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# What is driving unwillingness to receive the COVID-19 vaccine in adult Bangladeshi after one year of vaccine rollout? Analysis of observational data

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## ABSTRACT

**Objective:** The present study aimed to (1) assess the prevalence of COVID-19 vaccine unwillingness and (2) identify the factors associated with vaccine unwillingness.

**Methods:** This cross-sectional study analyzed data of 2633 Bangladeshi adults. Descriptive analysis was performed to compute the prevalence of vaccine unwillingness by the participants' sociodemographic characteristics. Multiple logistic regression analyses were performed to compute Adjusted Odds Ratios (AORs) with vaccine unwillingness as a dependent variable and sociodemographic characteristics as predictor variables for vaccine unwillingness.

**Results:** Overall, 27.4% respondents showed unwillingness to receive the COVID-19 vaccine. Regression model suggested that groups with significantly higher odds of vaccine unwillingness were found to be participants aged 18-25 years (AOR= 3.41, CI= 1.71-6.80), Muslim (AOR= 1.81, CI= 1.21-2.71), participants with higher secondary education (AOR= 3.12, CI= 1.73-5.63), unemployed (AOR= 8.79, CI= 5.42-14.26), participants with monthly household income < □ 15000 (AOR= 4.03, CI= 2.51-6.47), residents of a semi-urban setting (AOR= 1.43, CI= 1.01-2.03), participants affiliated with opposition parties (AOR= 2.82, CI= 1.89-4.21), and participants who did not report that they or their family members tested positive for COVID-19 (AOR= 4.32, CI= 3.08-6.07).

**Conclusion:** The study findings suggested that a certain vaccine literacy campaign targeting semi-urban, low-income, and low-educated Bangladeshi is warranted to ensure the widespread uptake of COVID-19 vaccines in Bangladesh.

## Introduction

Coronavirus disease-2019 (COVID-19) has killed more than 6.2 million people since the pandemic started in December 2019 (WHO, 2021). However, scientists responded to the pandemic at an unprecedented pace and invented safe vaccines that would reduce the severity of the disease, and consequently the death rate in less than one year (Voysey et al., 2021). The full pace of COVID-19 vaccine rollout has been started by the end of 2020 in several countries worldwide (Mathieu et al., 2021). Despite the high efficacy of COVID-19 vaccines, a significant number of people show unwillingness to receive the vaccine. As a result, a high prevalence of vaccine hesitancy has been observed globally (Cascini, Pantovic, Al-Ajlouni, Failla, & Ricciardi, 2021). Many anti-vaccine protest groups are still active in several parts of the world ("Canada truckers' vaccine protest spirals into calls to repeal all public health rules | Canada | The Guardian," n.d.).

More than 60% of the world population received at least one dose of the COVID-19 vaccine; however, some countries, for example, the United States of America (USA) and the United Kingdom (UK), are struggling to reach their optimum target ("Coronavirus (COVID-19) Vaccinations - Our World in Data," n.d.). It is observed that, in some countries, vaccinating around 70% of the country's population has gone smoothly, and getting the rest of the people becomes more challenging. In Bangladesh, a previous study suggested that more than 32% of the population were hesitant to receive the COVID-19 vaccine (Ali & Hossain, 2021). By February 2022, about 60% of Bangladeshi received at least one dose of vaccine ("Coronavirus (COVID-19) Vaccinations - Our World in Data," n.d.); however, vaccinating the rest of the population might be challenging. Like the USA and the UK, Bangladesh may face a hurdle when reaching the vaccination target of 80% of the general population. In addition, 43% of the parental vaccine hesitancy might be another concern when vaccinating the pediatric population in

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Bangladesh (Ali, Ahmed, et al., 2022; Ali, Proma, et al., 2022). Previous studies suggested that sociodemographic factors such as age, gender, occupation, household income, and religious belief determined vaccine hesitancy in Bangladesh (Ali & Hossain, 2021). However, vaccine hesitancy is complex in disposition and is adherence-specific, varying over time, location, and perceived behavioral nature of the community (Larson, Jarrett, Eckersberger, Smith, & Paterson, 2014). Most of the studies conducted in Bangladesh were when vaccine rollout just started. Very little is known about vaccine unwillingness after one year of vaccine rollout in Bangladesh. We hypothesized that the prevalence rate would not match the rate found in previous studies; thus, measuring the prevalence rate and identifying the subgroups of populations with higher unwillingness to receive vaccines might help the policymakers when discussing optimal vaccine coverage for unvaccinated population. This study aimed to (1) assess the prevalence of COVID-19 vaccine unwillingness and (2) identify the factors associated with vaccine unwillingness.

## Materials and Methods

### *Design, participants, and data collection*

Data were collected from October 10 to October 31, 2022, for this cross-sectional study. Approximately 3000 adult Bangladeshi were conveniently invited to participate in an in-person interview using a semi-structured questionnaire. Data were collected from marketplaces, shopping malls, waiting rooms of large hospitals, diagnostic centers, bus and rail stations, and residences. Eight teams comprised of two previously trained data collectors have collected data from all eight divisions of Bangladesh. We received data from 2703 participants due to a 90% response rate. However, 36 participants did not answer all the questions thus were excluded. We also excluded 34 subject points for contradicting answers to the question. These exclusions meant that only 2633 respondents were included in the final analysis.

### *Questionnaire*

A set of structured questions assessed the participants' age, sex, religion, current marital status, education, employment status, monthly household income (Bangladeshi taka, 1 USD = approximately 86 Bangladeshi taka), permanent address, and the region of residence (north, south, and central zones in Bangladesh, including Dhaka), current residence type (own/rented/others), family type (nuclear or extended, number of children), current tobacco use status, religious practice habits, and political affiliation was collected. Participants were asked some additional COVID-19 vaccine-related questions: "Did you or your family member(s) test positive for COVID-19?" and "Have you lost any of your family member(s) to COVID-19?" The last two questions received dichotomous (yes or no) answers. Finally, participants' vaccination decisions were measured by the vaccine willingness question: "Have you received or plan to receive the COVID-19 vaccine?". There were three answer options for this question: (a) I already received the vaccine, (b) I will receive the vaccine, (c) I will not receive the vaccine. The questions were based on published vaccine unwillingness or hesitancy articles (Ali & Hossain, 2021).

### *Statistical analysis*

Descriptive analysis was performed to compute the prevalence of vaccine unwillingness by the participants' sociodemographic characteristics. The Fisher's exact test was used for dichotomous variables, and the chi-squared test was used for the variables that consisted of more than two categories to assess vaccine unwillingness rates and draw comparisons between the subgroups. Response to the vaccine willingness question was dichotomized as 'yes' (already received/will receive the vaccine) and 'no' (will not receive the vaccine). To compute Adjusted

Odds Ratios (AORs) with a 95% Confidence Interval (CI), multiple logistic regression analyses were performed with vaccine unwillingness as a dependent variable and sociodemographic characteristics as predictor variables for vaccine unwillingness. Variables significantly associated with vaccine unwillingness in the descriptive analysis were included in the regression model. The Hosmer-Lemeshow goodness-of-fit test was used to ensure that the models adequately fit the data. The significance level was set at  $p \leq 0.05$ , and SPSS V.22.0 (IBM) was used for all data analyses.

## Results

### *Results of descriptive analysis*

This study included 2633 adult Bangladeshi aged  $34.97 \pm 7.87$  years (mean  $\pm$  standard deviation). The majority of the participants were female (52.8%), were in 31-35 years age group (24.8%), were married (96%), were Muslim (89.4%), had low-level education (38.8%), were homemakers (28.7%), had monthly household income  $\leq$  15000 – 30000 (31.6%), were living in their own house (54.5%), were from the village (58%) and central Bangladesh (50.2%), were tobacco non-user (64.4%), were regular religious practitioner (68.2%), and had no political affiliation (39.2%). Furthermore, 28% of participants reported that they or their family members tested positive for COVID-19, and 5.7% lost a family member to COVID-19.

Descriptive analysis suggested that 27.4% of surveyed Bangladeshi showed their unwillingness to receive the COVID-19 vaccine. However, the highest prevalence of unwillingness was found in males (30.3%), participants of age group 31-35 years (24.8%), Muslims (29.1%), participants who were from a nuclear family (28.5%), low educated participants (37.9%), unemployed (69.8%), participants who had monthly household income  $<$  15 000, residents of a village (31.9%) and northern Bangladesh (37.4%), tobacco users (30.7%), those who were affiliated with opposition parties (44.9%). Similarly, a higher level of unwillingness has been observed among participants who did not report that they or their family members tested positive for COVID-19 (35.6%) and did not lose a family member to COVID-19 (28.7%). Table 1 shows the detailed results.

### *Results of multiple logistic regression analysis*

The final model revealed that groups with significantly higher odds of vaccine unwillingness were found to be participants aged 18-25 years (AOR= 3.41, CI= 1.71-6.80), Muslim (AOR= 1.81, CI= 1.21-2.71), participants with higher secondary education (AOR= 3.12, CI= 1.73-5.63), unemployed (AOR= 8.79, CI= 5.42-14.26), participants with monthly household income  $<$  15000 (AOR= 4.03, CI= 2.51-6.47), residents of a semi-urban setting (AOR= 1.43, CI= 1.01-2.03), participants affiliated with opposition parties (AOR= 2.82, CI= 1.89-4.21), participants who did not report that they or their family members tested positive for COVID-19 (AOR= 4.32, CI= 3.08-6.07). Table 2 presents results of regression analysis.

## Discussion

This comprehensive study revealed that well above one-fourth of adult Bangladeshi were unwilling to receive the COVID-19 vaccine after one year of vaccine rollout in Bangladesh. Vaccine unwillingness was mainly associated with younger age, lower educational status, unemployment, low income, residence in rural and semi-urban settings, and political affiliation with opposition parties. Similarly, Muslims and participants who did not report that they or their family members tested positive for COVID-19 showed significant unwillingness to receive the COVID-19 vaccine compared to their counterparts.

A systematic review and meta-analysis of COVID-19 vaccine acceptance studies concluded that the overall vaccine acceptance had ranged

**Table 1**  
Descriptive analysis: Sociodemographic characteristics of the participants and vaccine unwillingness

Variables	Total sample n (%)		Have you taken or plan to take COVID-19 vaccine		P-value
	No	Yes	Yes	No	
All participants	2633 (100)	722 (27.4)	1911 (72.6)		N/A
<b>Sex</b>					<b>0.002</b>
Female	1390 (52.8)	345 (24.8)	1045 (75.2)		
Male	1243 (47.2)	377 (30.3)	866 (69.7)		
<b>Age group</b>					<b>&lt;0.001</b>
18 – 25	268 (10.2)	122 (45.5)	146 (54.5)		
26 – 30	604 (22.9)	204 (33.8)	400 (66.2)		
31 – 35	653 (24.8)	166 (25.4)	487 (74.6)		
36 – 40	563 (21.4)	130 (23.1)	433 (76.9)		
41 – 45	285 (10.8)	50 (17.5)	235 (82.5)		
46 – 50	162 (6.2)	32 (19.8)	130 (80.2)		
≥ 51	98 (3.7)	18 (18.4)	80 (81.6)		
<b>Marital status</b>					0.187
Married	2527 (96)	678 (27.2)	1840 (72.8)		
Others	106 (4)	35 (33.0)	71 (67.0)		
<b>Religion</b>					<b>&lt;0.001</b>
Muslim	2358 (89.4)	685 (29.1)	1669 (70.9)		
Hindu	258 (9.8)	35 (13.6)	223 (86.4)		
Buddhist	6 (.2)	0 (0)	6 (100)		
Christian	15 (.6)	2 (13.3)	13 (86.7)		
<b>Type of family</b>					0.077
Extended family	842 (32)	212 (25.2)	630 (74.8)		
Nuclear family	1791 (68)	510 (28.5)	1281 (71.5)		
<b>Educational qualification</b>					<b>&lt;0.001</b>
≤ High school	1022 (38.8)	387 (37.9)	635 (62.1)		
Higher secondary education	594 (22.6)	201 (33.8)	393 (66.2)		
Graduate	608 (23.1)	118 (19.4)	490 (80.6)		
Post-graduate	409 (15.5)	16 (3.9)	393 (96.1)		
<b>Occupation</b>					<b>&lt;0.001</b>
Service	677 (25.7)	116 (17.1)	561 (82.9)		
Business	472 (17.9)	118 (25.0)	354 (75.0)		
Unemployed	179 (6.8)	125 (69.8)	54 (30.2)		
Student	56 (2.1)	14 (25.0)	42 (75.0)		
Home maker	756 (28.7)	270 (35.7)	486 (64.3)		
Healthcare	216 (8.2)	13 (6.0)	203 (94.0)		
Daily labor	277 (10.5)	66 (23.8)	211 (76.2)		
<b>Monthly household income (□)</b>					<b>&lt;0.001</b>
<□15 000	799 (30.3)	343 (42.9)	456 (57.1)		
□ 15000 – 30000	833 (31.6)	267 (32.1)	566 (67.9)		
□ 31000 – 45000	433 (16.4)	76 (17.6)	357 (82.4)		
>□ 45000	568 (21.6)	36 (6.3)	532 (93.7)		
<b>Current residence type</b>					<b>&lt;0.001</b>
Own	1436 (54.5)	444 (30.9)	992 (69.1)		
Rented	1075 (40.8)	236 (22.0)	839 (78.0)		
Others	122 (4.6)	42 (34.4)	80 (65.6)		
<b>Permanent address</b>					<b>&lt;0.001</b>
Village	1528 (58)	488 (31.9)	1040 (68.1)		
Semi-urban	535 (20.3)	139 (26.0)	396 (74.0)		
City	570 (21.6)	95 (16.7)	475 (83.3)		
<b>Current living location</b>					<b>&lt;0.001</b>
Central zone	1323 (50.2)	293 (22.1)	1030 (77.9)		
North zone	921 (35)	344 (37.4)	577 (62.6)		
South zone	389 (14.8)	85 (21.9)	304 (78.1)		
<b>Present tobacco user</b>					<b>0.005</b>
No	1695 (64.4)	434 (25.6)	1261 (74.4)		
Yes	938 (35.6)	288 (30.7)	650 (69.3)		
<b>Regular religious practice</b>					0.724
No	836 (31.8)	233 (27.9)	603 (72.1)		
Yes	1797 (68.2)	489 (27.2)	1308 (72.8)		
<b>Political affiliation</b>					<b>&lt;0.001</b>
Ruling party	779 (30.3)	161 (20.2)	638 (79.8)		
Opposition	296 (11.2)	133 (44.9)	163 (55.1)		
Neutral	1032 (39.2)	345 (33.4)	687 (66.6)		
Prefer not to say	506 (19.2)	83 (16.4)	423 (83.6)		
<b>Have you or your family member(s) tested positive for COVID-19?</b>					<b>&lt;0.001</b>
No	1881 (71.4)	669 (35.6)	1212 (64.4)		
Yes	752 (28.6)	53 (7.0)	699 (93.0)		
<b>Have you lost any of your family member(s) to COVID-19?</b>					<b>&lt;0.001</b>
No	2482 (94.3)	712 (28.7)	1770 (71.3)		
Yes	151 (5.7)	10 (6.6)	141 (93.4)		

Bold faces are significant at ≤5% significance level.

**Table 2**  
Multiple logistic regression: predictors of vaccine unwillingness in study participants

Variables	Adjusted OR	SE	95% CI		P-value
<b>Sex</b>					
Female	0.712	0.165	0.516	0.984	<b>0.039</b>
Male	Reference				
<b>Age group</b>					
18 - 25	3.408	0.352	1.708	6.801	<b>0.001</b>
26 - 30	2.778	0.334	1.443	5.348	<b>0.002</b>
31 - 35	2.045	0.332	1.067	3.920	<b>0.031</b>
36 - 40	2.043	0.335	1.060	3.935	<b>0.033</b>
41 - 45	1.288	0.360	.637	2.606	0.481
46 - 50	1.356	0.389	.633	2.904	0.433
≥ 51	Reference				
<b>Religion</b>					
Muslim	1.810	0.206	1.209	2.708	<b>0.004</b>
Non-Muslim	Reference				
<b>Educational qualification</b>					
≤ High school	2.980	0.312	1.616	5.495	<b>&lt;0.001</b>
Higher secondary education	3.119	0.301	1.728	5.629	<b>&lt;0.001</b>
Graduate	2.648	0.295	1.485	4.724	<b>0.001</b>
Postgraduate	Reference				
<b>Occupation</b>					
Service	1.482	0.225	0.954	2.302	0.080
Business	1.925	0.222	1.246	2.975	<b>0.003</b>
Unemployed	8.793	0.247	5.423	14.256	<b>&lt;0.001</b>
Student	1.077	0.404	0.488	2.377	0.854
Home maker	1.989	0.225	1.279	3.092	<b>0.002</b>
Healthcare	0.809	0.379	0.385	1.699	0.575
Daily labor	Reference				
<b>Monthly household income (□)</b>					
<□15 000	4.026	0.242	2.506	6.467	<b>&lt;0.001</b>
□ 15000 - 30000	3.265	0.219	2.127	5.013	<b>&lt;0.001</b>
□ 31000 - 45000	1.889	0.234	1.195	2.987	<b>0.007</b>
>□ 45000	Reference				
<b>Current residence type</b>					
Own	0.742	0.246	0.458	1.201	0.225
Rented	0.866	0.247	0.534	1.405	0.561
Others	Reference				
<b>Permanent address</b>					
Village	1.064	0.157	0.782	1.447	0.695
Semi-urban	1.430	0.178	1.009	2.026	<b>0.044</b>
City	Reference				
<b>Current living location</b>					
Central zone including Dhaka	1.347	0.167	0.970	1.869	0.075
North zone	1.129	0.169	0.810	1.574	0.474
South zone	Reference				
<b>Present tobacco user</b>					
No	0.851	0.123	0.669	1.081	0.187
Yes	Reference				
<b>Political affiliation</b>					
Ruling party	1.103	0.170	0.791	1.538	0.563
Opposition	2.821	0.204	1.893	4.206	<b>&lt;0.001</b>
Neutral	2.184	0.156	1.608	2.968	<b>&lt;0.001</b>
I prefer not to say	Reference				
<b>Have you or your family member(s) tested positive for COVID-19</b>					
No	4.322	0.381	3.076	6.074	<b>&lt;0.001</b>
Yes	Reference				
<b>Have you lost any of your family member(s) to COVID-19</b>					
No	1.399	0.381	0.663	2.952	0.378
Yes	Reference				

Bold faces are significant at ≤5% significance level.

from 12% to 91.4% in the USA (Yasmin et al., 2021). Our previous study conducted in January 2021 in Bangladesh suggested that the day-to-day vaccine willingness rate had fluctuated from 35% to 83% (Ali & Hossain, 2021). Another study conducted in January reported an 80% positive intention toward the COVID-19 vaccine (Akiful Haque et al., 2021). On the contrary, a study conducted in early February 2021 estimated a 46.2% hesitancy rate (Hossain et al., 2021a). However, a late February study suggested a 79% acceptance rate (Lee et al., 2022). A study conducted in March revealed that 30% of adult Bangladeshi were hesitant to receive the COVID-19 vaccine (Rahman et al., 2021). Finally, a July 2021 study found only 15% of Bangladeshi were reluctant to be vacci-

nated against COVID-19 (Patwary et al., 2021). However, this study was conducted in the time when the vaccination program was matured, and vaccines were readily and freely available throughout the country for any Bangladeshi aged 12 and above. Thus our study findings (i.e., 27.4% unwillingness) indicate a necessity of further stress on a COVID-19 vaccine campaign targeting subgroups with higher vaccine unwillingness as found in this study.

Closer analyses of the data we extracted revealed that more men were unwilling to receive vaccines than were women. The previous study also found a similar scenario (Ali & Hossain, 2021); however, additional study is warranted to understand the cause behind the gender

heterogeneity regarding the COVID-19 vaccination decision. However, we found younger adults had higher odds of vaccine hesitancy in this study. Another similar study found no significant differences in vaccine unwillingness prevalence among different age groups (Hossain et al., 2021b). Contrarily, other Bangladeshi studies found lower odds of vaccine hesitancy among populations over 60 years (Akiful Haque et al., 2021; Lee et al., 2022). A possible cause of this contradiction may be the nature of data collection (i.e., online interview vs. in-person interview). An additional study that would take data using the in-personal interview method among Bangladeshi aged over 60 years might confirm the result.

Nonetheless, in line with the other Bangladeshi studies (Akiful Haque et al., 2021; Hossain et al., 2021a, 2021b; Lee et al., 2022), we found high vaccine unwillingness among the unemployed and homemakers. Similarly, participants with low household income and low educational status reported vaccine unwillingness at significantly higher rates. In addition, the trend of higher unwillingness to receive COVID-19 vaccine among unemployed, low income and low educated groups was observed internationally (Cascini et al., 2021; Hawlader et al., 2022; Yasmin et al., 2021). Furthermore, participants living in rural and semi-urban settings showed unwillingness to take the vaccine at a significantly higher rate. Unsurprisingly, previous studies have also shown similar results (Ali & Hossain, 2021; Cascini et al., 2021; Hawlader et al., 2022).

A systematic review and meta-analysis found that vaccine hesitancy in low and middle-income countries largely depended on a range of trust-based relationships, such as trust in healthcare professionals, the health system, the government, and friends and family members (Larson et al., 2018). Our study found higher vaccine unwillingness odds among participants who reported affiliation with opposition parties. Similarly, risk perception is central to many health behavior theories. A systematic review and meta-analysis concluded that vaccination behavior is significantly predicted by the likelihood of risk, susceptibility, and severity of the disease (Brewer et al., 2007). We found significantly higher odds of vaccine unwillingness among participants who said that they or their family members had not tested positive for COVID-19 yet.

Most of the previous studies measured COVID-19 vaccine intention using web-based data. However, the main strength of this study was the use of anonymous face-to-face interviews to reduce social desirability bias, minimize non-response, and maximize the quality of collected data. Further, this study included a larger sample size. Nonetheless, this study has several limitations. First, this research used a cross-sectional study design which cannot establish causality. Second, we did not use a validated vaccine intention questionnaire to determine vaccine unwillingness; thus, the subjective nature of the questions may undermine the result. Third, this study included many younger adults, which might undermine the prevalence rate.

## Conclusion

The findings of this study and a review of the existing literatures regarding COVID-19 vaccine intention potently indicated that a high prevalence of unwillingness to receive the vaccine is persistent among Bangladeshi adults who live in semi-urban and rural settings. Additionally, people with lower household income and lower educational status were reluctant to be vaccinated against COVID-19. Similarly, Muslims showed more unwillingness toward vaccines. Therefore, a special campaign targeting semi-urban, low-income, and low-educated populations is warranted. In addition, involving religious leaders in vaccination campaigns would also facilitate the program.

## Declaration of Competing Interest

None of the authors reported any conflict of interest.

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## Ethics Committee Approval and Consent

Ethical clearances for this study were obtained from the institutional review board of Uttara Adhunik Medical College and Hospital.

## Consent

All the participants have provided written informed consent.

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