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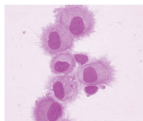
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RESEARCH PAPER



COVID-19 vaccine-taking hesitancy among Bangladeshi people: knowledge, perceptions and attitude perspective

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ABSTRACT

Several novel efforts have been put forth to make a readily available vaccine against the global pandemic of COVID-19. However, there seems to appear vaccine-taking hesitancy among the general people. Against this backdrop, this current study sets to assess the vaccine-taking intention, ways to overcome the vaccine-taking reluctance among Bangladeshi people and explore their knowledge, perceptions, and attitude toward the COVID-19 vaccine. To this end, this study leveraged on a cross-sectional survey, which was consisted of 1377 respondents covering the eight divisions of Bangladesh. The descriptive statistical method and ordinal logistics regression were employed to explore and rationalize our study outlined objectives. Empirical findings revealed that approximately 71% of the respondents had adequate knowledge about the COVID-19 vaccine, whereas 46% of the respondents were willing to be vaccinated against COVID-19 while the rest of the respondents were hesitant to take the vaccine. However, concern about the potential side effects was one of the core reasons for vaccine-taking hesitancy. Assuring the common people about vaccine safety and efficacy, along with easing the registration procedure, can ameliorate people's confidence to get vaccinated. Meanwhile, about 60% of the respondents believed that a vaccine could help Bangladesh win the battle against COVID-19 and will allow back to normal life. Although the government has taken some pragmatic action steps to promote the vaccination rate, it is recommended that the mass vaccination program should be extended to the grassroots level with proper extension community support and easing the registration process.

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Introduction

Since December 2019, the deadly unprecedented coronavirus (SARS-Cov-2) disease has threatened millions of lives, and still, it continues its rampage all around the globe.¹ On 11 March 2020, the World Health Organization (WHO) announced this disease as a pandemic,^{2,3} as the virus continues to spread from the seafood market of Wuhan, China, to every corner of the earth.^{4,5} Apart from health threats, the COVID-19 has triggered dire financial and economic distress throughout the globe, including those of the biggest economies (e.g., USA, UK, Germany, China, France, Italy, and Spain).⁶ However, underdeveloped and developing countries are digesting the worst wound induced by the economic and financial crisis that may lead many vulnerable communities to food shortage.^{7,8} What is more concerning is that the healthcare system in most nations, whether developed, or developing, or underdeveloped, is in grave turmoil due to COVID-19.⁹ Furthermore, according to a recent study, immune-related pharmaceutical products in the United States have experienced shocks from the economic downturn.¹⁰ Thus, it might result in yet another health crisis in many parts of the globe.¹⁰ Against the backdrop, as the pandemic moves way further, a potential vaccine can help get rid of the anathema. Scientists underwent magnificent research works to discover the magic to bring us

back to a new normal. Breaking all the records in the history of medical science, several potential vaccines have been developed in the quickest possible time phase. So far, 77 vaccines are under active investigation in animal health, among which 8 received approval for use.¹¹ Among them, the vaccine manufactured by BioNTech-Pfizer and Moderna Inc. proved to be 90% or more effective, whereas the vaccine of Oxford-AstraZeneca found 70% effective in terms of generating antibodies against the deadly virus.¹²⁻¹⁴ Primarily, vaccination programs are targeted at older ones and adults aged over eighteen since no vaccine testing was attempted for anyone around the world under this age. Therefore, until and unless extensive research is undertaken on children and teenagers, it is recommended to keep them away from the inoculation program.¹⁵ Apart from this, children and youth are found to be less severely affected by coronavirus than adults and older people.^{16,17}

However, the success of the inoculation program hinges upon the people's intention and decision to get vaccinated. The low acceptance of available vaccines for high-risk infection has been attributed to a pandemic public health paradox,¹⁸ which significantly contributes to vaccine hesitancy. Reportedly, vaccine hesitancy refers to unwillingness or refusal to take a vaccine despite their availability.¹⁹ It is worth

mentioning that hesitation in getting a vaccine led to a massive outbreak of disease previously,²⁰ since vaccine always remains a dilemma among general people.²¹

Bangladesh, likewise nations around the globe, is endeavoring to escape the tremor of the pandemic. In doing so, the Bangladesh government decided to import the COVIDSHIELD vaccine, manufactured by the Serum Institute of India using the Oxford-Astrazeneca vaccine patent.²² The rationale for choosing this vaccination may be ascribed to the fact that, unlike other leading vaccines, the Oxford-Astrazeneca vaccine is relatively inexpensive and can be stored easily in the refrigerator (2–8 Degree Celsius).²³ However, along with COVIDSHIELD, Bangladesh has also started to import others such as the vaccine of Pfizer, Sinopharm, and Moderna in recent times during the second phase of the inoculation program. As the mass inoculation program is making its way on 7 February 2021, tensions arise among general people regarding the vaccine. Also, some perpetrators are squandering their time pervading fabricated information on the vaccine. Under the circumstances, with the vaccination program is in proximity, peoples' knowledge, attitude, and perception toward the COVID-19 vaccine must be addressed from the socio-economic ground. It will not only help disclose people's choices toward the vaccine but also provide possible guidelines to improve the mass vaccination program for policymakers.

Over the last months, some studies devoted themselves to explore vaccine acceptability among people in different countries. An investigation led by Peretti-Watel et al.²⁴ revealed that about 4.7% of adults in Australia, 27% of adults in France, and 20% of adults in the USA are likely to defy the vaccine. However, the latest study led by Khubchandani et al.²⁵ unveiled that about 22% of people more or less likely to refuse the vaccine in the USA. Research on vaccine acceptability has also been conducted in the UK, Canada, Denmark, Germany, Italy, Portugal, unveiling the interesting and diversified outcomes.²⁶ Besides, Barelló et al.²⁷ found that 13.9% of students refused to take the vaccine in Italy. Meanwhile, Thorneloe et al.²⁸ concluded that younger people are more intend to refuse the vaccine.

Despite being a pressing issue, to our best knowledge, this is one of the first empirical studies that has been conducted to expose the Bangladeshi people's hesitancy toward the COVID-19 vaccine. However, our study contributes in several ways to the current extant literature on COVID hesitancy. Firstly, the intention to be vaccinated against COVID-19 according to the respondent's socio-demographic factors is assessed in this study. Secondly, we try to expose people's knowledge, attitude, and perception toward the COVID-19 vaccine. Thirdly, we intend to analyze the possible reasons that ensue vaccine-taking hesitancy. Lastly, we focus on several courses of action that may ease the vaccine-taking reluctance among sampled area.

Methods

Study design

A cross-sectional survey was enacted between January 31 to February 6, 2021. However, the mass vaccination program of Bangladesh onsets on 7 February. Therefore, to uncover

people's preoccupation regarding the vaccine, we halted our survey the day before the vaccination program commenced. People aged above eighteen and those who agreed to participate in the interview were included as respondents. The study covered respondents from every eight divisions of Bangladesh to portray a more substantiated and countrywide picture in our research. It also helped discover the overall scenario of the country. Our study adopted both web-based data collection and a face-to-face interview. The link created for online data collection was arbitrarily circulated through social media sites (i.e., Facebook, WhatsApp, and Messenger) and shared directly via e-mail with the researcher's contact list. The personal face-to-face interview was also conducted by maintaining at least 2 m physical distance in some isolated regions of the country where there are no proper internet facilities.

Study tool and data collection

A structured questionnaire was developed and tested in a pilot study through 20 participants. Evaluating the public views from the pilot study, we revised the survey questionnaire and confirmed it with a total of 56 questions. An online survey portal, KoBo Toolbox, was created to expedite the questionnaire formation for online data collection. After that, we briefly specified the research purposes to the respondents, and they were approached for participating in the survey. However, the response rate was approximately 65%. The survey questionnaire was designed both in English and Bangla for the convenience of respondents. The questionnaire had six parts where Part-A represented the socio-demographic profile of the respondents (11 questions), Part-B denoted participant's vaccine-taking decisions (2 questions), Part-C described the questions about what efforts can be implemented to reduce people's hesitancy to take the vaccine (8 questions), Part-D contained the knowledge about COVID-19 vaccine (8 questions). Besides, Part-E indicated the respondent's perception of the available COVID-19 vaccine (17 questions), and Part-F denoted attitude toward the COVID-19 vaccine (10 questions).

Sampling and validation

The sample size was determined following the convenience sampling technique since it is one of the most prevalent non-probability sampling techniques.^{29,30} The sample size estimation was based on the presumption that the probability of having adequate knowledge, perceptions, and positive attitude toward the coronavirus vaccine was 50.0%, with a 95% confidence interval and 5% margin of error. Based on the above estimation method, the minimum required sample size was 384 participants. However, as the survey ended, a total of 1377 samples was collected, which exceeded the minimum sample needed for this study. Besides, we employed Kaiser–Meyer–Olkin (KMO) sampling adequacy test to ensure that the collected sample was sufficient; the minimum acceptable value for this test is 0.6.³¹ However, the estimated value of the KMO test was 0.89, implying that the sample used for this study was adequate. Furthermore, collected data were assessed to verify the internal consistency reliability using Cronbach's alpha and the intra-class

correlation coefficient. The results showed acceptable internal consistency reliability (with Cronbach's alpha = 0.772 and the intra-class correlation coefficient was 0.955).

Data analysis

The descriptive statistical techniques, i.e., frequency and percentage, were employed to summarize data on socio-demographic characteristics, vaccine-taking hesitancy, knowledge, attitude, and perceptions toward the COVID-19 vaccine. Knowledge about the COVID-19 vaccine was estimated based on the responses to eight general questions about the COVID-19 vaccine. One point was added to the total score for each correct response, while one point was subtracted for each incorrect response. The total score ranges from - 8 to 8 on the arithmetic scale. Then, the respondents were categorized as having adequate knowledge for a cumulative score of more than or equal to one and inadequate knowledge who had less than one point in total. Respondents' attitude toward the COVID-19 vaccine was measured through a 5-point Likert-type scale (Strongly disagree = 1, Disagree = 2, Not sure = 3, Agree = 4, Strongly agree = 5). To assess participants' perceptions toward the COVID-19 vaccine, we asked a series of Yes/No/Not sure statements to the respondents. Besides, the intention to be vaccinated against the COVID-19 vaccine according to the respondent's demographic characteristics was estimated by ordinal logistic regression. Data were analyzed by using the STATA version 15 software.

Ethics approval

Ethical approval was not required for this study since human participants were ensured following local legislation and institutional requirements. Besides, all proceeds of this research were carried out following the Helsinki Declaration principles of human subject investigation. Participation in this survey was anonymous and voluntary, assuring consent of prospective respondents before the interview. Data accumulated for this research was treated confidentially.

Empirical results

Socio-demographic and clinical characteristics of the respondents

Table 1 shows the personal and clinical characteristics of the studied participants. Among the participants, more than half (56.64%) were males, and nearly half of the participants (48.17%) were young, whereas only 25.04% were more than 51 years aged. Approximately 60% of the respondents were university graduates, and only 18.53% completed primary education. By occupation, 27.37% of the participants were students, while 12.20% and 5.09% were day laborers and farmers, respectively. The monthly income of a large proportion of the participants (48.58%) ranged from 200\$ to 500\$. Almost more than half of the participants (54.47%) reported their residence in urban areas, whereas 19.83% and 25.71% were from rural and semi-urban areas, respectively. All participants stated that they had heard about the COVID-19

Table 1. Participants' characteristics (N = 1377).

Personal and clinical characteristics	Level	%
Age (years) ^a	18 to 36	48.17
	37 to 51	26.79
	More than 51	25.04
Sex	Male	56.64
	Female	43.36
Years of schooling	Primary	18.53
	Secondary	10.18
	Higher secondary	12.64
	Graduation	30.20
	Post-graduation or above	28.46
Occupation	Government job	16.78
	Private job	14.16
	Self-employed	19.17
	/businessmen	
	Retired person	2.40
	Students	27.37
	Health professional	2.83
	Farming	5.09
	Daily labor	12.20
	Total household income (US\$/month)	Less than \$200
	\$200-\$500	48.58
	More than \$500	18.08
Living area	Urban	54.47
	Rural	19.83
	Semi-urban	25.71
Affected by coronavirus	Yes	13.27
	No	63.41
	Did not test	23.32
Family members get affected by COVID-19	Yes	8.08
	No	64.63
	Did not test	27.29
Sources from where first know about COVID-19 vaccine	Social media	40.96
	Television	26.80
	Medical personnel	4.36
	Print newspaper	10.46
	Friends and family members	17.43
Become ill during the pandemic for having any chronic disease ^b	Yes	55.26
	No	44.74

^aAge is categorized as Young = 18–36 years, Middle-aged = 37–51 years, and Old-aged = more than 51 years according to the National Youth Policy of Bangladesh (2017).

^bChronic disease includes, e.g., Asthma, Kidney failure, Diabetes, others.

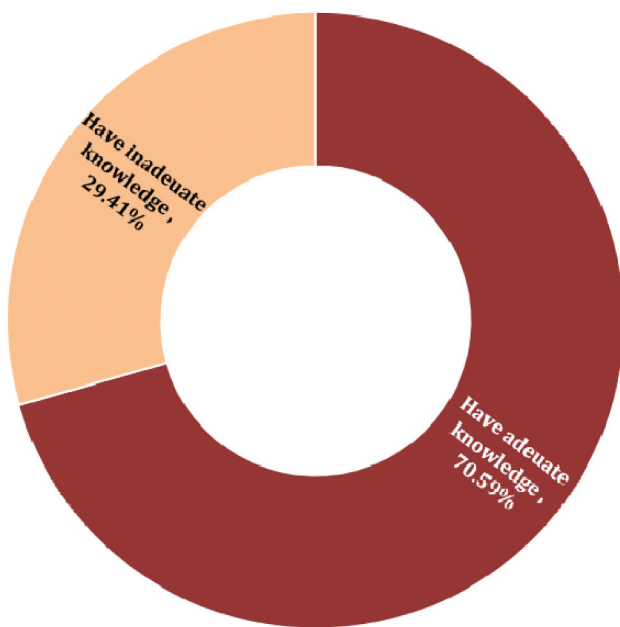
vaccine. The most commonly listed sources from where they know about the vaccine were social media (40.96%), followed by television (26.80%). Within the participants, 64.49% claimed that they were not affected by COVID-19, 13.27% were infected by COVID 19, and 23.32% did not test even. However, only 8.08% of respondents' family members got affected by the coronavirus. Besides, 55.26% of participants were ill during the pandemic having chronic diseases including, e.g., Asthma, kidney failure, Diabetes, and others.

Knowledge about the COVID-19 vaccine

For the knowledge assessment, respondents were asked eight questions related to the COVID-19 vaccine. The statistics of respondents' correct and incorrect answers to a particular question are presented in Table 2. Findings reveal that majority of the respondents were accurate for most of the questions. However, around fifty percent of the respondents were incorrect about the commencement date of the vaccination program and the age requirement for vaccination in Bangladesh. Besides, overall, 70.59% of respondents had adequate knowledge about vaccination programs (Figure 1).

Table 2. Knowledge about COVID-19 vaccine (N = 1377).

Question about knowledge on COVID-19 vaccine	Correct answer (%)	Incorrect answer (%)
What is the name of the vaccine that the Bangladesh Government has recently ordered?	67.76	32.24
How many doses will be applied for the vaccine that Bangladesh ordered?	84.97	15.03
Which country first approved the COVID-19 vaccine to roll out?	45.32	54.68
Via which app/website Bangladesh government invited registration for vaccination?	57.95	42.05
From when Bangladesh government will start mass vaccination?	81.66	18.34
From which country Bangladesh will get its first vaccine lot?	89.32	10.68
People of which age will get priority in the vaccination program in Bangladesh?	52.40	47.60
Which pharmaceutical company of Bangladesh has associated the government with the vaccination program?	92.16	7.84

**Figure 1.** Percentage of respondents having adequate and inadequate knowledge on COVID-19 vaccine.

Vaccination intentions among respondents

The details about the respondents' intentions toward vaccination based on socio-demographic are summarized in Table 3. Overall, 45.76% of the participants were willing to be vaccinated whereas, 35.25% were not sure about getting inoculated, and 18.99% were denied the vaccination. Among the respondents' age category, old respondents were more willing to be vaccinated. Besides, female participants were more inclined to get vaccinated than males. Respondents having graduation degrees were the largest category in ready to be vaccinated, where primary educated persons (18.18%) belonged to the minor category. Besides, in terms of profession, health professionals (76.92%) were more desired to have vaccinated, followed by government job holders (57.14%) and retired persons (45.45%). Moreover, participants living in the urban (50.00%), semi-urban areas (40.66%), and relatively wealthy persons were

more intended to be vaccinated. However, looking at the closure, we found that presence of chronic disease, previous COVID-19 affected, and adequate knowledge about COVID-19 had a significant influence on vaccination intention. More than half of the chronic disease-affected participants and three-fourth of the respondents who got affected by COVID-19 were willing to be vaccinated. Besides, 69.07% of the respondents were ready to be vaccinated who had adequate knowledge about the COVID-19 vaccine. However, the likelihood of being COVID-19 vaccinated was significantly increased with older age, having more years of schooling, holding healthcare profession, living in urban or semi-urban areas. Besides, rich people having chronic diseases, tested for COVID-19 positive, and respondents possessing adequate knowledge about the COVID-19 vaccine were significantly associated with the intention to vaccinate against COVID-19.

Findings from Figure 2 disclose that potential side effects of the vaccine were the primary concern for more than half of the participants (58.49%). However, a considerable number of participants (14.34%) were against the vaccination program, and approximately 10% of the respondents were concerned about the effectiveness of the vaccine. On the contrary, religious issues (1.89%), afraid of taking injections (3.77%), and belief in natural remedies (4.91%) were the least reported reasons for unwillingness or unsure of being vaccinated.

Lessening the hesitancy toward the vaccination program is the leading concern for Bangladesh now to attain a sizable inoculation rate. There may have a considerable number of strategies to lessen the vaccine hesitancy of the doubters. Assuring efficiency and safety (80%), details about the benefits of participants in the trial program (75.60%) can reduce the vaccine hesitancy (Figure 3). Besides, public exposé programs (65.35%) and recommendations from medical personal or locally accepted people (70.37%) can boost the confidence for being vaccinated. However, nearly fifty percent of respondents were against the strategy of mandatory vaccines for all.

Perceptions of participants about COVID-19 vaccine

In our study, most of the participants (75.16%) had a dissatisfied perception about the side effects of the vaccine, and only 9.15% of respondents believed in the vaccine's effectiveness (Table 4). Moreover, there had some prejudiced among the respondents like coronavirus disease is automatically curable (21.35%), antibiotics can cure the virus (22.66%), vaccine applicable only who got affected by COVID-19 (10.68%), and more stressfully some of the respondents (7.84%) believe the vaccine is not needed for Bangladesh. In addition, some of the participants (23.75%) believed media coverage about vaccination is exaggerated. Besides, more than 50% of respondents thought the vaccine is only applicable to patients with chronic disease, and developing immune systems by good diet practice can countervail the vaccine requirement. There were also some misconceptions about the vaccine among the participants. Some participants were concerned that vaccines were initially developed for business purposes (16.34%), and the vaccine would be overpriced (29.85%) in Bangladesh. However, more than fifty-five percent of participants were ready to buy the vaccine at an affordable price when available

Table 3. Percentage and odd ratio[^] (95% CI) of “intention to get vaccinated against COVID-19” classified as yes, not sure and no according to participants characteristics (N = 1377).

Socio-emographic characteristics	Intention to get vaccinated against COVID-19			Unadjusted OR (95% CI)	P-value
	Yes (45.76%)	Not sure (35.25%)	No (18.99%)		
Age (Years)					
18 to 36	39.70	37.83	22.47	Ref	
37 to 51	42.86	37.76	19.39	1.38 (0.81 to 2.35)	0.24
More than 51	51.06	35.11	13.83	1.62 (0.90 to 2.94)	0.07
Sex					
Male	40.38	38.08	21.54	Ref	
Female	45.73	36.18	18.09	0.94 (0.64 to 1.38)	0.75
Education (years of schooling)					
University	48.32	28.86	22.82	Ref	
Higher secondary	39.66	43.10	17.24	2.33 (0.07 to 2.72)	0.06
Secondary	30.00	20.00	50.00	3.58 (0.13 to 5.23)	0.17
Primary	18.18	27.27	54.55	3.43 (0.11 to 4.34)	0.25
Employment status					
Government job	57.14	23.38	19.48	Ref	
Private job	27.69	36.92	35.38	1.03 (0.53 to 2.01)	0.23
Health professional	76.92	15.38	7.69	0.95 (0.34 to 2.69)	0.02
Self-employed/businessmen	37.50	48.86	13.64	2.19 (1.13 to 4.22)	0.04
Students	40.28	40.97	18.75	1.63 (0.83 to 3.17)	0.15
Farming	0.00	0.00	100.00	0.04 (0.003 to 0.23)	0.67
Daily labor	7.14	42.86	50.00	1.79 (0.85 to 3.78)	0.15
Retired person	45.45	9.09	45.45	0.39 (0.10 to 1.43)	0.10
Living area					
Urban	50.00	39.83	10.17	Ref	
Rural	24.00	36.00	40.00	0.88 (0.52 to 1.48)	0.18
Semi-urban	40.66	37.36	21.98	1.15 (0.71 to 1.86)	0.05
Household income per month					
Less than \$200	36.60	41.83	21.57	Ref	
\$200-\$500	42.70	37.25	20.04	0.96 (0.62 to 1.48)	0.14
More than \$500	46.64	34.53	18.83	1.02 (0.58 to 1.81)	0.04
Having chronic diseases					
No	41.51	39.16	19.32	Ref	
Yes	53.68	27.63	18.68	0.60 (0.36 to 1.02)	0.05
COVID-19 affected					
No	45.86	35.35	18.79	Ref	
Yes	76.67	13.33	10.00	0.45 (0.16 to 1.22)	0.06
Did not test	34.62	44.62	20.77	1.41 (0.92 to 2.17)	0.12
Knowledge about the COVID-19 vaccine					
Inadequate	27.41	34.81	37.78	Ref	
Adequate	69.07	18.27	12.65	1.56 (1.12 to 2.29)	0.001

[^] Odds ratios were calculated using ordinal logistic regression, where respondents' demographic characteristics were the independent variables and intention to take the COVID-19 vaccine was the explanatory variable. The unadjusted odds ratio represents the change in the likelihood of taking the vaccine for a one-unit change in the independent variable (or, a shift from the reference category to the category for dummy variables).

at the open market. Over and above, 56.62% of the participants believed that the vaccine would help Bangladesh win the battle against COVID-19.

Respondents' attitude toward COVID-19 vaccine

Figure 4 represents the information about the respondents' attitude toward the COVID-19 vaccine. Around fifty percent of the respondents believed they need to get family permission to be vaccinated, and approximately sixty percent believed the vaccine would restore normal life in Bangladesh. However, a significant portion of participants agreed to be vaccinated if they are persuaded and recommended by the government (55.77%) and healthcare professionals (51.41%). Surprisingly, nearly one-quarter of respondents believed that they would get affected by coronavirus if they get vaccinated. Furthermore, roughly one-quarter of respondents thought access to vaccination would be difficult for them, whereas forty percent of the

respondents were unsure about access to the vaccine. Moreover, thirty percent of the respondents claimed that they would not regret it if they ended up getting affected by COVID-19 without a vaccine. Only one-quarter of respondents believed that they were likely to get affected by COVID-19 without being vaccinated, where nearly 50% of the respondent were not sure.

Discussions

The COVID-19 pandemic is continuously plundering the global healthcare system as well as the social and economic situation. The absence of vaccines leads to this ravaged social and economic situation as well as thousands of deaths.^{32,33} In Bangladesh, the government starts its COVID-19 vaccination program on February 7, 2021. However, low vaccine coverage and hesitancy toward the vaccine among the Bangladeshi people can spoil the current efforts. Despite the fact that Bangladesh has

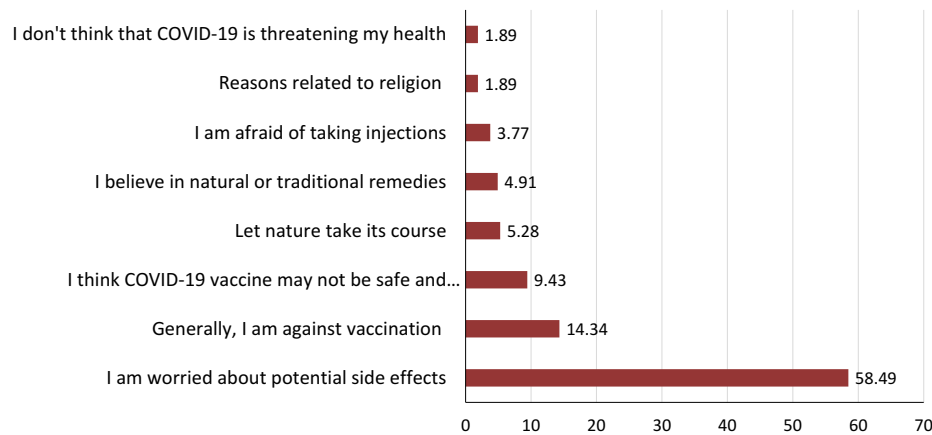


Figure 2. Reasons were given by respondents who were not willing or unsure whether they would like to take the COVID-19 vaccine in percent (N = 747).

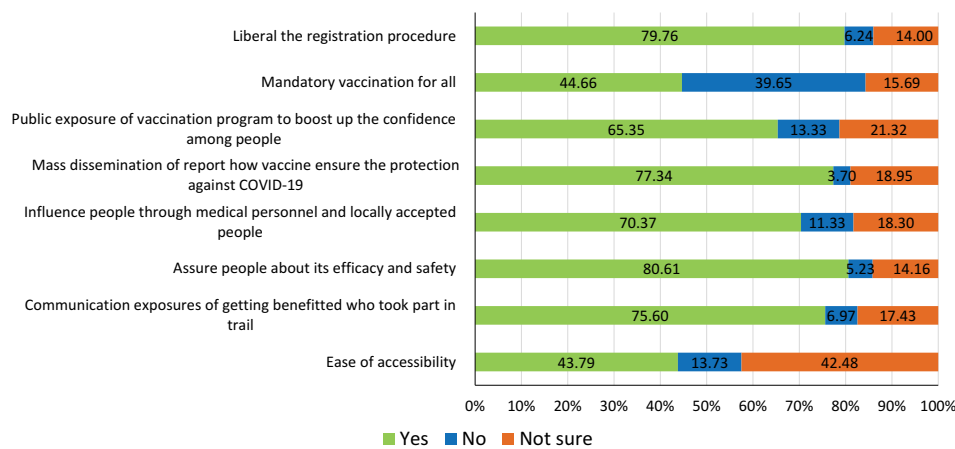


Figure 3. Ways to reduce the vaccine taking hesitancy among participants (N = 1377).

several vaccination services, the entire newness of the COVID-19 vaccination roll-out raises concerns about vaccine delivery and acceptance. In this regard, this study tries to assess the reluctance toward the vaccine by studying the knowledge, perceptions, and attitude toward the COVID-19 vaccine in Bangladesh. As a result, our findings will be critical in establishing COVID-19 vaccination-related health education and awareness campaigns.

In assessing knowledge about the COVID-19 vaccine, this study found that more than seventy percent of the respondents had adequate knowledge about the vaccine. Disparate findings were reported in the earlier study related to the knowledge about the COVID-19 vaccine in Bangladesh.³⁴ However, the level of knowledge is higher than the previous studies on the knowledge about COVID-19 pandemic (not vaccine) among Bangladeshi people (61.2%)³⁵ and (33.0%).³⁶ This is because people are trying to keep more information about the pandemic and vaccine since it is a burning issue in the country's present situation. The higher knowledge level among the participants about the COVID-19 vaccine could be linked with the government exposure or publicity about the COVID-19 vaccination. The rate of providing an appropriate answer of different questions in the knowledge assessment differed significantly from each question. For instance, the question regarding the name of the first vaccine-approved country,

priority age for vaccination, and vaccine registration application received the highest rate of the wrong answers. In addition, a significant number of respondents failed to answer the correct vaccine name that the Bangladesh government has ordered recently. Although the government of Bangladesh and medical professionals disseminating the information to the general public continuously, there is also a misconception prevailing among common people.^{37,38}

Findings revealed that forty-six percent of surveyed participants reported they intend to get vaccinated against COVID-19 once a vaccine becomes available to them, while it is pretty lower than China (83.8%)³⁹ and UK (64%),⁴⁰ even 53% of the participants were planning to get vaccinated in Pakistan.⁴¹ However, vaccination intention may likely differ from actual vaccine uptake due to several demographic and economic factors. Therefore, it's critical to investigate factors linked to vaccination intention early on, to formulate and support policy. We found that socio-demographic factors remarkably affect the vaccine-taking decision of the participants. Female and relatively old participants were more willing to be vaccinated than male and young participants because these groups of people are more vulnerable to COVID-19.⁴² Besides, educated and wealthy respondents were interested in the vaccination program. These findings are aligned with recent studies^{35,43} but contradict Neumann-Böhme et al.²⁶ who stated

Table 4. Perceptions about the COVID-19 vaccine (N = 1377).

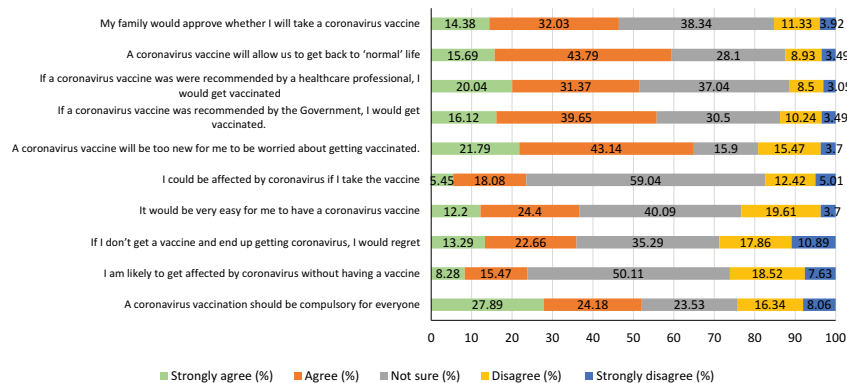
Statements	Yes (%)	Not sure (%)	No (%)
I think available vaccine is effective for COVID-19	9.15	50.98	39.87
I am concerned about the side effects of the vaccine	75.16	10.89	13.94
The higher class of people or Govt. professionals will get priority regarding vaccination	66.23	18.95	14.81
I think coronavirus disease is automatically curable without a vaccine	21.35	39.00	39.65
I think the media coverage about the vaccine is exaggerated	23.75	36.82	39.43
I think antibiotics can treat the disease without a vaccine	22.66	45.10	32.24
I think the vaccine is only applicable to the people who got affected by coronavirus disease	10.68	34.86	54.47
I think the vaccine will be overpriced and not be readily available for mass people	29.85	35.73	34.42
I think eating healthy food to improve the immune system is more effective than the currently available vaccine	52.29	26.36	21.35
Being isolated and maintaining social distancing from the beginning of the pandemic discouraged me from taking the vaccine.	38.13	33.55	28.32
I think the vaccine is initially designed for business motive	16.34	42.05	41.61
I think the vaccine is more applicable for patients with chronic diseases	50.07	10.72	39.22
I think the COVID-19 vaccine is unnecessary	7.84	33.12	59.04
If a vaccine is available at an affordable price, I will buy it	55.77	30.72	13.51
I am confident that vaccine can help Bangladesh to win the battle against COVID-19	56.62	36.41	6.97

men were more willing to be vaccinated. The difference in vaccination intentions among the urban, semi-urban, and rural areas may be attributed to the low exposure of vaccination programs in rural areas.⁴⁴ Since the rural communities of Bangladesh are comparatively less exposed to media and updated information, they are more ambiguous about the vaccine with prevailing prejudices. This discrepancy of interest in vaccination between rural and urban areas can hamper the whole effort of the government against the COVID-19 pandemic. Our findings also reported that healthcare and government professionals were more interested in being vaccinated than people of other professions. Surprisingly, none of the farmers in our study were willing to be vaccinated. This finding can be attributed to a lack of constructive, and clear information about vaccination in rural areas. In addition, having a chronic disease, previously corona-affected people were significantly willing to be vaccinated, and this finding can be

scrutinized based on their constant contact with the health professional. Popa et al.⁴⁵ also mentioned in their study continuous contact with physicians can reduce vaccine hesitancy.

However, we asked respondents the reason for their vaccine hesitancy. More than fifty percent of respondents were concerned about the side effects of vaccines, where a considerable number of participants believed the vaccine would not be safe and effective. But it is essential to convince them about the safety and effectiveness of the vaccine. Several scholars also agreed with the fact that public assurance should be ensured about vaccine safety and efficacy during mass vaccination programs.^{26,46} Otherwise, there is a potential risk of losing public interest to get vaccinated, ultimately losing possible herd immunity. Our findings also revealed that assuring the public about vaccine safety and efficiency (80.61%) can reduce vaccine hesitancy. According to this, mass dissemination of information about the vaccine's effectiveness, details about the imported vaccine, and different promotional and communication activities can upgrade the confidence of people to take the vaccine. Beyond this, the vaccine should be available in a timely and easily accessible manner without any attrition.⁴⁷ In addition, this study suggested that a liberal registration procedure also can be a good strategy (79.76%) for increasing vaccination intention. However, the scarcity of the COVID-19 vaccine forced the government to develop strategies to vaccinate the elder class and front-fighters of coronavirus on a priority basis. Findings also revealed that nearly forty percent of respondents are against mandatory vaccination. In line with the results, Nitschke et al.⁴⁸ reported that the government should avoid enforcement in vaccination as it may prove a good strategy for a limited time but has a destructive impact on the social system.

A considerable number of participants had some prejudice about coronavirus disease and its vaccine, i.e., automatic curable, antibiotics can treat the virus, only corona affected person should be vaccinated. But, a substantial portion of respondents was not sure about these statements, and we believed that proper information dissemination and building trust could easily remove these kinds of prejudice. However, the government should take a strong initiative against antibiotic use. The use of antibiotics against coronavirus can significantly increase antibacterial resistance.⁴⁹ Besides, less than fifty percent respondents disagreed with the statement that vaccine was developed for business purpose and vaccine will be overpriced

**Figure 4.** Attitude toward COVID-19 vaccine (N = 1377).

if it becomes available in the open market. Continued media coverage about the vaccine sale privately and vaccine price may be responsible for this misperception in Bangladesh.^{50,51} We also found that more than fifty percent of respondents were ready to buy vaccines at an affordable price. This acceptance rate in affordable price is lower than other countries, i.e., Indonesia (67–95%), USA (67–69%), and Ecuador (85%).^{52–55} These findings can be attributed to the impoverished financial condition of the Bangladeshi people, compounded by the recent loss of livelihood during the COVID-19 pandemic.⁵⁶ Consequently, this loss in livelihood has also contributed to unemployment, hunger, malnutrition, and social unrest, resulting in a lack of financial resources to pay for the COVID-19 vaccine among the general public.³⁴

A considerable number of respondents had an attitude that they will get affected by the coronavirus if they take the vaccine. Moreover, approximately 65% of respondents opined that they would be too worried to take the COVID-19 vaccine since it is newly developed. New vaccine hesitancy is usual for the respondent; they are concerned it may be experimental without sufficient clinical trial, and the vaccine may not be appropriate for some category people like an allergic person, pregnant women, etc.²⁶ However, the majority of the respondents agreed to get vaccinated if the government and health professionals recommend them because they had trust and reliability in the healthcare professionals. Along with this, more than half of the selected respondents believe that vaccination programs can bring back a normal life.

In our study, a substantial number of participants were unsure about the different statements related to their perceptions of the COVID-19 vaccine. Good communication and dispatch of pertinent information can easily persuade them in the vaccination program. Constant dissemination of information about the coronavirus and vaccination program is needed to reduce vaccine hesitancy as well as to develop a more positive perception and attitude toward the COVID-19 vaccine. In addition, the government should take initiatives like launching health education programs through health authorities immediately to curb misinformation. It is also crucial to ensure the accessibility and affordability of vaccines for increasing the acceptance rate.⁵⁷

One of the main limitations of our study, majority of the data were collected through the online self-reporting method, subject to memory bias and social acceptability. Therefore, future research can be conducted in a more engaging way with the respondents like face to face interview through proportionate participation from all over the country. However, COVID-19 vaccination is now a primary concern for the country's policymakers. Therefore, we believe our study will provide helpful information to the policymakers who want to vaccinate the majority proportion of people in Bangladesh to gain herd immunity against the coronavirus.

Concluding remarks

This study outlines the COVID-19 vaccine-taking hesitancy among Bangladeshi people and possible measures to increase the vaccine-taking intention. Besides, our study also demonstrates the knowledge, perceptions, and attitude toward the COVID-19

vaccine. Interestingly, a substantial portion of respondents is updated about the COVID-19 vaccine from social media and television, while approximately three-fourth of respondents have adequate knowledge about the COVID-19 vaccine. On the other hand, young less educated persons, farmers, and rural people are more hesitant to get vaccinated. Needless to know, targeting this portion of people with clear communication exposer of safety and efficacy of the vaccine and participation of rural community health clinic in vaccination program could ameliorate people's overall intention to taking the vaccine. It is a dire concern that only less than half of the participants exposed their willingness to be vaccinated. Among those who are hesitant to be vaccinated claimed that they are worried about the potential side effects. However, as a remarkable portion of respondents reported to be defiant about the vaccine, it is not surprising that respondents' perceptions and attitudes toward the vaccination program were unsatisfactory.

Recommendations and policy guidance

Indeed, to the best of our knowledge, this study is a novel approach in Bangladesh dedicated to revealing the vaccine-taking decision of general people. Given our findings, we may suggest some policies and recommendations that may guide the authority in expediting the mass vaccination program. First, vaccination awareness campaigns should be implemented immediately, especially in rural areas. Second, reports on the experiences of the people who received the vaccines should be disseminated widely. A campaign emphasizing mass vaccination irrespective of age, the public exposure of social benefits of vaccination, and influencing general people through locally accepted persons can increase the willingness to be vaccinated against COVID-19. Besides, doctors and healthcare professionals should play a key role in raising awareness about the vaccine among general people. Third, the vaccination registration procedure should be more convenient and easily accessible for all groups of people. Apart from online registration, in-person and booth registration can be implemented. Lastly, a combined effort from all the ministries concerned of the government, NGOs, different voluntary organizations, healthcare professionals, journalists, and the mass public can drive the country to a successful mass vaccination program in the battle against the pandemic should be pursued.

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Data available statements

Data used for this study are confidential and cannot be shared publicly, however, can be found from the corresponding author upon reasonable request.

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