru reported a 3.7 times lower risk of COVID-19 fear among those participants with two doses of vaccination than those unvaccinated. After a month of follow-up, it was reported that vaccination could help to reduce fear of and worry about COVID-19 and general anxiety.[12] In a study conducted in Pakistan with a sample of dental patients, 54.0% reported not suffering from COVID-19-like symptoms, and 25.0% thought that the environment of a dental clinic was the source of a high risk of infection of the virus. However, after the vaccination of the patients, a decrease in dental anxiety scores was found.[13] In another study conducted in Hong Kong, adult residents reported low levels of mental health problems after the COVID-19 vaccination.[14] About 13% and 17% lower odds of anxiety and depression, respectively, were found in those participants who received the COVID-19 vaccine than those who did not, as per a study conducted in the United States.[15] Thus, it can be said that vaccination can strengthen the state of mental health.

In Bangladesh, studies on mental health status were conducted before the availability of the COVID-19 vaccines, and those studies focused on the impact of the pandemic.[1] But it is not well-known what is the mental health status of the Bangladeshi people after the

inauguration of the COVID-19 vaccination as a very limited number of studies were conducted. For instance, lower levels of psychiatric problems were found among the Bangladeshi healthcare professionals who received COVID-19 vaccination than the nonvaccinated healthcare professionals (i.e., 16.7% vs. 59.1% for general health problems, 15.6% vs. 31.9% for depression, 22.3% vs. 30.8% for posttraumatic stress disorder [PTSD], and 13.9% vs. 21.8% for loneliness symptoms).[16] In another study, 51.5% of the general population who did not receive a vaccine had psychological distress, and it was 36.4% for those who received it; whereas 37.9% versus 21.2% had depression, 4.9% versus 25.1% had anxiety, 39.4% versus 19.4% had stress, 38.2% versus 29.4% had PTSD compared to those who did not receive COVID-19 vaccination.[17] Those two studies were conducted using the short version of the scales to assess mental health conditions, where most symptoms of a particular problem were not possibly considered. In this study, therefore, the prevalence of mental health problems using established full-version tools among general people with respect to their vaccination status was investigated to fulfill the knowledge gap in the country.

2 | METHODS

2.1 | Study design, settings, and procedure

A web-based cross-sectional study was conducted from November 15, 2021, to January 2, 2022. These data were collected using a snowball sampling technique. Initially, the participants were requested to fill-up the questionnaire and then circulate the questionnaire link to their friend circle using social media platforms such as Facebook and WhatsApp. The inclusion criteria were being a Bangladeshi resident and aged over 18 years.

$$n = \frac{Z^2 p(1-p)}{d^2}.$$

For assessing sample size, the abovementioned formula was used. Considering the prevalence of depression among general Bangladeshi people as estimated by a previous study,[17] the sample size was calculated to be 257 (where $p = 21.2\%$, $Z = 1.96$, $d = 5\%$), while given the assumption of a 10% nonresponse rate, the final sample size was estimated to be 283. However, a total of 459 data was collected, including vaccinated and non-vaccinated participants (where 374 were vaccinated participants).

2.2 | Measures

2.2.1 | Sociodemographic information

Sociodemographic information related to age, gender (male and female), educational status (secondary vs. tertiary), occupation (student vs. nonstudent who belonged to other occupations), current residence (urban vs. rural), and marital status (married vs. unmarried)

was included in the study. In addition, information related to smoking status, alcohol consumption, and chronic medical condition (i.e., diabetes, hypertension, cardiovascular problems, asthma, kidney disease, and others not listed here) were also included with a binary (yes/no) response.

2.2.2 | Depression

The nine-item Patient Health Questionnaire-9 (PHQ-9) was used to assess depression.[18] Items (e.g., "Little interest or pleasure in doing things?") are rated on a four-point scale from 0 (*not at all*) to 3 (*more than half of the days*). Total scores range from 0 to 27, with higher scores indicating greater depression. Severity of depression was measured as scoring from 0 to 4 = *none*, 5–9 = *mild*, 10–14 = *moderate*, 15–19 = *moderately severe*, and 20–27 = *severe*. A cutoff of 10 was used to detect the presence of depression in the present study.[18] Cronbach's α was 0.84 in the present study.

2.2.3 | Anxiety

The seven-item Generalized Anxiety Disorder (GAD-7) was used to assess anxiety.[19] Items (e.g., "Being able to stop or control worrying") are rated on a four-point scale from 0 (not at all) to 3 (more than half of the days). The total score ranges from 0 to 21, where a higher score indicating greater anxiety. Severity of anxiety was measured as scoring from 0 to 4 = *none*, 5–9 = *mild*, 10–14 = *moderate*, 15–21 = *severe*. A cutoff of 10 was used to detect the presence of anxiety in the present study.[19] Cronbach's α was 0.77 in the present study.

2.2.4 | PTSD

The 10-item Trauma Screening Questionnaire was used to assess PTSD symptomology.[20] Example items include questions like "Difficulty falling or staying asleep" and "Upsetting thoughts or memories about the event that have come into your mind against your will." Based on the past weeks, items are rated using a binary response (yes/no). The score ranges from 0 to 10, whereas a higher score indicates higher symptoms of PTSD. A cutoff score of 6 was used to detect the presence of PTSD.[20] Cronbach's α was 0.82 in the present study.

2.3 | Statistical analysis

These data were collected using *Google Forms* and then converted to an SPSS file for final analysis using SPSS Software version 25. Descriptive statistics such as frequency and percentages were reported for the categorical variables. The χ^2 test was used to estimate the association between the dependent variables (i.e.,

depression, anxiety, and PTSD) and the study variables in terms of vaccination status. Participant distribution with respect to vaccination status was examined, considering whether participants who were vaccinated had a single dose of the COVID-19 vaccine. A logistic regression analysis was used to identify the associated factors of depression, anxiety, and PTSD, considering the significant variables in univariate analysis. The statistical significance for a two-sided test was set at $p < 0.05$.

3 | RESULTS

3.1 | Description of the participants

A total of 459 data were analyzed for this study. The mean age of the respondents was 24.28 ± 4.85 years (age range: 18–61). Most of them were male (54.0%), belonged to tertiary education (91.9%), were a student in occupation (68.0%), lived in an urban area (86.3%), and were unmarried (75.4%). Of the participants, 10.9% reported being smokers, 2% consumed alcohol, and 28.3% suffered from chronic diseases. About 81.5% of participants received at least a single dose of COVID-19 vaccines. However, a detailed description of the sociodemographic information with respect to vaccination status was presented in Table 1.

3.2 | Prevalence of mental health problems

About 21.4% of the participants reported suffering from depression in the total sample, whereas depression was prevalent among the nonvaccinated participants compared to those who were vaccinated (24.70% vs. 20.60%; $\chi^2 = 0.699$, $p = 0.403$). Similarly, the prevalence of anxiety was 17.4% in the total sample, but higher anxiety was found among the vaccine nonreceivers (21.20% vs. 16.60%; $\chi^2 = 1.018$, $p = 0.313$). In addition, a 13.1% prevalence of PTSD was reported in the total sample, whereas PTSD was more prevalently reported among the nonvaccinated group than in the vaccinated group (15.30% vs. 12.60%; $\chi^2 = 0.453$, $p = 0.501$) (Figure 1). Only depression in the severity-based distribution of mental health problems by comparing vaccination status was reported to differ significantly ($\chi^2 = 10.433$, $p = 0.034$).

3.2.1 | Associations between the study variables and depression

Of the sociodemographic variables, gender was significantly associated with depression for both groups. That is, female participants reported being more likely to suffer from depression (25.9% vs. 16.5%; $\chi^2 = 4.98$, $p = 0.026$ for the vaccinated group, and 34.7% vs. 11.1%; $\chi^2 = 6.20$, $p = 0.013$ for the nonvaccinated group). In addition, chronic health status was significantly associated with depression for both groups. That is, participants with a chronic condition were more

Variables	Total; n (%)	Vaccination status Yes; n (%)	No; n (%)	χ^2 (p Value)
Age group				
18–22 year	194 (42.3%)	147 (75.8%)	47 (24.2%)	8.283 (0.016)
23–27 year	189 (41.2%)	159 (84.1%)	30 (15.9%)	
More than 27 years	76 (16.6%)	68 (89.5%)	8 (10.5%)	
Gender				
Male	248 (54.0%)	212 (85.5%)	36 (14.5%)	5.727 (0.017)
Female	211 (46.0%)	162 (76.8%)	49 (23.2%)	
Education level				
Up to secondary	37 (8.1%)	21 (56.8%)	16 (43.2%)	16.304 (<0.001)
Tertiary	422 (91.9%)	353 (83.6%)	69 (16.4%)	
Occupational status				
Nonstudent	147 (32.0%)	127 (86.4%)	20 (13.6%)	3.460 (0.063)
Student	312 (68.0%)	247 (79.2%)	65 (20.8%)	
Residence				
Urban	396 (86.3%)	323 (81.6%)	73 (18.4%)	0.014 (0.907)
Rural	63 (13.7%)	51 (81%)	12 (19%)	
Marital status				
Unmarried	346 (75.4%)	278 (80.3%)	68 (19.7%)	1.199 (0.273)
Married	113 (24.6%)	96 (85%)	17 (15%)	
Smoking status				
Yes	50 (10.9%)	45 (90%)	5 (10%)	2.698 (0.100)
No	409 (89.1%)	329 (80.4%)	80 (19.6%)	
Alcohol consumption				
Yes	9 (2.0%)	8 (88.9%)	1 (11.1%)	0.334 (0.563)
No	450 (98.0%)	366 (81.3%)	84 (18.7%)	
Chronic condition				
No	329 (71.7%)	265 (80.5%)	64 (19.5%)	0.672 (0.412)
Yes	130 (28.3%)	109 (83.8%)	21 (16.2%)	

prone to be depressed than those who were not (31.2% vs. 16.2%; $\chi^2 = 10.58$, $p < 0.001$ for vaccinated participants, and 42.9% vs. 18.8%; $\chi^2 = 4.94$, $p = 0.026$ for nonvaccinated participants) (Table 2).

### 3.2.2 | Associations between the study variables and anxiety

Gender was the only factor significantly associated with anxiety in both groups (i.e., vaccinated and nonvaccinated). About 21.6% of vaccinated females had anxiety, whereas it was 12.7% of male vaccine receivers, which was statistically significant ($\chi^2 = 5.22$, $p = 0.022$). In addition, 30.3% of vaccine receivers who had chronic

diseases were anxious, whereas it was 10.9% of those without chronic conditions ($\chi^2 = 20.871$, $p < 0.001$) (Table 3).

3.2.3 | Associations between the study variables and PTSD

For the nonvaccinated group, only gender had a significant relationship with PTSD; that is, the female gender was reported to have more likely to suffer from PTSD (22.4% vs. 5.6%; $\chi^2 = 4.57$, $p = 0.033$). In the vaccinated group, participants higher age group ($\chi^2 = 17.91$, $p < 0.001$), low education level ($\chi^2 = 13.197$, $p < 0.001$), nonstudent ($\chi^2 = 18.451$, $p < 0.001$), married person ($\chi^2 = 21.34$,

FIGURE 1 Distribution of mental health problems across vaccination status. PTSD, posttraumatic stress disorder.
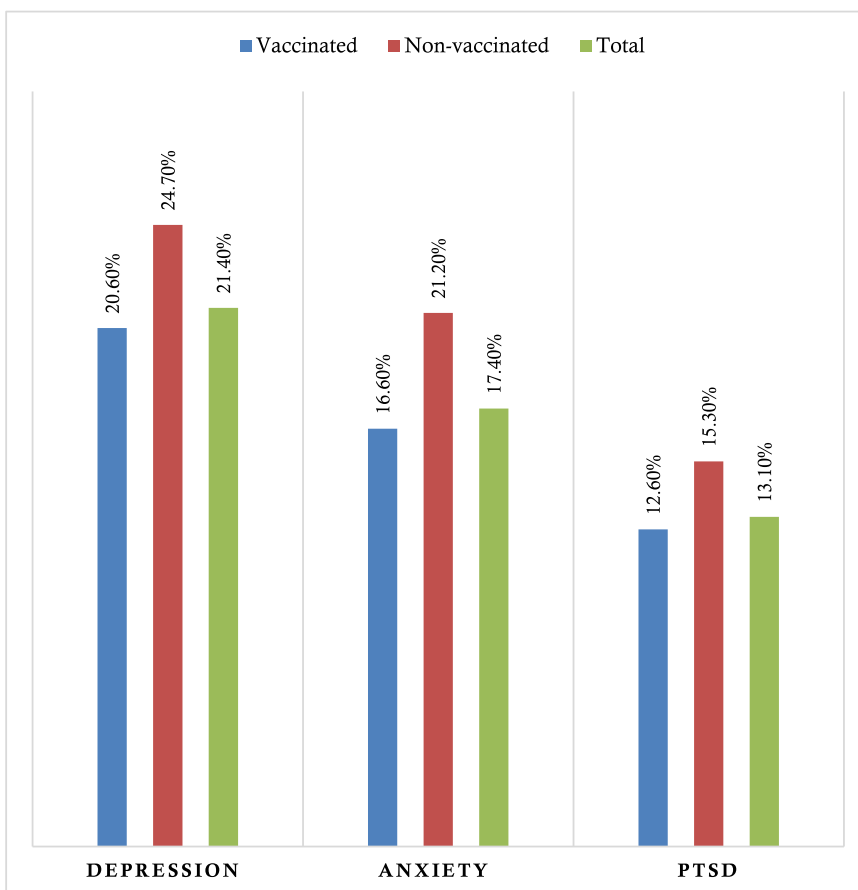
$p < 0.001$), smokers ($\chi^2 = 4.340$, $p = 0.037$), and alcohol consumers ($\chi^2 = 10.425$, $p = 0.001$) had a higher rate of PTSD (Table 4).

3.2.4 | Factors associated with depression, anxiety, and PTSD

The female gender belonging to the nonvaccinated group was at a 4.34-times higher risk of depression than the males (adjusted odds ratio [aOR]: 4.34, 95% confidence interval [CI]: 1.27–14.80, $p = 0.019$). In addition, having a chronic condition increased the risk of suffering from depression by 2.16 and 3.34 times for the vaccinated group (aOR: 2.16, 95% CI: 1.27–3.67, $p = 0.004$), and the nonvaccinated group (aOR: 3.34, 95% CI: 1.08–10.28, $p = 0.035$), respectively. Similarly, a 3.27 times higher risk of anxiety was reported for the vaccinated participants with a chronic disease compared to those who had no such condition (aOR: 3.27, 95% CI: 1.84–5.78, $p < 0.001$) (Table 5). In addition, considering the vaccinated participants, being educated up to secondary school were at 3.24 times higher risk of PTSD than tertiary educated participants (aOR: 3.24, 95% CI: 1.13–9.28, $p = 0.028$). Similarly, being nonstudent (aOR: 2.93, 95% CI: 1.06–8.07, $p = 0.037$), unmarried (aOR: 2.57, 95% CI: 1.08–6.08, $p = 0.031$), and alcohol consumers (aOR: 8.71, 95% CI: 1.71–44.25, $p = 0.009$) increased the odds of PTSD by 2.93, 2.57, and 8.71-times, respectively, compared to their counterpart (Table 6).

4 | DISCUSSION

Vaccination is a crucial tool in stopping the transmission of COVID-19. Due to the combined efforts of the scientists, many vaccines have been developed within a short period of time. At the same time, it is reported that people with a lack of trust, low levels of fear, and misconception were more likely not to be vaccinated.[21] In addition, another study with 35% of the participants having the symptoms of depression or anxiety observed that they were less likely to have the COVID-19 vaccine shoot, but more likely to intend to get a vaccine than those without mental health symptoms.[22] Possible side effects, cost associated with vaccination, disliking vaccine, and lack of trust have accounted for vaccine hesitancy as prevalently to those people with depression or anxiety symptoms.[22] Despite the fact, Bangladeshis are getting vaccinated and it was anticipated that those people are less likely to report psychological problems—but this study did not find statistical differences in mental health problems across two groups (vaccinated or nonvaccinated participants).

In this study, it was found that there is a slightly higher prevalence of mental health problems for those participants who did not receive a COVID-19 vaccine compared to those who received at least a single dose of the vaccine; but such associations were not statistically significant. More specifically, about 25% of nonvaccinated participants had depression, but it was 20.6% for the vaccinated individuals. Similarly, 21.2% and 15.30% prevalence of anxiety and PTSD,

TABLE 2 Relationship of the studied variables with depression across vaccination status.

Variables	Vaccinated participants			Nonvaccinated participants		
	Normal; n (%)	Depressed; n (%)	χ² (p value)	Normal; n (%)	Depressed; n (%)	χ² (p Value)
Age group						
18–22 years	117 (79.6%)	30 (20.4%)	0.114 (0.945)	32 (68.1%)	15 (31.9%)	4.295 (0.117)
23–27 years	127 (79.9%)	32 (20.1%)		24 (80%)	6 (20%)	
>27 years	53 (77.9%)	15 (22.1%)		8 (100%)	-	
Gender						
Male	177 (83.5%)	35 (16.5%)	4.980 (0.026)	32 (88.9%)	4 (11.1%)	6.205 (0.013)
Female	120 (74.1%)	42 (25.9%)		32 (65.3%)	17 (34.7%)	
Education level						
Up to secondary	17 (81%)	4 (19%)	0.032 (0.857)	13 (81.3%)	3 (18.8%)	0.376 (0.540)
Tertiary	280 (79.3%)	73 (20.7%)		51 (73.9%)	18 (26.1%)	
Occupational status						
Nonstudent	100 (78.7%)	27 (21.3%)	0.053 (0.818)	18 (90%)	2 (10%)	3.041 (0.081)
Student	197 (79.8%)	50 (20.2%)		46 (70.8%)	19 (29.2%)	
Residence						
Urban	253 (78.3%)	70 (21.7%)	1.701 (0.192)	54 (74%)	19 (26%)	0.485 (0.486)
Rural	44 (86.3%)	7 (13.7%)		10 (83.3%)	2 (16.7%)	
Marital status						
Unmarried	222 (79.9%)	56 (20.1%)	0.131 (0.718)	51 (75%)	17 (25%)	0.016 (0.900)
Married	75 (78.1%)	21 (21.9%)		13 (76.5%)	4 (23.5%)	
Smoking status						
Yes	34 (75.6%)	11 (24.4%)	0.465 (0.495)	4 (80%)	1 (20%)	0.063 (0.801)
No	263 (79.9%)	66 (20.1%)		60 (75%)	20 (25%)	
Alcohol consumption						
Yes	6 (75%)	2 (25%)	0.097 (0.755)	1 (100%)	-	0.332 (0.564)
No	291 (79.5%)	75 (20.5%)		63 (75%)	21 (25%)	
Chronic condition						
No	222 (83.8%)	43 (16.2%)	10.581 (<0.001)	52 (81.3%)	12 (18.8%)	4.940 (0.026)
Yes	75 (68.8%)	34 (31.2%)		12 (57.1%)	9 (42.9%)	

respectively, were reported for the nonvaccinated individuals, whereas it was 16.6% and 12.6% for those who received the vaccine. Despite the vaccination status, the overall prevalence rates of mental health problems reported in this study (i.e., 21.4% for depression, 17.4% for anxiety, and 13.1% for PTSD) seem very lower than those studies conducted before the COVID-19 vaccine inauguration in Bangladesh. For instance, a meta-analysis estimated the prevalence of mental health problems among nearly 50,000 Bangladeshis from a total of 24 studies; that is, about 47% prevalence for depression was reported, whereas it was 44% and 47% for stress and anxiety.[1] In comparison with the previous studies conducted among the vaccine receivers, 15.6% and 21.2% of depression among healthcare professionals and the general population, respectively, were reported in the country, where 22.3%

and 29.4% prevalence were found for PTSD, respectively; and those rates were higher in those people without vaccination.[16,17] This is a good sign that COVID-19 vaccinated people are out of COVID-19 infection risk in general; at the same time, they are psychologically more stable than nonvaccinated individuals. Vaccine hesitancy and lack of trust in vaccines are associated with lower vaccination rates and increased mental health problems. Therefore, it is important to increase public awareness and education about the importance and safety of COVID-19 vaccines. This can be done through various means, such as public service announcements, social media campaigns, and community outreach programs. Healthcare providers can also play a crucial role in educating patients about vaccines and addressing any concerns or misconceptions.

TABLE 3 Relationship of the studied variables with anxiety across vaccination status.

Variables	Vaccinated participants			Nonvaccinated participants		
	Normal; n (%)	Anxiety; n (%)	χ^2 (p value)	Normal; n (%)	Anxiety; n (%)	χ^2 (p Value)
Age group						
18–22 years	126 (85.7%)	21 (14.3%)	2.041 (0.360)	35 (74.5%)	12 (25.5%)	1.710 (0.425)
23–27 years	133 (83.6%)	26 (16.4%)		26 (86.7%)	4 (13.3%)	
>27 years	53 (77.9%)	15 (22.1%)		6 (75%)	2 (25%)	
Gender						
Male	185 (87.3%)	27 (12.7%)	5.223 (0.022)	32 (88.9%)	4 (11.1%)	3.790 (0.052)
Female	127 (78.4%)	35 (21.6%)		35 (71.4%)	14 (28.6%)	
Education level						
Up to Secondary	15 (71.4%)	6 (28.6%)	2.314 (0.128)	12 (75%)	4 (25%)	0.173 (0.678)
Tertiary	297 (95.2%)	56 (15.9%)		55 (79.7%)	14 (20.3%)	
Occupational status						
Nonstudent	104 (81.9%)	23 (18.1%)	0.327 (0.568)	16 (80%)	4 (20%)	0.022 (0.883)
Student	208 (84.2%)	39 (15.8%)		51 (78.5%)	14 (21.5%)	
Residence						
Urban	271 (83.9%)	52 (16.1%)	0.392 (0.531)	56 (76.7%)	17 (23.3%)	1.381 (0.240)
Rural	41 (80.4%)	10 (19.6%)		11 (91.7%)	1 (8.3%)	
Marital status						
Unmarried	236 (84.9%)	42 (15.1%)	1.691 (0.193)	56 (82.4%)	12 (17.6%)	2.537 (0.111)
Married	76 (79.2%)	20 (20.8%)		11 (64.7%)	6 (35.3%)	
Smoking status						
Yes	40 (88.9%)	5 (11.1%)	1.105 (0.293)	5 (100%)	0	1.427 (0.232)
No	272 (82.7%)	57 (17.3%)		62 (77.5%)	18 (22.5%)	
Alcohol consumption						
Yes	7 (87.5%)	1 (12.5%)	0.098 (0.754)	1 (100%)	0	0.272 (0.602)
No	305 (83.3%)	61 (16.7%)		66 (78.6%)	18 (21.4%)	
Chronic condition						
No	236 (89.1%)	29 (10.9%)	20.871 (<0.001)	51 (79.7%)	13 (20.3%)	0.116 (0.734)
Yes	76 (69.7%)	33 (30.3%)		16 (76.2%)	5 (23.8%)	

The present study found that females are more likely to suffer from mental health problems than males. A Bangladeshi study comprising a total of 10,000 subjects during the COVID-19 pandemic found a 1.52- and 1.76-times higher risk of depression and suicidality for the female participants, respectively. This gender-based difference in mental health suffering is also observed in other studies. For instance, vaccinated female healthcare workers had reported a 2.71 times greater risk of general health problems, 2.17 times risk of anxiety, and 2.52 times risk of loneliness.[16] It is said that the physiological and psychological structure of the female makes them vulnerable to coping with stressful events like the pandemic. In this study, 25.9% of the vaccinated females were depressed and the rate was 16.5% for the male vaccinated participants, whereas a similar gender-based difference in suffering from

depression was found for the nonvaccinated participants (34.7% and 11.1%, respectively). Similarly, for the anxiety of both groups (vaccinated and nonvaccinated participants), a higher prevalence was reported for the female gender. But, a significant relationship between gender and PTSD was found for only the nonvaccinated participants; that is, 22.4% of females had PTSD and it was 5.6% of males. In general, this study suggests that the female gender despite their belonging group either vaccinated or not, is more likely to suffer from mental health problems. Therefore, it is important to consider gender-specific approaches to address mental health issues and provide support to females. This can include gender-sensitive counseling services and support groups, as well as targeted outreach programs to encourage females to seek mental health services.

TABLE 4 Relationship of the studied variables with PTSD across vaccination status.

Variables	Vaccinated participants			Nonvaccinated participants		
	Normal; n (%)	PTSD; n (%)	χ^2 (p value)	Normal; n (%)	PTSD; n (%)	χ^2 (p Value)
Age group						
18–22 years	133 (90.5%)	14 (9.5%)	17.915 (<0.001)	38 (80.9%)	9 (19.1%)	1.236 (0.539)
23–27 years	145 (91.2%)	14 (8.8%)		27 (90%)	3 (10%)	
>27 years	49 (72.1%)	19 (27.9%)		7 (87.5%)	1 (12.5%)	
Gender						
Male	185 (87.3%)	27 (12.7%)	0.013 (0.910)	34 (94.4%)	2 (5.6%)	4.572 (0.033)
Female	142 (87.7%)	20 (12.3%)		38 (77.6%)	11 (22.4%)	
Education level						
Up to secondary	13 (61.9%)	8 (38.1%)	13.197 (<0.001)	14 (87.5%)	2 (12.5%)	0.119 (0.730)
Tertiary	314 (89%)	39 (11%)		58 (84.1%)	11 (15.9%)	
Occupational status						
Nonstudent	98 (77.2%)	29 (22.8%)	18.451 (<0.001)	19 (95%)	1 (5%)	2.139 (0.144)
Student	229 (92.7%)	18 (7.3%)		53 (81.5%)	12 (18.5%)	
Residence						
Urban	286 (88.5%)	37 (11.5%)	2.664 (0.103)	61 (83.6%)	12 (16.4%)	0.523 (0.470)
Rural	41 (80.4%)	10 (19.6%)		11 (91.7%)	1 (8.3%)	
Marital status						
Unmarried	256 (92.1%)	22 (7.9%)	21.342 (<0.001)	57 (83.8%)	11 (16.2%)	0.204 (0.651)
Married	71 (74%)	25 (26%)		15 (88.2%)	2 (11.8%)	
Smoking status						
Yes	35 (77.8%)	10 (22.2%)	4.340 (0.037)	5 (100%)	-	0.959 (0.327)
No	292 (88.8%)	37 (11.2%)		67 (83.8%)	13 (16.3%)	
Alcohol consumption						
Yes	4 (50%)	4 (50%)	10.425 (0.001)	1 (100%)	-	0.183 (0.669)
No	323 (88.3%)	43 (11.7%)		71 (84.5%)	13 (15.5%)	
Chronic condition						
No	236 (89.1%)	29 (10.9%)	2.181 (0.140)	54 (84.4%)	10 (15.6%)	0.022 (0.882)
Yes	91 (83.5%)	18 (16.5%)		18 (85.7%)	3 (14.3%)	

Abbreviation: PTSD, posttraumatic stress disorder.

People with mental health conditions are often comorbid with adverse health outcomes. A study among 60 countries with a total of 245,404 participants found a 3.2% prevalence for past-year depression episodes, whereas 4.5%, 4.1%, 3.3%, and 2.0% were for angina, arthritis, asthma, and diabetes.[23] The study also found that 9.3% of the participants with one chronic disease had depression as a comorbid, whereas this was 23.0% for those with more than one comorbidity; thus, it has been said that mental health incrementally worsens health while it was comorbid with other physical conditions.[23] A Bangladeshi study reported a 3.34 times higher risk of depression among those participants who suffered from physical health problems.[24] In this study, it was found that both vaccinated and nonvaccinated people were more

likely to report depression. However, the relationship between suffering from chronic disease and anxiety was significant for vaccinated subjects. However, there was no significant relationship between PTSD and chronic diseases. In general, comorbidity with chronic physical conditions can exacerbate mental health problems. Therefore, promoting a healthy lifestyle that includes regular physical activity, a balanced diet, and proper sleep hygiene can help individuals better manage their physical and mental health. Healthcare providers can play a crucial role in promoting healthy behaviors and providing resources and support to patients to adopt healthy habits.

It should be noted that this study has limitations, particularly in terms of its design. Since it was a cross-sectional study, it was

TABLE 5 Factors associated with depression and anxiety among vaccinated and nonvaccinated participants.

	Depression				Anxiety	
	Vaccinated		Nonvaccinated		Vaccinated	
Variables	aOR (95% CI)	p Value	aOR (95% CI)	p Value	aOR (95% CI)	p Value
Gender						
Male	Reference	0.089	Reference	0.019	Reference	0.124
Female	1.56 (0.93–2.62)		4.34 (1.27–14.80)		1.56 (0.88–2.77)	
Chronic condition						
No	Reference	0.004	Reference	0.035	Reference	<0.001
Yes	2.16 (1.27–3.67)		3.34 (1.08–10.28)		3.27 (1.84–5.78)	

Abbreviations: aOR, adjusted odds ratio; CI, 95% confidence interval.

TABLE 6 Factors associated with PTSD among vaccinated participants.

Variables	aOR (95% CI)	p Value
Age group		
18–22 years	1.45 (0.38–5.46)	0.399
23–27 years	0.76 (0.29–1.98)	
>27 years	Reference	
Education level		
Up to secondary	3.24 (1.13–9.25)	0.028
Tertiary	Reference	
Occupational status		
Nonstudent	2.93 (1.06–8.07)	0.037
Student	Reference	
Marital status		
Unmarried	2.57 (1.08–6.08)	0.031
Married	Reference	
Smoking status		
Yes	1.38 (0.54–3.49)	0.497
No	Reference	
Alcohol consumption		
Yes	8.71 (1.71–44.25)	0.009
No	Reference	

Abbreviation: PTSD, posttraumatic stress disorder.

impossible to establish a cause-effect relationship between vaccination status and mental health problems. In addition, the data was collected using an online platform, which may limit the generalizability of the results to the broader population. Furthermore, the study did not use probability sampling techniques, which may have weakened the actual representation of the participants belonging to two groups (vaccinated and nonvaccinated). However, despite those limitations, this study still provides valuable insight into the relationship between mental health and vaccination status.

5 | CONCLUSIONS

This study investigated how the prevalence of mental health problems among Bangladeshis differed between those who received COVID-19 vaccines and those who were not. A non–significant higher prevalence of mental health problems was reported among nonvaccinated individuals compared with vaccinated ones. In general, female gender and having chronic condition were the factors associated with mental health problems. However, vaccination is crucial for preventing COVID-19, and whatever this study finds in relation to vaccination and mental health, the authors would like to urge their recommendation for intaking vaccination. In addition, based on the findings reported in this study, a number of recommendations focusing on mental health aspects are suggested for psychological well-being, which may include:

- *Increasing vaccination awareness*: educating the public about the importance and safety of COVID-19 vaccines to combat vaccine hesitancy and improve vaccination rates;
- *Addressing mental health concerns*: providing mental health support and services to individuals, particularly those at higher risk of developing mental health problems, such as access to counseling services, support groups, and stress-management resources;
- *Addressing gender disparities*: consider gender-specific approaches to support females, who are more likely to suffer from mental health problems than males;
- *Promoting a healthy lifestyle*: encourage healthy habits, such as regular physical activity, a balanced diet, and proper sleep hygiene, to help individuals manage their physical and mental health better;
- *Conducting more research*: more research is needed to establish the relationship between vaccination status and mental health problems and to explore factors contributing to vaccine hesitancy and mental health issues among individuals.

AUTHOR CONTRIBUTIONS

Mohammad Imtiaz Nur: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; resources; software; validation; writing—original draft. **Firoj Al-Mamun**: Conceptualization;

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon a reasonable request.

ETHICS STATEMENT

Ethical aspects of this study were reviewed and approved by the review board at the CHINTA Research Bangladesh (chinta/2021/05). In addition, the Declaration of Helsinki 2013 has adhered to conduct this study. The study aims and objectives were explained to the participants. They were also informed about potential benefits and/or risks associated with participating in the study. However, no financial or other types of remuneration were given to those participating in the study. All participants provided their online informed consent before data collection.

TRANSPARENCY STATEMENT

The lead author Firoj Al-Mamun, Mohammed A. Mamun affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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