


# The COVID-19 vaccination experience in Bangladesh: Findings from a cross-sectional study

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## Abstract

**Objectives:** Vaccination rollout against COVID-19 has started in developed countries in early December 2020. Mass immunization for poor or low-income countries is quite challenging before 2023. Being a lower–middle-income country, Bangladesh has begun a nationwide COVID-19 vaccination drive in early February 2021. Here, we aimed to assess the opinions, experiences, and adverse events of the COVID-19 vaccination in Bangladesh.

**Methods:** We conducted this online cross-sectional study from 10 February 2021, to 10 March 2021, in Bangladesh. A self-reported semi-structured survey questionnaire was used using Google forms. We recorded demographics, disease history, medication records, opinions and experiences of vaccination, and associated adverse events symptoms.

**Results:** We observed leading comorbid diseases were hypertension (25.9%), diabetes (21.1%), heart diseases (9.3%), and asthma (8.7%). The most frequently reported adverse events were injection site pain (34.3%), fever (32.6%), headache (20.2%), fatigue (16.6%), and cold feeling (15.4%). The chances of having adverse events were significantly higher in males than females ( $p = 0.039$ ). However, 36.4% of respondents reported no adverse events. Adverse events usually appeared after 12 h and went away within 48 h of vaccination. Besides, 85.5% were happy with the overall vaccination management, while 88.0% of the respondents recommended the COVID-19 vaccine for others for early immunization.

**Conclusion:** According to the present findings, reported adverse events after the doses of Covishield in Bangladesh were non-serious and temporary. In Bangladesh, the early vaccination against COVID-19 was possible due to its prudent vaccine deal, previous mass vaccination experience, and vaccine diplomacy.

## Keywords

COVID-19, Vaccination, Post-vaccination symptoms, Adverse events, Public health, Cross-sectional study, Vaccination experience, Bangladesh

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## Introduction

The COVID-19 has predated in almost all countries after its first detection in Wuhan City of China in December 2019.<sup>1</sup> The pandemic remains aggressively spreading. As of September 29, 2021, the reported confirmed cases and death were more than 232 million and 4.7 million, respectively.<sup>2</sup> Social distancing and wearing masks are the only measures to reduce viral spread without mass inoculation.<sup>3,4</sup> These defensive actions have drastically changed our social life and disturbed national and household economies in many countries.<sup>5</sup> Therefore, the COVID-19 has become a leading cause of death in the USA due to its failure to take adequate steps to prevent viral transmission.<sup>6</sup> Despite current mitigation efforts, the severity of the pandemic and its increasing morbidity and mortality underlines the need for mass immunization.<sup>7,8</sup> Therefore, vaccination is the central strategy to mitigating the COVID-19 pandemic.<sup>9</sup> At least 13 different vaccines are being administered against COVID-19 across the world.<sup>10</sup> Scientists employed various traditional and novel approaches to develop effective vaccines. They applied several technologies such as mRNA, viral vector, inactivated, protein subunit for new vaccine development. The viral spike protein and its receptor-binding domain were the principal targets of most vaccine candidates. The interaction between this domain and the human angiotensin-converting enzyme-2 receptor allows the viral entry into human epithelial cells.<sup>11</sup> Currently approved vaccines are engaging both humoral and cellular immune pathways through stimulating both B- and T-cell responses.

We can achieve mass immunity only through the extensive acceptance of COVID-19 vaccines among the general population. Experts assessed that about 67% of the people must be immunized against the coronavirus to stop transmission.<sup>12</sup> However, COVID-19 vaccine hesitancy is an obstacle to achieve herd immunity through mass vaccination.<sup>13</sup> The first mass vaccination program started in early December 2020.<sup>14</sup> Several reports showed the acceptance of COVID-19 vaccines were less than optimal. Eight surveys conducted between May 2020 and October 2020 showed that people who want to receive a COVID-19 vaccine ranged from 35–75% without a clear trend over time.<sup>15</sup> Acceptance rates varied by race or ethnicity; lower acceptance among Blacks than Whites.<sup>15</sup> A systematic review of 126 surveys regarding the acceptance of COVID-19 vaccines reported that hesitancy is increasing worldwide.<sup>16</sup> Most people were worried about the safety of the new COVID-19 vaccines. Thus, they were not willing to get COVID-19 vaccines due to their worries.<sup>16</sup> Bangladesh has started a nationwide vaccination drive on February 7, 2021.<sup>17</sup> As a developing country, Bangladesh has administered more than 41.5 million vaccine doses. However, 6.2 billion doses have been used globally as of 29 September 2021.<sup>18</sup> However, the Economist anticipated that most low-income

countries might not rollout mass vaccination programs before 2023.<sup>19</sup> Therefore, the present poll aimed to assess the opinions, experiences, disease, medication history, risks and impacts of COVID-19, and symptoms after the dose of COVID-19 vaccines among the Bangladeshi population.

## Methods

### Study design and participants

We conducted a cross-sectional web-based open survey among the Bangladeshi population who received the dose of the COVID-19 vaccine. We assumed the response rate, significance level, and margin of error as 20%, 5%, and 5%, respectively. Based on this calculation, the required sample size was 385 to achieve 80% statistical power.<sup>20,21</sup> Initially, the present study received 407 responses. We screened and excluded 15 responses due to partial or incomplete information. Finally, we took a total of 392 responses for the final analysis. The respondents were aware of the scope, eligibility criteria, and procedure of this survey. Then they voluntarily acknowledged and submitted an e-consent form to confirm their participation in a condition that the authors can publish anonymous data in a journal article. Eligibility criteria included the ability to read Bangla, Bangladeshi ethnicity and living in Bangladesh at that time, recipient of the dose of COVID-19 vaccine, and willingness to participate in this survey. We performed the present study following the CHERRIES (Checklist for Reporting Results of Internet E-Surveys) guidelines.<sup>22</sup>

### Survey questions

We used a self-reported semi-structured questionnaire regarding demographics, disease and health-related information, perception towards COVID-19 vaccination procedure, and post-vaccination adverse events (AEs). We prepared this questionnaire in English then translated them into Bangla. At first, a medical graduate and a general person who translated the questionnaire into Bangla were fluent in English and native speakers of Bangla. Then we compiled these two Bangla versions addressing the discrepancies to make a single Bangla forward version. Again, another medical graduate and a professional medical translator translated the Bangla version back into English. We compiled these two English versions addressing the issues to make a single English backward version.<sup>23</sup> We conducted a pilot survey to confirm the clarity and understanding of the questions.

### The estimations

We collected the data regarding the age, sex, body mass index (BMI), residence, marital status, educational qualification, profession, economic solvency, risk of getting

**Table 1.** Socio-demographic characteristics and their association with COVID-19 pandemic among the respondents.

Characteristics	Total (N = 392)		High risk of coronavirus infection (N = 114)				High impact of COVID-19 on life (N = 91)					
	n	%	n	%	$\chi^2$	df	p-value	n	%	$\chi^2$	df	p-value
Age in years												
20–40	177	45.15	52	45.61	0.78	2	0.679	41	45.05	0.07	2	0.968
41–60	164	41.84	47	41.23				38	41.76			
61 or above	51	13.01	15	13.16				12	13.19			
Sex												
Male	290	73.98	84	73.68	0.014	1	0.907	67	73.63	3.54	1	0.060
Female	102	26.02	30	26.32				24	26.37			
BMI (kg/m <sup>2</sup> )												
Below 18.5 (CED)	15	3.83	4	3.51	0.15	2	0.928	4	4.40	0.63	2	0.728
18.5–25 (normal)	199	50.77	58	50.88				46	50.55			
Above 25 (obese)	178	45.40	52	45.61				41	45.05			
Residence area												
Urban	295	75.26	86	75.44	4.98	1	0.026	69	75.82	1.72	1	0.189
Rural	97	24.74	28	24.56				22	24.18			
Marital status												
Married	305	77.81	89	78.07	1.64	1	0.201	71	78.02	0.003	1	0.959
Unmarried	87	22.19	25	21.93				20	21.98			
Education level												
Illiterate	5	1.28	1	0.88	0.88	3	0.831	1	1.10	1.45	3	0.694
Primary	10	2.55	3	2.63				2	2.20			
Secondary	87	22.19	26	22.81				21	23.08			
Graduate and above	290	73.98	84	73.68				67	73.62			
Profession												
Private service	143	36.48	41	35.96	14.36	5	0.013	33	36.26	7.44	5	0.190
Government service	82	20.92	24	21.05				19	20.88			
Self-employed/business	36	9.18	10	8.77				8	8.79			
Retired person	10	2.55	3	2.63				2	2.20			
Unemployed/student	46	11.74	13	11.40				11	12.09			
Others	75	19.13	23	20.18				18	19.78			
Economic impression												
Low	229	58.42	67	58.77	6.1	2	0.047	53	58.24	0.17	2	0.919
Medium	138	35.20	40	35.09				32	35.16			
High	25	6.38	7	6.14				6	6.60			
Health insurance												
Yes	87	22.19	25	21.93	9.9	1	0.002	20	21.98	1.27	1	0.259
No	305	77.81	89	78.07				71	78.02			

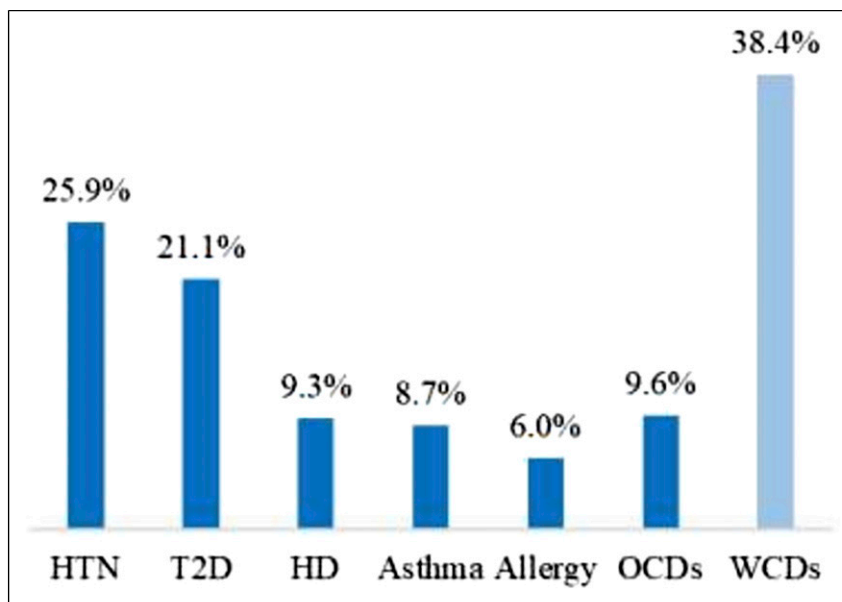
Abbreviations: BMI, body mass index; CED, chronic energy deficiency; COVID-19, coronavirus disease 2019.

infected by the coronavirus, and the impact of the COVID-19 pandemic. The disease and health-related information included COVID-19 history, pre-existing comorbidities, current medication, and vaccination history. The questions about the perception of vaccination procedure were related to the online registration procedure, discipline at the vaccination center and time required for vaccination, options for change or cancellation of the vaccination schedule, and service and information at the vaccination center. And finally, we tried to collect information related to post-vaccination AEs, duration of those effects, and management. We designed

the questionnaire into four sections and presented multiple questions on a single page for this survey. We used adaptive questioning to reduce the number and complexity of the questions. Also, questions were randomized to prevent biases.

### Data collection

We carried out this cross-sectional study between February 10, 2021 and March 10, 2021. We used snowball sampling to send a structured questionnaire link of Google Form to the participants via personal emailing, Facebook, Messenger,



**Figure 1.** History of one or multiple pre-existing comorbid diseases among the vaccinated individuals; Abbreviations: WCDs, individuals without comorbid diseases; HTN, hypertension; T2D, type two diabetes; HD, heart disease; OCDs, other comorbid diseases.

**Table 2.** Risk estimations of adverse events after the dose of the COVID-19 vaccine among the respondents.

Variables	Total N = 392		Adverse events after the dose of COVID-19 vaccine						Risk estimation		
	n	%	Yes (N = 252)		No (N = 140)		Chi-square tests			OR	95% CI
			n	%	n	%	$\chi^2$	df	p-value		
Age in years											
Below 40	177	45.18	114	64.41	63	35.59	0.003	1	0.957	0.988	0.629–1.550
40 or above	215	54.82	138	64.19	77	35.81					
Sex											
Male	255	65.06	154	60.39	101	39.61	4.24	1	0.039	0.601	0.369–0.978
Female	137	34.94	98	71.53	39	28.47					
BMI (kg/m <sup>2</sup> )											
Below 25	204	52.11	131	64.22	73	35.78	0	1	0.998	1	0.639–1.568
Above 25	188	47.89	121	64.36	67	35.64					

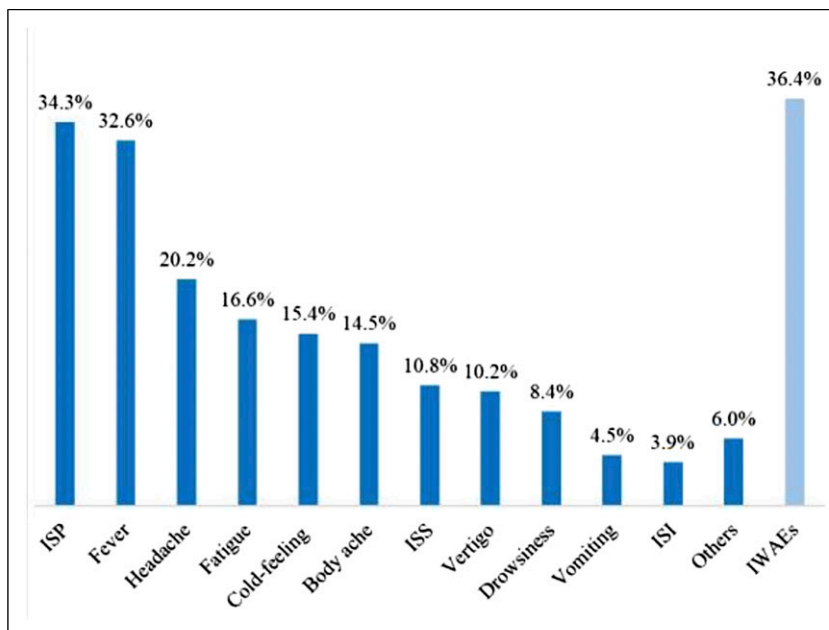
Abbreviations: BMI, body mass index; COVID-19, coronavirus disease 2019; CI, confidence interval; n, number; OR, odds ratio.

WhatsApp, Instagram, Twitter, Linked In, etc. Sign in to the Google account was a prerequisite to avoid multiple responses from the same respondents. Also, we checked the IP addresses of respondents to identify potential duplicate entries from the same user. We considered the most recent response in the case of multiple replies from the same IP address. We provided the survey questionnaire in native Bangla. We requested the educated family members to help the illiterate or older respondents in collecting their responses. Respondents were able to review and change their answers before final submission. Respondents received feedback messages once they submitted responses. The representative sample size and the expected

response rate for this study were 385 and 20%. Therefore, we invited 1925 ( $385/20 \times 100 = 1925$ ) potential respondents to get the required number of responses. We did not offer any incentives to the respondents for participating in this study.

### Statistical analysis

We used Statistical Package for the Social Sciences (IBM SPSS, version 25.0) and Microsoft Excel 2016 for statistical analysis. Similarly, we used Microsoft Excel 2016 for data editing, coding, classification, sorting, and tabulation.



**Figure 2.** Reported one or more adverse events among the vaccinated individuals after vaccine doses; Abbreviations: ISP, injection site pain; ISS, injection site swelling; ISI, injection site itching; IWAEs, individuals without adverse events.

Then we ran IBM SPSS software using the imported data for descriptive statistics and characteristics analysis of the respondents. Cross-tabulation between outcome measures (risk of coronavirus infection, the effect of COVID-19 pandemic on individual's life, and adverse events after vaccination) and the covariates. We applied a binary logistic regression model to assess the relationship of socio-demographic variables and vaccination experience with the overall satisfaction of COVID-19 vaccination. We exponentiated and presented the regression coefficient from the model as odd ratios (OR) with corresponding 95% confidence intervals (CI). The chances of an outcome in the exposed group compared to the unexposed group is called OR. Also, OR is easier to interpret by the readers than others risk ratios obtained from different regression models. Also, we derived variance inflation factors (VIF) from the regression model to assess the potential multicollinearity.

### *Ethical approval*

Committee for Advanced Studies at the Department of Pharmacy, University of Asia Pacific approved this study protocol (No. UAP/Pharm/2021/01002).

## **Results**

### *General description of the participants*

We received 392 complete responses for this study. Among the respondents, males and females were 73.9% and 26.1%,

respectively. More than three-fourths of the respondents were married, and 54.8% were above 40 years of age. Urban people received more vaccines (75.3%) than the rural population (24.7%). More than one-third of the vaccinated people were private job holders (36.5%), and others were government servants (20.9%), unemployed/students (11.4%), self-employed (9.2%), retired persons (2.6%), and others (19.1%). In this study, 58.4% of respondents were from a low economic background, respondents having medium and high economic impressions were 35.2% and 6.4%, respectively. Among the respondents, 73.9% had a graduate or more educational qualification. Moreover, more than 77.8% of respondents do not have any life insurance (Table 1).

### *Disease, medication, and vaccination records of the respondents*

Among the vaccinated population, 62.6% had one or multiple pre-existing comorbid diseases. The leading comorbid diseases were hypertension (25.9%), diabetes (21.1%), heart diseases (9.3%), asthma (8.7), severe allergy (6.0%), and others (9.2%). However, 38.4% of respondents did not have any pre-existing comorbid diseases (Figure 1). More than half of the respondents reported COVID-19 positive history among them, their close friends, family members, or relatives. About one-third of respondents had COVID-19 like symptoms though they did not perform any confirmatory tests. Only

**Table 3.** Regression analysis of socio-demographic variables by overall satisfaction among respondents.

Socio-demographic parameters	Satisfied respondents after the dose (N = 335)				Respondents who recommend this vaccine to others (N = 345)			
	OR	df	95% CI	p-value	OR	df	95% CI	p-value
Age in years								
20–40	0.387	1	0.028–5.179	0.474	0.214	1	0.018–2.449	0.215
41–60	0.171	1	0.016–1.817	0.143	0.105	1	0.012–0.891	0.039
61 or above								
Sex								
Male	19.253	1	3.122–118.700	0.001	1.503	1	0.397–5.685	0.549
Female								
BMI (kg/m <sup>2</sup> )								
Below 18.5 (CED)	0.257	1	0.015–4.321	0.345	0.883	1	0.12–6.483	0.903
18.5–25 (normal)	0.235	1	0.014–3.795	0.308	0.551	1	0.074–4.086	0.560
Above 25 (obese)								
Residence area								
Urban	4.709	1	1.062–20.87	0.041	1.988	1	0.629–6.282	0.242
Rural								
Marital status								
Married	0.814	1	0.089–7.395	0.855	8.130	1	1.517–43.560	0.014
Unmarried								
Profession								
Private service	11.525	1	0.413–321.4	0.150	1.753	1	0.165–18.610	0.642
Government service	1.249	1	0.118–13.16	0.853	1.917	1	0.251–14.610	0.530
Self-employed/business	4.973	1	0.466–52.96	0.184	2.194	1	0.352–13.660	0.400
Retired person	0.157	1	0.005–4.407	0.277	0.685	1	0.034–13.590	0.804
Unemployed/student	3.248	1	0.097–107.6	0.510	1.191	1	0.084–16.820	0.897
Others								
Economic impression								
Low	1.483	1	0.095–22.99	0.778	2.989	1	0.377–23.690	0.300
Medium	0.865	1	0.176–4.246	0.858	2.486	1	0.624–9.898	0.197
High								
Education level								
Illiterate	0.301	1	0.043–2.084	0.224	0.816	1	0.179–3.713	0.793
Primary	4.539	1	0.002–10.364	0.456	0.155	1	0.002–10.890	0.390
Secondary	3.809	1	0.210–68.900	0.365	1.071	1	0.067–16.920	0.961
Graduate and above								

Abbreviations: BMI, body mass index; CED, chronic energy deficiency; COVID-19, coronavirus disease 2019; CI, confidence interval; N, number; OR, odds ratio.

8.1% of respondents received other regular vaccines during the COVID-19 pandemic. However, 86.4% of respondents received their scheduled vaccines for themselves or their families before the ongoing pandemic. And, 40.1% of participants are currently under medication for their diseases.

### Risks and impact assessment of COVID-19 among the participants

According to the responses, the estimations of COVID-19 risks among the respondents were low (19.9%), medium (51.2%), and high (28.9%). Also, the impact of

COVID-19 on their lives was low (28.0%), medium (48.8%), and high (23.2%). The proportions of respondents having coronavirus infection risk were higher in (i) people living in urban area versus rural area (75.4% vs. 24.6%,  $p = 0.026$ ), (ii) private serve holder versus government employee (35.9% vs. 21.1%,  $p = 0.013$ ), (iii) people with lower economic class versus higher economic class (58.8% vs. 6.1%,  $p = 0.047$ ), and (iv) individual without health insurance versus individual having health insurance (78.1% vs. 21.9%,  $p = 0.002$ ). According to the present study responses, the impact of COVID-19 was not significantly associated with their socio-demographic profiles.

**Table 4.** Regression analysis of different response variables by overall satisfaction among respondents.

Response parameters	Satisfied respondents after the dose (N = 335)				Respondents who recommend this vaccine to others (N = 345)			
	OR	df	95% CI	p-value	OR	df	95% CI	p-value
Risk of getting coronavirus infection								
Low	1.183	1	0.211–6.624	0.849	0.480	1	0.140–1.636	0.240
Medium	0.440	1	0.062–3.111	0.411	2.881	1	0.560–14.790	0.205
High								
Impact of COVID-19 on life								
Low	0.477	1	0.085–2.653	0.398	0.578	1	0.160–2.085	0.403
Medium	6.181	1	1.058–36.09	0.043	0.502	1	0.135–1.866	0.304
High								
Family history of COVID-19								
Yes	2.518	1	0.695–9.117	0.160	1.187	1	0.374–3.764	0.771
No								
Previous COVID-19 like symptoms								
Yes	1.004	1	0.236–4.264	0.996	1.006	1	0.303–3.338	0.992
No								
History of one or more chronic diseases								
Yes	0.113	1	0.002–6.243	0.287	0.106	1	0.005–2.120	0.142
No								
Got routine vaccination during COVID-19								
Yes	1.615	1	0.051–50.63	0.785	0.633	1	0.042–9.514	0.741
No								
Family history of regular immunization								
Yes	36.689	1	5.390–249.700	<0.001	2.160	1	0.621–7.513	0.226
No								
Motivation towards COVID-19 vaccination								
Own willingness	0.070	1	0.004–1.151	0.063	0.510	1	0.086–3.010	0.458
Employers' condition for vaccination	4.457	1	0.445–44.560	0.203	6.089	1	1.060–34.950	0.043
Both								
Felt discomfort during vaccination								
Yes	1.646	1	0.314–8.617	0.555	3.666	1	0.963–13.950	0.057
No								
Adverse events after the dose of vaccine								
Yes	1.677	1	0.322–8.726	0.539	0.253	1	0.071–0.893	0.033
No								
Faced problem during online registration								
Yes	0.120	1	0.019–0.731	0.022	0.431	1	0.090–2.056	0.291
No								
Registration support by the local authority								
Yes	4.889	1	1.149–20.800	0.032	2.274	1	0.740–6.984	0.151
No								
Observed discipline at the vaccination center								
Yes	106.448	1	14.640–773.500	<0.001	6.346	1	1.832–21.970	0.004
No								
Wait for vaccination at the center								
Yes	0.170	1	0.042–0.684	0.013	2.748	1	0.947–7.971	0.063
No								
Aware about the reschedule of vaccination time								
Yes	0.291	1	0.036–2.337	0.246	0.757	1	0.148–3.872	0.739
No								

(continued)

**Table 4.** (continued)

Response parameters	Satisfied respondents after the dose (N = 335)				Respondents who recommend this vaccine to others (N = 345)			
	OR	df	95% CI	p-value	OR	df	95% CI	p-value
Volunteer present at the vaccination center								
Yes	2.967	1	0.711–12.360	0.135	4.022	1	1.241–13.020	0.020
No	1				1			
Information from the vaccination center								
Yes	0.810	1	0.205–3.196	0.763	1.761	1	0.544–5.697	0.345
No	1				1			
Recorded disease and allergic history by vaccine provider								
Yes	56.318	1	7.805–406.3	<0.001	4.026	1	1.317–12.300	0.015
No	1				1			
Aware about COVID-19 vaccine source								
Yes	5.496	1	1.251–24.140	0.024	2.447	1	0.750–7.984	0.138
No	1				1			

Abbreviations: COVID-19, coronavirus disease 2019; CI, confidence interval; N, number; OR, odds ratio.

### Post-vaccination side effects after the dose of COVID-19 vaccine

The present study estimated the risk of developing AEs with the age, sex, and BMI of the respondents who received the dose of the COVID-19 vaccine. We observed similar chances of getting AEs for all biophysical characteristics except for sex (Table 2). The tendency to develop AEs was higher among males compared to females ( $p = 0.039$ ). In this study, 63.6% of the respondents reported common AEs after the doses. The frequently reported AEs were injection site pain (34.3%), fever (32.6%), headache (20.2%), fatigue (16.6%), cold feeling (15.4%), body ache (14.5%), swelling at the site of injection (10.8%), vertigo (10.2%), drowsiness (8.4%), vomiting (4.5%), itching at the site of injection (3.9%), and others (6.0%). However, 36.4% of respondents reported that they did not feel any AE after the doses of COVID-19 vaccines (Figure 2). In most cases, these side effects appeared after 12 h of vaccination and went away within the next couple of days. Respondents who faced side effects, 71.7% did not take any medication, and others took only paracetamol to reduce those side effects.

### Opinions and experiences of the respondents towards COVID-19 vaccine

Among all, 78.9% received the dose of the COVID-19 vaccine of their interest. Also, 91.2% of respondents did not face any problem during online self-registration for vaccination. And, 84.0% observed proper disciplines at their vaccination centers. However, 50.3% reported that they had to wait at the center before vaccinating. However, more than half of the respondents expressed their waiting

time was below 30 min. In Bangladesh, 69.8% of them were aware of the source and manufacturer of their vaccine. Among the respondents, 47.5% reported that they were not well briefed about the jab before administration. However, 84.9% of respondents found volunteers at the vaccination centers to help them. Only 37.3% reported that they received vaccination-related information from the centers. Besides, 79.5% of respondents expressed their interest in obtaining vaccine-related information via television, newspaper, social media, and text message. 69.5% of respondents did not experience any physical discomfort during vaccination. Moreover, 87.9% of the respondents would like to recommend COVID-19 vaccines for others. And, 85.5% of people were happy with the overall COVID-19 vaccination management.

Male respondents were 19.25 times more satisfied after getting COVID-19 vaccine than females (OR = 19.25; 95% CI = 3.122–118.700,  $p = 0.001$ ). Respondents living in urban areas were 4.70 times more satisfied than rural people (OR = 4.70; 95% CI = 1.062–20.87,  $p = 0.041$ ). Respondents from the medium economic class were 6.18 times higher satisfied than the respondents from high economic status with the COVID-19 vaccine (OR = 6.18; 95% CI = 1.058–36.09,  $p = 0.043$ ) (Table 3). Respondents who regularly received other scheduled vaccines were 36.68 times more satisfied than those who did not receive scheduled vaccines (OR = 36.68; 95% CI = 5.390–249.700,  $p < 0.001$ ). The satisfaction was 4.88 times more among the respondents who got support during the registration at the vaccination center (OR = 4.88; 95% CI = 1.149–20.800,  $p = 0.032$ ); respondents who found discipline at the vaccination center were extremely happy than others (OR = 106.44; 95% CI = 14.640–773.500,  $p < 0.001$ ). Respondents who found vaccine providers were



taking their disease and allergic history during vaccination were happier than others (OR = 56.31; 95% CI = 7.805–406.3,  $p < 0.001$ ). Moreover, respondents knowing the source and manufacturer of the vaccine were more satisfied than those who did not know (OR = 5.49; 95% CI = 1.251–24.140,  $p = 0.024$ ). However, respondents who faced problem during registration were 0.12 times less satisfied than who did not face any problems (OR = 0.12; 95% CI = 0.019–0.731,  $p = 0.022$ ), respondents who had to wait for vaccination for 0.17 times less happy than others (OR = 0.17; 95% CI = 0.042–0.684,  $p = 0.013$ ) (Table 4).

Similarly, the people who observed discipline at the vaccination center has 6.34 times more chances to recommend others for this vaccine (OR = 6.34; 95% CI = 1.832–21.970,  $p = 0.004$ ). Respondents found volunteers at the vaccination center were 4.02 times more likely to recommend others (OR = 4.02; 95% CI = 1.241–13.020,  $p = 0.022$ ). The respondents who noticed that the healthcare providers collecting their disease and allergic history were 4.02 times more confident to recommend this vaccine (OR = 4.02; 95% CI = 1.317–12.300,  $p = 0.015$ ). However, the middle-aged people were 0.10 times less likely to recommend this COVID-19 vaccine to others (OR = 0.10; 95% CI = 0.012–0.891,  $p = 0.039$ ). Moreover, the individuals who experienced AEs have 0.25 times less chance to recommend this vaccine (OR = 0.25; 95% CI = 0.071–0.893,  $p = 0.033$ ) (Table 4).

## Discussion

According to the present study, the male and female ratio among the vaccinated population was 74% and 26%, respectively. The age-wise distribution of participants: 45.1% aged between 20 to 40 years, 41.8% aged between 41 to 60 years, and 13.0% were above 60 years of age. Moreover, the present study noticed that educated persons, married, residing in urban areas are taking more COVID-19 vaccines in Bangladesh. Also, people from a lower economic impression, private job holders who do not have health insurance showed a greater tendency to be vaccinated. Among the respondents, male sex, urban resident, medium economic impression, people who previously received scheduled vaccination, individuals who completed the online registration without any problem, or who received help for registration were more satisfied than others. Also, respondents considered waiting time, proper discipline, and adequate volunteers at vaccination centers as satisfactory factors. In this study, people with enough knowledge about the vaccine were five times more satisfied than others. We observed the frequently reported AEs were injection site pain, fever, headache, fatigue, cold feeling, body ache, injection site swelling, and vertigo after their dose. Most of the AEs usually appeared after 12 h and went away within 48 h of vaccination. We did not observe any

reported anaphylaxis cases related to the COVID-19 vaccine in Bangladesh.

During the first month of the COVID-19 vaccination program in the USA, among persons who received the first vaccine dose and had reported demographic data, 63.0% were women, 55.0% were aged  $\geq 50$  years, and 60.4% were White. Among 12,924,116 (99.9%) persons whose age was known, 55.0% were aged  $\geq 50$  years, 16.8% were aged 40–49 years, and 28.2% were aged 18–39 years.<sup>24,25</sup> One study reported that information about the vaccine, social influences, and trust in the healthcare profession significantly influence people to vaccinate.<sup>26,27</sup> There is no question that the current COVID-19 vaccines are effective and safe. The side effects are temporary and expected after taking COVID-19 vaccines following authorized clinical-trial data.<sup>28</sup> About 372 out of every million administered doses of the mRNA vaccines lead to produce mild AEs. Therefore, at least 80% of people would experience injection site pain.<sup>29</sup> Genetically modified common cold virus has been used in COVID-19 vaccine of Oxford-AstraZeneca to produce immunity against coronavirus. Adverse reactions might observe in 4000 respondents out of per million administered doses. Clinical-trial data reported that around 50% of participants had injection site pain, headache, or fatigue.<sup>30</sup> However, the adverse reactions monitoring authority relies on healthcare workers and vaccinated individuals to self-report side effects.<sup>31</sup> According to a study report, the median age of persons reporting AEs of COVID-19 vaccines (Pfizer-BioNTech and Moderna) was 42 years. The most frequently reported symptoms were headache (22.9%) and dizziness (16.8%), and fatigue (16.8%). However, we classified 92.4% of AEs as non-serious.<sup>32</sup> Anaphylaxis after vaccination is rare (1.3 per million vaccine doses) in all age groups.<sup>33</sup>

Being a developing country, Bangladesh showed initial success in COVID-19 vaccine rollouts. The government of Bangladesh focused on three key points to be ahead in this global vaccination race. First, India has taken vaccine development and distribution strategy as its national pride.<sup>34</sup> Also, the country has a long track record of vaccine manufacture and launched a neighborhood first policy for COVID-19 vaccine distribution.<sup>35</sup> Serum Institute of India (SII) is the largest vaccine manufacturer in the world. SII is producing the doses of Oxford-AstraZeneca's vaccine locally known as Covishield.<sup>36</sup> The long diplomatic consistency of Bangladesh with the neighborhood countries helped in early access to quality vaccines. Second, they took prompt vaccine procurement decisions and signed a priority contract for 30 million doses from SII. It received 7 million Oxford-AstraZeneca vaccine doses from SII as of 23 February 2021.<sup>37</sup> And finally, the country's previous mass immunization experience helped efficient rollout of the COVID-19 vaccination program.<sup>38</sup> The reported AEs were non-serious and temporary that was observed after the

dose in Bangladesh. Also, the leading pre-existing comorbid diseases were hypertension and diabetes among the people who received COVID-19 vaccines. Similar to present findings, one study reported that diabetes and hypertension were common comorbidities among COVID-19 patients.<sup>39</sup> Therefore, these vulnerable groups should get COVID-19 vaccines first. Bangladesh did not participate in any phase 3 trials in the vaccine development process. So, it was hard to assume how well this vaccine will protect Bangladeshi people against the virus and whether it will have unwanted AEs. However, few studies reported the positive perception and attitude of the healthcare workers based in COVID-dedicated hospitals in Bangladesh.<sup>40-42</sup> Therefore, the present study might help to evaluate the COVID-19 vaccination effects among the Bangladeshi population.

The development of COVID-19 vaccines is an extraordinary success. However, vaccinating most of the population across the world is a big challenge for healthcare authorities. Gaining and maintaining public trust in COVID-19 vaccines and vaccination are essential for successful mass inoculation programs. Therefore, the COVID-19 vaccination experience of Bangladesh will help to build confidence and trust in COVID-19 vaccination. The government authorities can engage and communicate with people regarding the effectiveness and safety of the COVID-19 vaccines. The healthcare authorities can launch campaigns to partner and support community organizations to conduct extensive and well-managed vaccination programs. Global healthcare organizations need to demonstrate that they did not compromise quality and safety standards during the development and approval processes of COVID-19 vaccines to promote public trust. The findings of the present study would help policymakers in developing immunization plans and implementing vaccination programs. Also, the authorities can utilize the current study results to address vaccine hesitancy and increase public interest in the COVID-19 vaccine.<sup>43</sup> Media professionals and communication experts can play a vital role in disseminating information about the safety and effectiveness of COVID-19 vaccines. Also, they can help the general population in filtering the spread of misinformation regarding the vaccination.<sup>44-49</sup> Our findings highlight that the reported adverse events of COVID-19 vaccines were non-serious and temporary. The government of Bangladesh should take steps to communicate these messages to rural people and slum dwellers and homemakers to build their trust in COVID-19 vaccines. The government should develop communication messages that can be easily understandable to people with low literacy. Also, the government must take the necessary initiatives to ensure the availability of effective vaccines in rural areas.

The present study has few limitations. Reporting biases are possible in a self-reported analysis due to the lack of

awareness or compliance with the reporting system. An online survey requiring an internet connection in a suitable device, and all the vaccinated population might not have online access to equally enroll in such a program. The questionnaire used in this study was not validated. Therefore, we piloted it to confirm the clarity and understanding of the questions. Besides, a better perception about the vaccination might obtain after the post-dose-2. Therefore, information from the present study might not be representative or generalizable.

## Conclusions

Vaccines are the only weapon to fight the ongoing COVID-19 pandemic and achieve herd immunity against the coronavirus. Bangladesh did not participate in any phase three trials, dry run, or practice trial on the field level before this mass inoculation. According to our knowledge, this is the first study related to adverse events, opinions, and experiences after the doses of COVID-19 vaccines among the Bangladeshi population. The reported AEs in the present study were non-serious and temporary. Therefore, this study might help to reduce vaccine hesitancy in Bangladesh.

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## Author Contributions

Md. Rabiul Islam: Conception of the study, methodology, data analysis, data collection, analysis, drafting the manuscript, revising it critically for important intellectual content, Moynul Hasan: Data collection, data analysis, drafting the manuscript, Waheeda Nasreen: Methodology, data analysis, data collection, analysis, and drafting the manuscript, Md. Ismail Tushar: Data analysis, interpretation, and revise the manuscript, and Mohiuddin Ahmed Bhuiyan: Conception of the study and revising it critically for important intellectual content

## Declaration of conflicting interests

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## Ethics approval

Ethical approval for this study was obtained from Committee for Advanced Studies at the Department of Pharmacy, University of

Asia Pacific approved this study protocol (No. UAP/Pharm/2021/01002).

### Informed consent

Written informed consent was obtained from all subjects before the study.

### Animal welfare

Guidelines for humane animal treatment did not apply to the present study because the present study did include any experimental animals.

### Data availability statement

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

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