



**Nasir Ahmed Shuvo,  
Md Sanaul Haque Mondal**

Department of Social Relations, East West  
University, Dhaka, Bangladesh

Received: March 2, 2022

Revised: April 30, 2022

Accepted: June 24, 2022

Corresponding author:

Md Sanaul Haque Mondal, MSc, PhD  
Department of Social Relations, East West  
University, Jahurul Islam City, Aftabnagar, Dhaka,  
Bangladesh

Tel: +880-2-09666775577 (ext. 462)

Fax: +880-2-9857322

E-mail: mshaquem@gmail.com; shmondal@  
ewubd.edu

No potential conflict of interest relevant to this  
article was reported.

We would like to appreciate the support extended  
by the respondents during the entire period of the  
survey. We would like to express our gratitude to  
the anonymous peer reviewers for their valuable  
comments on the earlier version of this paper.

# Factors associated with intention to take COVID-19 vaccine among the university students in Bangladesh

**Purpose:** This study examined the Bangladeshi university students' intention to take coronavirus disease 2019 (COVID-19) vaccines by assessing the Health Belief Model and Theory of Planned Behavior.

**Materials and Methods:** University students were queried on their intention to take COVID-19 vaccines. The sample used in this study (n=310) was obtained through an online survey among university students (age, 18–25 years old) from August 7 to September 18, 2021.

**Results:** Although over 90% of respondents showed their willingness to take the COVID-19 vaccine, around 37.3% of respondents still desired to wait and see to take the vaccine. The most frequently cited reasons for vaccines hesitancy were concerns over side effects (62.4%). There is still an unmet need for adequate information on COVID-19 vaccines (81.4%). Results of the binary logistic regression model showed that students from private universities (odds ratio [OR], 0.19; 95% confidence interval [CI], 0.04–0.97), respondents who concerned about the vaccine safety (OR, 0.07; 95% CI, 0.01–0.44) and side effects of vaccine (OR, 0.21; 95% CI, 0.05–0.89) were less willing to take COVID-19 vaccine. On the other hand, desire to wait to take COVID-19 vaccines was associated with marital status (OR, 7.76; 95% CI, 1.50–40.27); COVID-19 preventive behavior, including use of facemask (OR, 0.25; 95% CI, 0.09–0.70) and maintain social distance (OR, 1.75; 95% CI, 1.00–3.07); COVID-19 infection (OR, 0.50; 95% CI, 0.26–0.99); provide more information on vaccines (OR, 2.32; 95% CI, 1.06–5.09); the perceived side effects (OR, 2.82; 95% CI, 1.54–5.17); and effectiveness of COVID-19 vaccines (OR, 2.41; 95% CI, 1.16–5.01).

**Conclusion:** Public health managers should provide adequate information on COVID-19 vaccines to address the concerns about the safety and side effects of the vaccines.

**Keywords:** COVID-19 vaccine, Wait and see, Willingness, Bangladesh, Young adult, Physical distancing

## Introduction

The coronavirus disease 2019 (COVID-19) pandemic poses a threat to the health and well-being of humans [1]. Numerous strategies have been implemented worldwide to reduce the spread of COVID-19, including lockdowns, closing business, school closure, travel bans, social distancing, case isolation, contact tracing, quarantine, enhanced surveillance, and testing [2,3]. However, only these preventive measures cannot ensure reducing disease burden due to COVID-19. Vaccination is an important strategy to prevent infection and to reduce the mortality of many infectious diseases [4-6], especially

COVID-19. The U.S. Food and Drug Administration first authorized a vaccine for COVID-19 in December 2020 [7].

Vaccine availability or vaccination campaigns will never ensure higher vaccination rates [8] because misinformation and conspiracy theories can influence vaccine uptake [5]. Although studies reported numerous reasons for willingness or unwillingness to take COVID-19 vaccines, these are highly contextual. Hence, it is urgent to examine under which conditions people are willing, hesitant or unwilling to take COVID-19 vaccines. Such public preference for vaccination may have useful information for the policymakers to develop effective and efficient vaccination programs [8].

People's willingness to take COVID-19 vaccine have previously been examined [1,4,5,9]. Much of these studies were conducted to receive the hypothetical vaccine [1,4,5,10]. However, only assessing the willingness to vaccination will not provide sufficient information on inoculation especially when it comes to the deadliest disease of COVID-19. In many cases, government is offering benefits to take COVID-19 vaccines. On the other hand, there are numerous protests on anti-vaccination in different parts of the world. Some people may be willing for inoculation but want to wait before taking the final decisions on inoculation. On the other hand, some people may be unwilling to take vaccines at present; however, they desire to wait before inoculation [8]. These two groups are very critical for the vaccination program. The success of a mass vaccination campaign depends on the public perceptions and their acceptance of vaccines [1].

Bangladesh is one of the most affected countries by the COVID-19 pandemic in South Asia. By January 15, 2022, the country had experienced the 2nd highest number of cases, the 3rd highest number of deaths in South Asia [11,12]. The first confirmed case on COVID-19 in Bangladesh was detected on March 8, 2020, and by July 9, 2021, the confirmed cases of COVID-19 had crossed 1 million [11]. The government of Bangladesh has taken extensive measures to control the spread of COVID-19 disease, including mandatory face masks in public spaces, compulsory social distance, lockdowns, contact tracing, case isolation, quarantine, and closing educational institutions. The COVID-19 vaccination program was launched in Bangladesh on 27 January 2021 starting with people of 40 years or above, government officials, and front-line workers using an app-based registration system. At the time of conducting this study (August 7 to September 18, 2021), individual's below 25 years were out of mass vaccination coverage in Bangladesh. Younger generation is at high risk because they

may be reluctant to undertake the precautions [13] or may be unwilling to take vaccine. In addition, secondary transmission of COVID-19 can occur in educational institutions if the preventive measures are not strictly maintained [14,15].

There is no agreement among the recent studies which risk perception variables influence to take COVID-19 vaccines [1]. Previous studies have reported a wide range of factors that influence people's intention to take COVID-19 vaccines (e.g., [5,6,10,16-21]), including concern about the possible side effects, safety of vaccine, and effectiveness of the vaccine. Individuals may be fearful towards vaccine due to the misunderstanding that vaccine will pose a risk of being infected or may perceive vaccine is not necessary [22]. Therefore, people tend to get more information on COVID-19 vaccine safety [23], which, in turn, affects people's trust in vaccine safety [1]. Research showed that individuals who perceive higher COVID-19 risk, they intend to follow preventive measures, such as maintain social distancing, regular hand washing, and wearing facemask [15,20,21,24].

Vaccine safety is one of the factor which determine individuals desire to wait and see to take a vaccine [1,22]. Most recently, some studies investigated public preference to wait and see to take the COVID-19 vaccine: Netherlands [8], the United States [25], China [26], and Finland [1]. Numerous studies have been conducted focusing on students' perception on COVID-19 [13] and their willingness to take vaccine [20,25].

In the context of Bangladesh, studies have explored willingness to take COVID-9 vaccine [27,28], willingness to pay for vaccine [18], and COVID-19 vaccine hesitancy [17]. A number of studies have been conducted focusing on university students' perception on COVID-19 [29] and vaccine acceptability [30]. However, the likelihood that people may desire to wait to take COVID-19 vaccine was overlooked intentionally or unintentionally. Our study addresses this gap by investigating the university students' willingness to take COVID-19 vaccine and their desire to wait and see to take COVID-19 vaccine. The acceptance of COVID-19 vaccines by the mass people must be evaluated by the policymakers to design national plans and policies of vaccination programs.

The main goal of this study is to evaluate the intension to take COVID-19 vaccines among the Bangladeshi university students who are aged between 18 to 25 years. Specific objectives include (1) to obtain information on students' perceived risk of COVID-19 and vaccine hesitancy against COVID-19, and (2) to examine the factors that determine students' will-

ingness and their desire to wait to take COVID-19 vaccine. This study employed Health Belief Model (HBM) and Theory of Planned Behavior (TPB). The analysis of this study can be seen as a partial test of HBM and TPB, in the context of COVID-19, with the data from the collected from the university students in Bangladesh.

The HBM was originally developed by Irwin M. Rosenstock to predict health-promoting behaviors [31]. This framework has been used to explore the intention to uptake COVID-19 vaccine [17,18]. According to the HBM, the intention to take COVID-19 vaccine among the university students depends on numerous factors, including: (1) perceived susceptibility (possibility of getting COVID-19), (2) perceived severity (risk perception of the likelihood of infection), (3) perceived benefits (potential advantage of getting vaccine), (4) perceived barriers (perceived obstacles that may act as impediments to take vaccine), and (5) cues to action (factors that trigger an individual to take vaccine) [20,31].

The TPB is used to determine the individual's intention to get vaccinated [10]. This model assumes that actions are determined by intentions and perceived behavioral control [15]. According to this model, the intention to get vaccine are determined by attitudes towards vaccine, subjective norms, and perception of behavioral controls [10,15].

In this study, we hypothesized that during the current COVID-19 pandemic, individuals would like to get COVID-19 vaccine (willingness to take vaccine). However, misinformation about the side effects and effectiveness of vaccine might affect the intention to take the vaccine [18]. We also expected that some people may desire to wait to take COVID-19 vaccine.

## Materials and Methods

An online self-administered questionnaire survey was conducted among university students of Bangladesh during the August 7 to September 18, 2021. The survey was designed to measure university students' knowledge and attitude about COVID-19, risk perceptions, willingness, and hesitancy to take COVID-19 vaccines.

### Measures

The socio-demographic questions comprised of age, sex, marital status, level of education (undergraduate/graduate), residence (rural/urban), income, and so forth.

Health related variables were measured using two questions: (1) I had a COVID-19 infection. (2) do you have any chro-

nic diseases? The response alternatives for the health-related variables were dichotomous (yes/no). To measure self-efficacy, the respondents were asked two items (question asked): (1) Do you practice social distancing (avoid leaving home/avoid crowded)? (2) Do you wear a face mask when outside? The response alternatives for these two questions were always, sometimes, and never.

Perceived susceptibility and severity consisted of two questions: (1) I am worried of getting COVID-19 myself. (2) I think there could be a new outbreak of COVID-19 in Bangladesh. The response alternatives include agree, disagree, and undecided. The perceived benefits of getting COVID-19 vaccine were examined by two items: (1) I think vaccine will provide me full protection from being infected with COVID-19. (2) I think we will be able to resume our classes physically soon after vaccination. The response alternatives include agree, disagree, and undecided.

To measure COVID-19 vaccine hesitancy (perceived barrier), the respondents were asked three items: question asked: (1) COVID-19 vaccine is not safe; (2) I am worried about some side effects of the COVID-19 vaccine; and (3) the effectiveness of COVID-19 vaccine is very low. The response alternatives include agree, disagree, and undecided.

Cues to action were measured using one: Do you think you need more information about the COVID-19 vaccine? The response alternatives included yes/no.

The willingness to receive COVID-19 vaccine was measures using one item: If you have an opportunity to be vaccinated, do you willing to get the COVID-19 vaccine? The response options included: willing, unwilling, and undecided. Subsequently, they were asked whether they desire to wait and see to take COVID-19 vaccine which was measures by a single item. A dichotomous response option (yes=1, no=0) was used to measure their willingness to wait to take vaccine.

### Participants' recruitment

The inclusion criteria for the interviews were aged between 18 to 25 years and currently studying in either private or public universities in Bangladesh. Recruitment of respondents occurred via email and social media platforms, including WhatsApp and Facebook Messenger. Potential respondents were emailed and were asked to contact the researcher if they had any queries about the study.

### Sample size

The required sample size for this study was 385 based on en-

rolled students in university in Bangladesh (11,797,996 enrolled students in the university in 2019 [32]), a 5% margin of error with a 95% confidence interval (CI) and a 50% prevalence rate. A total of 314 students filled the survey form. We could not collect the required number of samples since the universities were closed for COVID-19 outbreak. Finally, 310 valid responses (four ineligible responses) were considered for the data analysis.

**Data analysis**

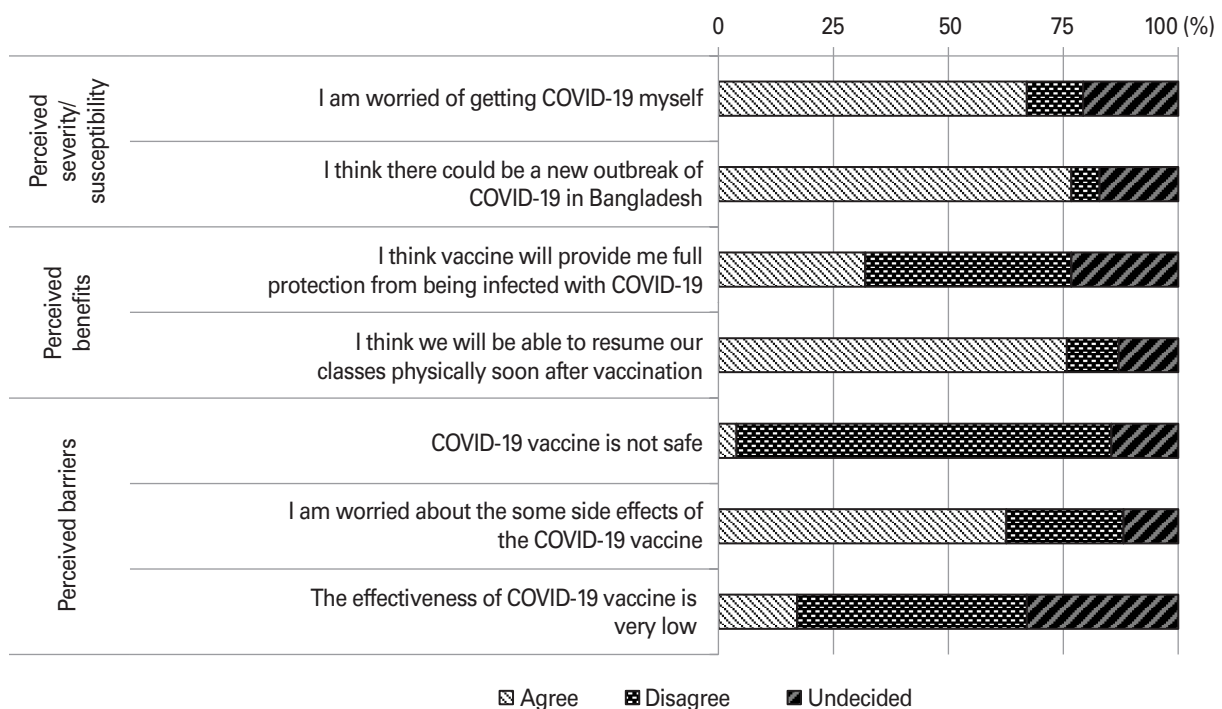
Statistical analyses were conducted in IBM SPSS Software ver. 24.0 (IBM Corp., Armonk, NY, USA). Descriptive analyses were performed to calculate frequencies and percentages. Binary logistic regression was used in this study to explore the factors affecting students’ intension to take COVID-19 vaccines.

**Ethical consideration**

Participation of respondents in this study was voluntary. The respondents provided their informed consent in the online survey platform to participate in this study before they precede the survey items. The respondents were also informed about the objective of the study, confidentiality and anonymity, and their freedom to withdraw from the study at any point of the survey. This study was conducted in accordance with the Declaration of Helsinki.

**Table 1.** Socio-demographic characteristics of respondents (n=310)

Characteristic	Frequency (%)
Sex	
Male	156 (50.3)
Female	154 (49.7)
Age (yr)	
18–21	146 (47.1)
22–25	164 (52.9)
Type of university	
Public	83 (26.8)
Private	227 (73.2)
Residence	
Urban	245 (79.0)
Rural	65 (21.0)
Marital status	
Married	18 (5.8)
Single	292 (94.2)
Having personal income	
Yes	124 (40.0)
No	186 (60.0)
Academic level	
Undergraduate	250 (80.6)
Graduate	60 (19.4)
Health status	
Poor	19 (6.1)
Good	152 (49.0)
Fair	139 (44.8)



**Fig. 1.** Perceived severity, susceptibility, benefits, and barriers to take coronavirus disease 2019 (COVID-19) vaccine.

Results

Respondents were aged between 18–25 years old and were predominately in the undergraduate level (80.6%). The majority (79.0%) of respondents was from urban areas and 40.0% respondents had an income. Nearly, three-quarters of respondents (73.2%) studied in private universities. Around 6.1% respondents informed their current health status was as poor. Respondents’ characteristics are presented in the Table 1.

Most of the respondents (76.8%) believed that there will be a new outbreak of COVID-19 in Bangladesh and 67.1% respondents felt worried of getting COVID-19 (Fig. 1). Fig. 1 shows perceived benefits of respondents to take COVID-19 vaccines. Over three-fourth of respondents (75.8%) believed they can start their classes physically after vaccination. However, most of the respondents (44.8%) considered vaccination will not provide them full protection of being infected with COVID-19.

The results showed that a large proportion of respondents disagreed with the two-hesitancy statements: (1) The effectiveness of COVID-19 vaccine is very low (50.0%) and (2) CO-

VID-19 vaccine is not safe (81.6%). On the other hand, majority of the respondents (62.6%) were concerned about the side effects of the vaccine.

Results of this study showed that 91.9% of responders were willing to take vaccines while 2.9% were unwilling and 5.2% were still undecided whether they will take the vaccines. For the desire to “wait and see” to take COVID-19 vaccine, around 37.1% (n=115) of respondents preferred to wait to take the vaccine (Fig. 2).

Over one-fifth (21.9%) of the respondents had diagnosed with COVID-19 and 11.6% respondents have been facing chronic diseases. Regarding the personal health measures, majority of the respondents (92.3%) informed that they always use face mask while they go outside of their houses and rest of the respondents use it sometimes (Fig. 3). On the other hand, when they were queried about social distancing, 51% of respondents informed that they always try to practice social distancing and only 1.9% respondents never practice social distancing (Fig. 3). Interestingly, over four-fifth of the respondents informed that they need more information on COVID-19 vaccine.

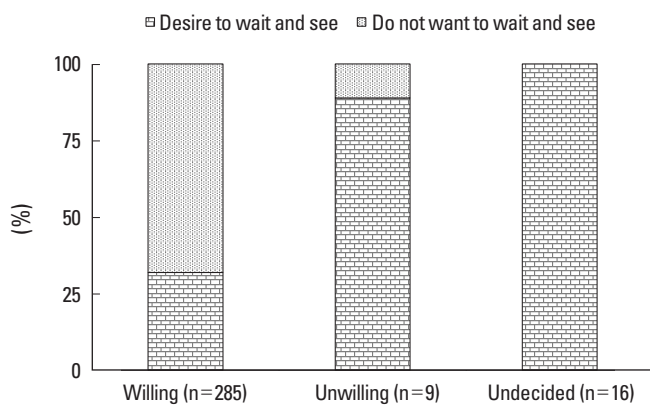


Fig. 2. Respondents’ willingness and desire to wait and see to take coronavirus disease 2019 (COVID-19) vaccine.

Factors associated with the intention to take COVID-19 vaccines

We performed regression analysis to identify the determinants of COVID-19 vaccination intention in terms of socio-demographic characteristics, and HBM and TPB constructs (Table 2).

First, we analyzed the willingness to take COVID-19 vaccine, in which respondents selected one of the three choices: willing, unwilling, and undecided. For the analysis, we dichotomized the response variables into two variables: an “agree” variable containing the choices for the willingness to take vaccine and “otherwise” variable containing the choices for “unwilling” and “undecided.” Second, we analyzed the data from the follow-up question asking whether they desire to

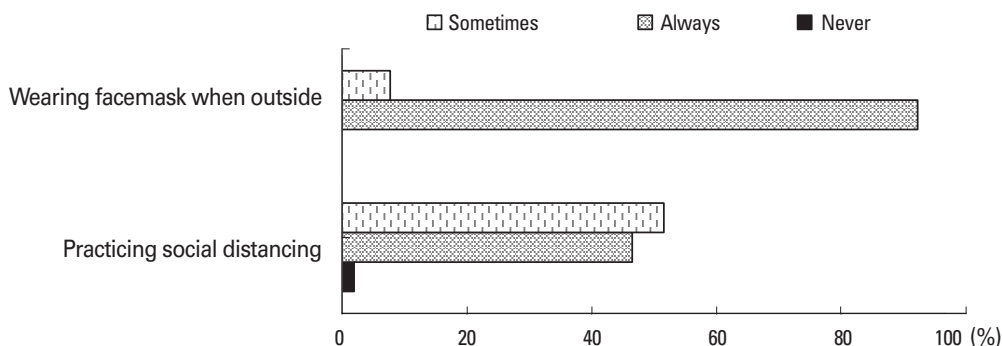


Fig. 3. Use of facemask and practicing social distancing by the respondent.

**Table 2.** Summary statistics of the selected variables

Variable	Variable description	Mean <sup>a</sup> ± SD
<b>Socio-demographic</b>		
Age	Age of respondents (≥22 yr=1, <21 yr=0)	0.53±0.50
Sex	Sex of respondents (female=1, male=0)	0.5±0.5
Marital status	Marital status of respondents (unmarried=1, married=0)	0.94±0.23
Residence	Area of residence (urban=1, otherwise=0)	0.79±0.41
Income	Having personal income of respondents (yes=1, no=0)	0.40±0.49
University	Type of university (private=1, public=0)	0.73±0.44
<b>Health related variables</b>		
COVID-19 experience	Respondent diagnosed with COVID-19 (yes=1, no=0)	0.22±0.41
Chronic disease	Respondent has chronic disease (yes=1, no=0)	0.12±0.32
<b>Self-efficacy</b>		
Facemasks	Respondent use facemask out-of-home (always=1, otherwise=0)	0.92±0.27
Social distancing	Respondent maintains social distance in public (always=1, otherwise=0)	0.46±0.50
<b>Perceived severity and susceptibility</b>		
Worried of getting COVID-19	I am worried of getting COVID-19 myself (agree=1, otherwise=0)	0.67±0.47
New outbreak	I think there could be a new outbreak of COVID-19 in Bangladesh (agree=1, otherwise=0)	0.77±0.42
<b>Perceived benefits</b>		
Protection	I think vaccine will provide me full protection from being infected with COVID-19 (agree=1, otherwise=0)	0.32±0.47
Class starts	I think we will be able to resume our classes physically soon after vaccination (agree=1, otherwise=0)	0.76±0.43
<b>Perceived barriers</b>		
Vaccine safety	COVID-19 vaccine is not safe (agree=1, otherwise=0)	0.04±0.19
Side effects	I am worried about some side effects of the COVID-19 vaccine (agree=1, otherwise=0)	0.63±0.48
Effectiveness	The effectiveness of COVID-19 vaccine is very low (agree=1, otherwise=0)	0.17±0.38
<b>Vaccination intension</b>		
Willingness	If you have an opportunity to be vaccinated, do you willing to get the COVID-19 vaccine? (willing to take vaccine=1, otherwise=0)	0.92±0.27
Desire to wait and see	Do you plan to “wait and see” to take COVID-19 vaccine? (yes=1, no=0)	0.37±0.48
<b>Cues to action</b>		
Vaccine information	Respondent needs more information about COVID-19 vaccine (yes=1, no=0)	0.81±0.39

SD, standard deviation; COVID-19, coronavirus disease 2019.

<sup>a</sup>Calculated from the questionnaire survey data, 2021.

wait to take COVID-19 vaccine, in which respondents selected one of the two choices: yes and no. In the binary logistic regression model, the dependent variable becomes the natural logarithms of the odd when a positive choice is made. Hence, binary logistic regression model was used in this study to identify the factors that determine students' willingness to take COVID-19 vaccine and their desire to wait and see to take COVID-19 vaccine.

The findings of the logistic regression model are presented in the Table 3. Both of the models were statistically significant and no multicollinearity issues were detected.

Model 1 presents the willingness of respondents to take COVID-19 vaccine (Table 3). Our results suggest that the probability of willingness to vaccination was lower among the private university students as compared to the public university

(odds ratio [OR], 0.19; 95% CI, 0.04–0.97). Individuals concerned with the vaccine safety were less willing for vaccination against COVID-19 (OR, 0.07; 95% CI, 0.01–0.44). Side effects of vaccine had negative and significant effects on the willingness to take vaccine, meaning that respondents who were concerned about the side effects of the vaccine were less willing to take vaccine (OR, 0.21; 95% CI, 0.05–0.89).

The results (model 2) showed that unmarried respondents were more likely to express their desire to wait to take COVID-19 vaccine as compared with the married respondents (OR, 7.76; 95% CI, 1.50–40.27). Respondents who were concerned about the side effects of the vaccines were more willing to wait to take vaccine (OR, 2.82; 95% CI, 1.54–5.17). The significant positive coefficient of the effectiveness of the vaccine variable implied that those respondents believed in the

**Table 3.** Binary logistic regression model for factors associated with the desire to wait and see to take COVID-19 (n=310)

Variable	Model 1: willingness to take vaccine		Model 2: desire to wait and see to take vaccine	
	B ± SE	Exp(B) (95% CI)	B ± SE	Exp(B) (95% CI)
Age	-0.16±0.52	0.86 (0.31–2.36)	0.19±0.27	1.20 (0.71–2.05)
Sex	0.30±0.52	1.34 (0.49–3.71)	-0.04±0.28	0.96 (0.56–1.65)
Marital status	0.51±1.11	1.67 (0.19–14.65)	2.05±0.84*	7.76 (1.50–40.27)
Residence	-0.38±0.62	0.68 (0.20–2.32)	-0.30±0.34	0.74 (0.38–1.44)
Income	-0.89±0.53	0.41 (0.14–1.17)	0.27±0.30	1.32 (0.73–2.36)
University	-1.68±0.84*	0.19 (0.04–0.97)	0.51±0.35	1.66 (0.84–3.28)
Worried of getting COVID-19	0.81±0.53	2.24 (0.79–6.32)	0.06±0.30	1.06 (0.59–1.91)
New outbreak	0.60±0.59	1.81 (0.57–5.76)	0.10±0.34	1.11 (0.57–2.16)
Protection	1.59±0.85	4.91 (0.93–25.92)	0.18±0.31	1.19 (0.65–2.20)
Class start	0.97±0.56	2.64 (0.88–7.94)	-0.29±0.32	0.75 (0.40–1.41)
Vaccine safety	-2.68±0.95**	0.07 (0.01–0.44)	0.50±0.77	1.65 (0.36–7.43)
Side effects	-1.56±0.74*	0.21 (0.05–0.89)	1.04±0.31***	2.82 (1.54–5.17)
Effectiveness	-0.60±0.60	0.55 (0.17–1.77)	0.88±0.37*	2.41 (1.16–5.01)
COVID-19 experience	1.42±0.78	4.12 (0.90–18.89)	-0.69±0.35*	0.50 (0.26–0.99)
Facemasks	0.10±0.91	1.10 (0.18–6.58)	-1.39±0.53**	0.25 (0.09–0.70)
Social distancing	0.07±0.54	1.08 (0.38–3.08)	0.56±0.29*	1.75 (1.00–3.07)
Chronic disease	-0.74±0.68	0.48 (0.13–1.80)	0.24±0.40	1.27 (0.58–2.79)
Vaccine information	-0.34±0.84	0.71 (0.14–3.72)	0.84±0.40*	2.32 (1.06–5.09)
Constant	3.79±1.87*	44.31	-3.25±1.138**	0.04

Authors’ calculations based on Questionnaire Survey data (2021).

COVID-19, coronavirus disease 2019; SE, standard error; CI, confidence interval.

\*p<0.05. \*\*p<0.01. \*\*\*p<0.001.

lower effectiveness of the vaccine were more likely to choose the wait and see option (OR, 2.41; 95% CI, 1.16–5.01). Furthermore, we observed that respondents who were infected with COVID-19 they were not prone to selecting wait and see option to take vaccine (OR, 0.50; 95% CI, 0.26–0.99).

Mixed effects were found in the case of practicing health rules with positive relationship for the respondents who maintain social distance (OR, 1.75; 95% CI, 1.00–3.07) and negative for the respondents who wear facemask (OR, 0.25; 95% CI, 0.09–0.70), and both of these relationships were statistically significant. Respondents who indicated that they need more information on vaccines were more prone to select wait and see option (OR, 2.32; 95% CI, 1.06–5.09).

## Discussion

This study provided insights into university students’ intention to take COVID-19 vaccine using various socio-demographic, health-related, and behavioral variables. Although majority of the respondents (91.9%) were willing to take vaccine, 37.1% respondents still desire to wait and see before inoculation. The reason behind their desire to wait was to see

the experiences of others are known [8]. The findings of our study was similar to that of Du et al. [26], which reported that 37.2% Chinese mainlander’s chose to wait and see to take COVID-19 vaccine. Our study found higher willingness to take COVID-19 vaccine, which is higher than other studies in Bangladesh [17,18,27]. This can be explained by the education of our studied respondents, as university students have higher education levels and bio-background [13]. Higher intention to take COVID-19 vaccine were also reported by other studies in Bangladesh [28].

This study identified numerous factors associated with the intension to take COVID-19 vaccine. We did not find any evidence of an association between socio-demographic characteristics of respondents (such as sex, income, residence, and income) and intention to take COVID-19 vaccine. The findings were in the line with those of Shmueli [10] and Kabir et al. [18] who reported insignificant associations between socio-demographic variables (gender, education) and vaccination intensions. Furthermore, area of residence did not play important role for vaccination intentions. This is true in the sense that all the respondents are educated and the universities are mostly located in the urban areas. The findings of our

study were different from those of other studies [17,18,27].

The vaccination intention rate was higher than the previous study on the public university students in Bangladesh [30]. The findings showed that respondents from the private university were less willing to take vaccine. This is due to the fact that most of the private universities in Bangladesh have been conducting online academic activities, including online classes, examinations, and publishing results since the beginning of the lockdown in the country which might influence their willingness to take the vaccine [33]. According to a female student of a private university, "I do not have enough idea about vaccines whether it is safe or not, how effective. I do not see any logic behind opening educational institutes. We are quite familiar with these online classes" (female, 2nd year student of a private university). On the other hand, online classes and examinations were limited in the public universities. As a result, their educational life has been disrupted which perhaps the main reason for their higher motivation to be vaccinated among the public university students. Therefore, our study provides novel information.

Interestingly, marital status of the respondents was associated with their desire to wait and see for COVID-19 vaccination. The results does not corroborate that of Alqudeimat et al. [5], that reported that unmarried respondents were more likely to accept COVID-19 vaccine as compared with married. These differences in the findings could be due to the target audiences (our study targeted only university students), possibility of reopening of universities (married respondents might be concerned for their family members), as well as COVID-19 situation in Bangladesh at the time of the interview.

The variable chronic disease did not have significant impact on the desire to wait and see. As the coefficient of chronic disease was positive, although not significant, it may be inferred that having chronic disease/health problem might influence to take the decisions on vaccines uptake. One respondent informed "I am in a huge dilemma about if I should get vaccine or not. I am also worried to have an allergic reaction, as I have blood allergy. Government should let people know that if it is going to be a problem too or not" (female, 3rd year student of a private university).

In contrast, the respondents who were infected with COVID-19 had a lower intention to wait and see to take vaccine as compared with who did not. This might be higher disease risk perception which influence them to take vaccine despite vaccine concern [1]. This is in line with other study findings in Bangladesh [18,27]. However, our study findings different

from other study [10] that showed health-related predictors did not significantly associated with the intention to receive vaccine.

Among the preventive behaviors, students were preferred wearing facemasks over social distancing which is consistent with the findings of Park and Oh [15]. This suggests the need to improve the preventive behavior of university students, especially in the case of social distancing. One male respondent noted that "we must maintain social distance from each other" (male, 2nd year student of a private university).

The findings suggest that respondents who always use facemasks were less likely to select their desire to wait and see to take vaccine. Surprisingly, our study suggests that, the proportion of respondents who were maintaining social distancing desire to wait and see for vaccination. As one respondent informed "Vaccine will not stop from getting the COVID-19. Even after getting the vaccine, some people are being infected. The vaccine will help to lower the death rate and suffering level. Maintaining hygiene and social distancing is the ultimate prevention" (female, 3rd year student of a private university).

Although our study found no evidence of an association between vaccination intention with perceived severity, perceived susceptibility and perceived benefits variables, previous studies conducted elsewhere reported otherwise [10]. A study in Bangladesh revealed that perceived benefits are associated with the vaccine hesitancy [17]. Another study in Israel found that vaccination intention was higher among the respondents who perceived higher disease severity [10]. Surprisingly, the perceived susceptibility (worried of getting COVID-19) of university students was lower. The findings is consistent with the findings of Park and Oh [15] which reported lower perceived susceptibility of COVID-19 among the South Korean adolescents. This may be because students believe that they are not susceptible to COVID-19 infection which necessities to increase their perceived susceptibility when classes will be resumed physically.

Our findings also demonstrated that larger proportion of respondents believed that the vaccine is safe. Lower rate of vaccination willingness were reported among the respondents who were concerned about the COVID-19 vaccine safety, similar to what was seen by other studies [6,17,18,28,30]. On the other hand, the positive association between desire to wait and see with the side effects and doubts in the effectiveness of vaccines implied that respondents preferred to delay their decision to vaccinate. This may be because of the short peri-



od vaccine development resulting in worries about the side effects of the vaccine [8]. These results are in the agreement with those of Alqudeimat et al. [5] and Mouter et al. [8], who reported that the desire to wait and see to take COVID-19 were higher among the respondents who were concerned about the side effects and effectiveness of the vaccines. Similarly, a study conducted by Adams et al. [25] in the United States found that unvaccinated young adult desire to wait and see to take the COVID-19 vaccine because of their concern over side effects, and safety of the vaccine. One respondent informed “I think the COVID-19 vaccine will show its side effects in the future, and the vaccine is not well tested. Now no one knows what will happen” (male, 2nd year student of a private university).

Our findings also suggested that the probability to desire to wait and see was higher among the respondents who want to get more information on vaccines. Studies reported that misinformation regarding the side effects and rumors about the COVID-19 vaccine negatively affect the intention to take vaccine [17,18]. This means that respondents were not inclined to believe the rumors rather they seek more information that is based on science. This is probably because the respondents are currently studying at the university level. Our findings are in the agreement with those of other studies [5,10,19,25,34]. One of the respondents noted, “It is not like I do not want to take the vaccine. The information about the COVID-19 vaccine provided by our government is not enough for me” (female, 1st year student of a private university). Another respondent informed that “I want to be vaccinated, but the news about the side effects worries me” (male, 1st year student of a private university).

The study has some limitations. Since this study adopted online approach to collect data, individuals without internet were out of the survey. However, it was the only effective ways to conduct a survey with the university students since no educational institutions were allowed to take classes physically. Therefore, caution is required before generalizing the findings of this study.

Another concern is the timing of the survey when all the dormitories of universities were closed in response to COVID-19. Preferences for the willingness to vaccination and desire to wait and see might also be changed through time as more students get in touch with their peers, as more and more students will change their attitude towards vaccination. The data collection period covered the period of COVID-19 outbreak by the infectious Delta variant in Bangladesh. This may

affect respondents’ willingness to vaccination. Willingness to wait to take vaccine may also be changed once the potential side effects and effectiveness of COVID-19 vaccine is readily available to all. We welcome further studies including face-to-face interviews using qualitative approach in hard-to-reach area where internet services are poor or have limited access to mobile phones or personal computers. Nevertheless, this study examined a wide range of factors in relations to students’ intention to take COVID-19 vaccine which might help public health managers to reduce vaccine hesitancy at population level.

In conclusion, with the spread of COVID-19 throughout the world, the government is trying to reach the herd immunity through the mass vaccination campaigns. In total, over 90% respondents from the universities of Bangladesh were willing to take COVID-19 vaccine and only 37.1% respondents desire to wait to take COVID-19 vaccine, with numerous factors influencing their intension to take vaccine. This study found several health beliefs variables correlated with the intention to take COVID-19 vaccine. Our results highlight that marital status and type of university seems to be significant predictors of vaccination intention. Other important variables associated with the intension to take vaccine are concern about the side effects and effectiveness of the vaccine. However, individuals who are practicing social distancing at public spaces are more likely to wait to take the vaccine. Perceived susceptibility and COVID-19 preventive behaviors especially, maintaining social distancing was lower among the university students. Such findings are very important for the university managers and policymakers to take appropriate measures for the vaccination programs in Bangladesh and other developing countries. Although vaccination is one of the efficient ways to end the COVID-19 pandemic, dissemination of trusted and adequate information on COVID-19 vaccine is essential to success the nation-wide voluntary vaccination campaign efforts.

## ORCID

Nasir Ahmed Shuvo <https://orcid.org/0000-0002-2261-2097>

Md Sanaul Haque Mondal <https://orcid.org/0000-0002-0412-0558>

## References

1. Karlsson LC, Soveri A, Lewandowsky S, et al. Fearing the

- disease or the vaccine: the case of COVID-19. *Pers Individ Dif* 2021;172:110590.
2. Najmi A, Nazari S, Safarighouzhdi F, MacIntyre CR, Miller EJ, H Rashidi T. Facemask and social distancing, pillars of opening up economies. *PLoS One* 2021;16:e0249677.
  3. Patel SP, Patel GS, Suthar JV. Inside the story about the research and development of COVID-19 vaccines. *Clin Exp Vaccine Res* 2021;10:154-70.
  4. Kwok KO, Li KK, Wei WI, Tang A, Wong SY, Lee SS. Editor's choice: influenza vaccine uptake, COVID-19 vaccination intention and vaccine hesitancy among nurses: a survey. *Int J Nurs Stud* 2021;114:103854.
  5. Alqudeimat Y, Alenezi D, AlHajri B, et al. Acceptance of a COVID-19 vaccine and its related determinants among the general adult population in Kuwait. *Med Princ Pract* 2021;30:262-71.
  6. Al-Mistarehi AH, Kheirallah KA, Yassin A, et al. Determinants of the willingness of the general population to get vaccinated against COVID-19 in a developing country. *Clin Exp Vaccine Res* 2021;10:171-82.
  7. The U.S. Food and Drug Administration (FDA). FDA takes key action in fight against COVID-19 by issuing emergency use authorization for first COVID-19 vaccine [Internet]. Silver Spring (MD): FDA; 2020 [cited 2022 Feb 2]. Available from: <https://www.fda.gov/news-events/press-announcements/fda-takes-key-action-fight-against-covid-19-issuing-emergency-use-authorization-first-covid-19>.
  8. Mouter N, de Ruijter A, Ardine de Wit G, et al. "Please, you go first!" preferences for a COVID-19 vaccine among adults in the Netherlands. *Soc Sci Med* 2022;292:114626.
  9. Lamptey E, Serwaa D, Appiah AB. A nationwide survey of the potential acceptance and determinants of COVID-19 vaccines in Ghana. *Clin Exp Vaccine Res* 2021;10:183-90.
  10. Shmueli L. Predicting intention to receive COVID-19 vaccine among the general population using the health belief model and the theory of planned behavior model. *BMC Public Health* 2021;21:804.
  11. Directorate General of Health Services. COVID-19 dynamic dashboard for Bangladesh [Internet]. Dhaka: Directorate General of Health Services; 2022 [cited 2022 Jan 15]. Available from: <http://103.247.238.92/webportal/pages/covid19.php>.
  12. World Health Organization. WHO coronavirus (COVID-19) dashboard [Internet]. Geneva: World Health Organization; 2022 [cited 2022 Feb 20]. Available from: <https://covid19.who.int/table>.
  13. Hatabu A, Mao X, Zhou Y, et al. Knowledge, attitudes, and practices toward COVID-19 among university students in Japan and associated factors: an online cross-sectional survey. *PLoS One* 2020;15:e0244350.
  14. Stein-Zamir C, Abramson N, Shoob H, et al. A large COVID-19 outbreak in a high school 10 days after schools' reopening, Israel, May 2020. *Euro Surveill* 2020;25:2001352.
  15. Park S, Oh S. Factors associated with preventive behaviors for COVID-19 among adolescents in South Korea. *J Pediatr Nurs* 2022;62:e69-76.
  16. Daly M, Robinson E. Willingness to vaccinate against COVID-19 in the U.S.: representative longitudinal evidence from April to October 2020. *Am J Prev Med* 2021;60:766-73.
  17. Hossain MB, Alam MZ, Islam MS, et al. COVID-19 vaccine hesitancy among the adult population in Bangladesh: a nationwide cross-sectional survey. *PLoS One* 2021;16:e0260821.
  18. Kabir R, Mahmud I, Chowdhury MT, et al. COVID-19 vaccination intent and willingness to pay in Bangladesh: a cross-sectional study. *Vaccines (Basel)* 2021;9:416.
  19. Lazarus JV, Ratzan SC, Palayew A, et al. A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med* 2021;27:225-8.
  20. Rosental H, Shmueli L. Integrating health behavior theories to predict COVID-19 vaccine acceptance: differences between medical students and nursing students. *Vaccines (Basel)* 2021;9:783.
  21. Faasse K, Newby J. Public perceptions of COVID-19 in Australia: perceived risk, knowledge, health-protective behaviors, and vaccine intentions. *Front Psychol* 2020;11:551004.
  22. World Health Organization. Report of the SAGE Working Group on vaccine hesitancy. Geneva: World Health Organization; 2015.
  23. Wibowo J, Heriyanto RS, Wijovi F, et al. Factors associated with side effects of COVID-19 vaccine in Indonesia. *Clin Exp Vaccine Res* 2022;11:89-95.
  24. Harper CA, Satchell LP, Fido D, Litzman RD. Functional fear predicts public health compliance in the COVID-19 pandemic. *Int J Ment Health Addict* 2021;19:1875-88.
  25. Adams SH, Schaub JP, Nagata JM, Park MJ, Brindis CD, Irwin CE Jr. Young adult perspectives on COVID-19 vaccinations. *J Adolesc Health* 2021;69:511-4.
  26. Du SY, Dai YX, Li PW, Zhao N, Li S, Zheng Y. Vaccinated or not?: survey on attitude toward 'approach-avoidance conflict' under uncertainty. *Hum Vaccin Immunother*

- 2022;18:1-6.
27. Abedin M, Islam MA, Rahman FN, et al. Willingness to vaccinate against COVID-19 among Bangladeshi adults: understanding the strategies to optimize vaccination coverage. *PLoS One* 2021;16:e0250495.
28. Patwary MM, Bardhan M, Disha AS, et al. Determinants of COVID-19 vaccine acceptance among the adult population of Bangladesh using the health belief model and the theory of planned behavior model. *Vaccines (Basel)* 2021;9:1393.
29. Wadood MA, Mamun A, Rafi MA, et al. Survey on knowledge, attitude, perception and practice among university students during the COVID-19 pandemic. *SciMed J* 2021; 3:67-79.
30. Hossain ME, Islam MS, Ghose TK, et al. COVID-19 vaccine acceptability among public university students in Bangladesh: highlighting knowledge, perceptions, and attitude. *Hum Vaccin Immunother* 2021;17:5089-98.
31. Jones CJ, Smith H, Llewellyn C. Evaluating the effectiveness of health belief model interventions in improving adherence: a systematic review. *Health Psychol Rev* 2014; 8:253-69.
32. Bangladesh Bureau of Statistics. *Statistical yearbook Bangladesh 2020*. Dhaka: Bangladesh Bureau of Statistics; 2021.
33. Shahriar SH, Arafat S, Sultana N, et al. The transformation of education during the corona pandemic: exploring the perspective of the private university students in Bangladesh. *Asian Assoc Open Univ J* 2021;16:161-76.
34. Dror AA, Eisenbach N, Taiber S, et al. Vaccine hesitancy: the next challenge in the fight against COVID-19. *Eur J Epidemiol* 2020;35:775-9.