

# Understanding Factors Responsible for Delay and Non-Compliance in COVID-19 Vaccination at a Tertiary Care Hospital in Mumbai, India

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## ABSTRACT

**Background:** Despite extensive first-dose coverage, delays in second doses and late first doses prompted a study on vaccine hesitancy and non-compliance.

**Methods:** In 2022, a cross-sectional survey was conducted at a Mumbai vaccination center, involving 504 individuals who had received either the first or second dose of the COVID-19 vaccine. The study, conducted from February to April 2022, included interviews using a pre-validated schedule to assess vaccine acceptance, refusal, socio-demographics, and reasons for hesitancy. Data analysis was performed using IBM SPSS Statistics software 23.0 to understand factors influencing vaccine delay and non-compliance.

**Result:** The study interviewed 504 participants at a Mumbai vaccination center. Most were male (63.9%), aged 18-44 (80%), and skilled workers (22.6%). Of those surveyed, 64 had received only the first vaccine dose. The delay in receiving the second dose was 37.4% for BBV152 and 41% for ChAdOx1 nCoV-19. The primary reason for delay was lack of time (50.6%), followed by fear of the vaccine (14.8%). Reasons for getting vaccinated later included resolving constraints (40.5%) and compulsion (25.8%). Vaccine choice reasons varied significantly ( $p < 0.0005$ ), but delay proportions were similar across vaccines ( $p = 0.531$ ).

**Conclusion:** Even after many efforts by the government, large numbers of people have not taken vaccine on time. One of the reasons, as seen in the study is a busy work schedule which has hindered timely vaccination in individuals. Making vaccine available at work place may address this issue to some extent, besides ownership of the program by the public.

**Keywords:** COVID-19, Vaccination hesitancy, Hospital

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### Introduction

The COVID-19 pandemic created a public health emergency which became a global concern. This disease has caused nearly 545 million infections and 63 lakh deaths worldwide as of 1st of July, 2022 (1). Personal protection measures such as wearing mask, social distancing, and hand sanitization have been shown to be effective in curbing the spread of COVID-19 (2). Vaccination is expected to be the key to the long-term prevention and control of the pandemic (3, 4). COVID-19 vaccine is regarded as the panacea for limiting the spread or eliminating the pandemic or protecting from succumbing to disease. Knowing the importance of vaccine, the Government of India had rolled out free vaccination program on January 16, 2021. It is postulated that to extinguish the pandemic completely, vaccination coverage must be high in the population. In addition, there is an increasing misinformation leading to vaccine hesitancy in a significant amount of population (3). Vaccine hesitancy refers to the postponement, uncertainty, or rejection of vaccination despite vaccination services being available. The World Health Organization (WHO) has recognized it as one of the major threats to global health (4, 5). Consequently, WHO's Strategic Advisory Group of Experts (SAGE) has recommended that governments adopt proactive measures to address vaccine hesitancy's 'hotspots' using social and behavioral insights (3). When confidence in vaccines diminishes, hesitancy can lead to significant consequences such as delays, refusals, and disruptions in vaccination programs, ultimately resulting in the resurgence of disease outbreaks. Vaccine hesitancy is a complex issue influenced by various factors including emotional, cultural, social, spiritual, and political beliefs of individuals (4). In Mumbai, 9,253,647 first doses and 6,033,148 two doses of COVID-19 vaccination were done till November 13, 2021 (6), which accounts for the majority of the population of the city. However, it has been observed that many people still took the first dose of the vaccine, and many delayed taking the second dose. Many reasons for this delay in accepting vaccination

have been assumed including lack of faith in vaccines, long queues at vaccination centers and shortage of vaccines (7). Many of these issues have been addressed by various measures taken by the Government of India, including increased number of centers, thereby increasing accessibility to the vaccine and compulsory vaccination certificates for travel and entry to various public places. Even then, many individuals are still unvaccinated and are seen to be hesitant to take the vaccines. This study is done to explore factors responsible for delaying first dose of vaccine or noncompliance for second dose and characters of such individuals as well as reasons for acceptance of vaccine later; hence, increasing vaccine confidence and compliance is proposed.

### Methods

A descriptive cross-sectional survey was conducted among individuals visiting COVID-19 vaccination center attached to a Tertiary Care Hospital in Mumbai, Maharashtra, India during the month of February-April 2022. This center at the time of the study administered only two types of COVID-19 vaccines, namely BBV152 (COVAXIN) and ChAdOx1 nCoV-19 (COVISHIELD). Only those who took either first or second dose of any vaccination were included. Pediatric or adolescent populations were not included since they were not eligible for vaccination under the vaccination program by the Government of India at the time of commencement of the study.

All individuals meeting the inclusion criteria with consecutive sampling during the study period were given a questionnaire. Assuming a proportion of 50 percent, which would provide the maximum sample size, the sample size formula for proportions was used to obtain a required sample size of 384 for a margin of error of 0.05 and 95 percent confidence interval. A total of 504 individuals met the inclusion criteria and were included in the study. The study was conducted only after obtaining approval from the Institutional Ethics Committee. Good Clinical Practices

according to the Declaration of Helsinki have been followed in conducting the study. Informed consent was obtained from all the participants in their mother's tongue by explaining the purpose of the study. The questionnaire was developed based on literature review and consisted of total 25 items regarding vaccine acceptance or refusal, faith in vaccine, socio-demographics, vaccine intentions and behavior, etc. The content validation of the questionnaire was done by experts from the field. The participants were asked to reply to the questions on a Likert's scale with 1-definitely not likely, 2-probably not likely, 3-possibly, 4-probably, and 5-definitely. The interview schedule was administered by the investigators to the participants in the waiting room after they had taken the vaccine.

Statistical analysis was done using Microsoft Office Home and Student 2021 (Excel) and IBM SPSS Statistics software 23.0. The continuous data was summarized using mean and standard deviation and categorical data as frequency and percentages. Fisher's Exact test was used for comparison between groups. A p-value of less than 0.05 was considered statistically significant.

## Results

In the study, 504 participants were interviewed. The mean age of the participants was 33.9 with a standard deviation of 14.7. The youngest participant was 18 years old and the oldest one was 87 years old. The profile of the participants is given in Table 1. About 59 (11.7%) of the participants had co-morbidities; in 30 (6%) had hypertension, 29 (5.8%), diabetes, 4 (0.8%), thyroid disorders in 3 (0.6%), asthma, in 1 (0.2%),

tuberculosis, in 1 (0.2%), HIV. Among the participants, 105 (20.8%) had taken BBV152, while 399 (79.2%) had taken ChAdOx1 nCoV- 19. Out of those who had taken BBV152, 14 (13.3%) had taken the first dose, while 91 (86.7%) had taken the second dose. For those who had taken ChAdOx1 nCoV- 19 vaccine, 50 (12.5%) had taken first dose while 349 (87.5%) had taken second dose. Overall, 64 (12.7%) and 440 (87.3%) had taken the first and second doses respectively. The mean (standard deviation) of the duration between the doses for those who had taken the second dose was 49.8 (27.6) days for BBV152 and 111.3 (40.8) days for ChAdOx1 nCoV- 19 vaccine.

It was seen that among the participants who had completed two doses of the vaccines, those who had taken BBV152, which was 57 (62.6%), had taken the second dose within the recommended time gap of 28 to 42 days from the first dose, while 34 (37.4%) had delayed the second dose. For participants who had taken two doses of ChAdOx1 nCoV- 19 vaccine, 206 (59%) had taken it before or within the recommended gap of 84 to 112 days, and 143 (41%) had taken the second dose later. The proportion of participants delaying the second dose was similar for both the vaccines ( $p = 0.531$ ). Also, 199 (45.2%) out of the 440 participants who had taken the second dose had taken the first dose at the same center, out of the remaining cases, 205 (46.6%) had taken the first dose within Mumbai at a different center, 8 (1.8%) had taken the first dose outside Mumbai but within Maharashtra state and the remaining 28 (6.4%) had taken it in a different state in India. The reasons for delay in taking the vaccine are summarized in Table 2.

**Table 1.** Socio-demographic profile of the study participants [frequency (percentage)]

Category	Frequency (n)	Percentage (%)
<b>Age groups (in years)</b>		
18 to 44	403	80.0
45 to 59	65	12.5
60 and above	36	7.1
<b>Sex</b>		
Male	322	63.9
Female	182	36.1
<b>Religion</b>		
Hindu	358	71.0
Muslim	123	24.4
Buddhist	11	2.2
Christian	7	1.4
Jain	3	0.6
Parsi	2	0.4
<b>Residence</b>		
Mumbai	502	99.6
Outside Mumbai	2	0.4
<b>Education</b>		
Illiterate	91	18.1
Primary	109	21.6
Secondary	81	16.1
Higher secondary	105	20.8
Graduation	90	17.9
Post-graduation	10	2.0
Professional	18	3.6
<b>Occupation</b>		
Unemployed	23	4.6
Homemakers	95	18.8
Students	97	19.2
Unskilled worker	56	11.1
Skilled worker	114	22.6
Clerical work, small scale business & shopkeepers	103	20.5
Professionals	12	2.4
Others (Film industry, sports)	4	0.8
<b>Family monthly mncome (in Indian rupees)</b>		
Less than 20,000	24	4.8
20,001 to 50,000	57	11.3
50,001 to 1,00,000	178	35.3
1,00,000 to 2,00,000	104	20.6
More than 2,00,000	141	28.0
<b>Total</b>	<b>504</b>	<b>100.0</b>

According to Table 2, most common reasons for delay in 255 (50.6%) of participants was the lack of time, followed by fear of vaccine in 74 (14.8%) participants, inaccessibility in 64 (12.7%), non-eligibility in 42 (8.3%), no specific

reason in 31 (6.2%), doubt about vaccine effectiveness in 9 (5.1) and unawareness about the vaccine in 6 (1.2%) participants. The reasons for later acceptance of the vaccine are summarized in Table 3.

**Table 2.** Reason for vaccine hesitancy among the participants of the study – frequency (%)

Reasons for delay in taking vaccination		First dose taken	Second dose within recommended gap	Second dose delayed beyond gap	Total
Fear	Health reasons	2 (3.1)	13 (4.9)	2 (1.1)	17 (3.4)
	Pregnancy	3 (4.7)	6 (2.3)	2 (1.1)	11 (2.2)
	Injection	3 (4.7)	15 (5.7)	7 (4)	25 (5)
	Vaccine side-effects	4 (6.3)	9 (3.4)	5 (2.8)	18 (3.6)
	Death	2 (3.1)	1 (0.4)	0 (0)	3 (0.6)
Doubt vaccine effectiveness		12	12 (18.8)	11 (4.2)	9 (5.1)
Lack of time	Work	10 (15.6)	114 (43.3)	98 (55.4)	222 (44)
	Study	4 (6.3)	16 (6.1)	4 (2.3)	24 (4.8)
	Family matters	0 (0)	0 (0)	4 (2.3)	4 (0.8)
	Surgery/other treatment	1 (1.6)	2 (0.8)	2 (1.1)	5 (1)
Inaccessibility	Crowding at center	2 (3.1)	3 (1.1)	1 (0.6)	6 (1.2)
	Not getting appointments	2 (3.1)	30 (11.4)	23 (13)	55 (10.9)
	No accompanying person	1 (1.6)	1 (0.4)	1 (0.6)	3 (0.6)
Not eligible	Had COVID infection	0 (0)	3 (1.1)	1 (0.6)	4 (0.8)
	No documents	0 (0)	3 (1.1)	0 (0)	3 (0.6)
	Underage	8 (12.5)	16 (6.1)	11 (6.2)	35 (6.9)
Not aware		0 (0)	1 (0.4)	5 (2.8)	6 (1.2)
No reason		10 (15.6)	19 (7.2)	2 (1.1)	31 (6.2)

**Table 3.** Reasons for vaccine acceptance among the participants of the study – frequency (%)

Reasons for vaccine acceptance		First dose taken	Second dose within recommended gap	Second dose delayed beyond gap	Total
Eligible now	Eligible in age criteria	8 (12.5)	18 (6.8)	10 (5.6)	36 (7.1)
	Recovered from COVID 19	1 (1.6)	2 (0.8)	0 (0)	3 (0.6)
	Got necessary documents	0 (0)	1 (0.4)	0 (0)	1 (0.2)
Compulsion	Foreign travel	2 (3.1)	5 (1.9)	5 (2.8)	12 (2.4)
	Compulsory at workplace	29 (45.3)	68 (25.9)	20 (11.3)	117 (23.2)
	Compulsory for train travel	0 (0)	1 (0.4)	0 (0)	1 (0.2)
Following advice	Doctor advised	3 (4.7)	9 (3.4)	3 (1.7)	15 (3)
	Family pressure	0 (0)	2 (0.8)	0 (0)	2 (0.4)
Resolution of issue	Recovery from illness/surgery	3 (4.7)	4 (1.5)	0 (0)	7 (1.4)
	Family issues resolved	0 (0)	0 (0)	2 (1.1)	2 (0.4)
	Post delivery	2 (3.1)	5 (1.9)	1 (0.6)	8 (1.6)
	Exam completed	0 (0)	5 (1.9)	0 (0)	5 (1)
	Got time	9 (14.1)	82 (31.2)	91 (51.4)	182 (36.1)
Availability	Better accessibility to center	3 (4.7)	27 (10.3)	21 (11.9)	51 (10.1)
	Camp in residential area	0 (0)	0 (0)	4 (2.3)	4 (0.8)
	Less crowd at center	0 (0)	4 (1.5)	0 (0)	4 (0.8)
	Availability of vaccine	0 (0)	1 (0.4)	0 (0)	1 (0.2)
Others	Fear of new variant of virus	1 (1.6)	15 (5.7)	11 (6.2)	27 (5.4)
	Got convinced	3 (4.7)	11 (4.2)	5 (2.8)	19 (3.8)
	Understood procedure	1 (0.4)	1 (0.4)	1 (0.6)	2 (0.4)
	No reason	2 (0.8)	2 (0.8)	3 (1.7)	5 (1)
Total		<b>64 (100)</b>	<b>263 (100)</b>	<b>177 (100)</b>	<b>504 (100)</b>

The reason for taking vaccine now was mostly the resolution of constraining issue in 204 (40.5%) participants such as recovery from illness, followed by compulsion for taking vaccine in 130 (25.8%), improved availability of COVID 19 vaccine in 60 (11.9%), becoming eligible for the vaccine in 40 (7.9%), following advice of a doctor or family member in 17 (3.4%) and other reasons in 53 (10.6%). The participants reported that their family members had received at least one dose of COVID-19 vaccines except

for one participant who had a few family members who were not vaccinated at all. Among the participants, 53 (10.5%) had developed COVID-19 disease in the past. Out of these, 7 (13.2%) people needed ICU admission, 21 (39.6%) were admitted to a hospital set-up, and 25 (47.2%) recovered in home isolation and care. The reasons for making decisions by the participants for selecting the vaccine are given in Table 4, which differed significantly between the two types of vaccines ( $p < 0.0005$ ).

**Table 4.** Reasons given by participants about selection of the vaccine by them – frequency (%)

Reason for choice	BBV152	ChAdOx1 nCoV- 19	Total
I did not have any preference	47 (44.8)	307 (76.9)	354 (70.2)
Relatives/ friends have taken this vaccine	4 (3.8)	57 (14.3)	61 (12.1)
It has less side effects	32 (30.5)	20 (5)	52 (10.3)
It has better efficiency	12 (11.4)	14 (3.5)	26 (5.2)
Less gap between two doses	9 (8.6)	0 (0)	9 (1.8)
Doctor advised	1 (1)	0 (0)	1 (0.2)
It is approved worldwide	0 (0)	1 (0.3)	1 (0.2)
Total	105 (100)	399 (100)	504 (100)

Almost all the participants who had taken ChAdOx1 nCoV- 19 vaccine had experienced some mild forms of adverse events

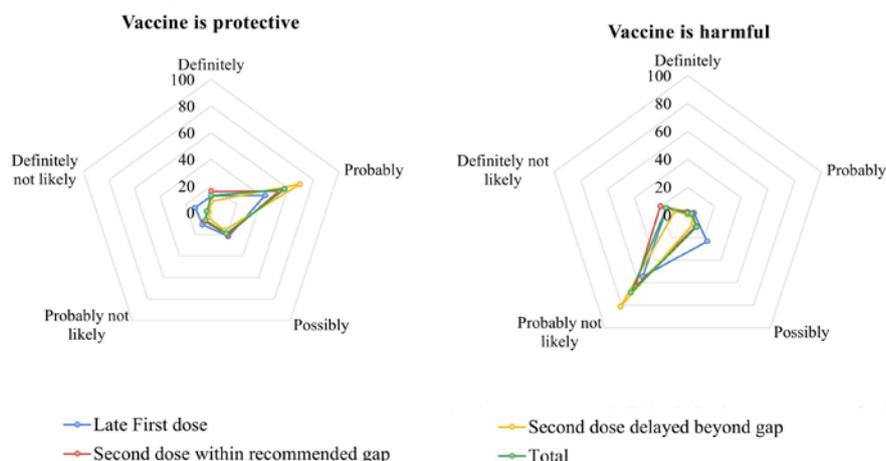
post-vaccination after the first dose, whereas for BBV152, 71 (78%) had mild adverse effects as seen in Table 5.

**Table 5.** Adverse events after first dose reported by the participants for each type of vaccine {Single participant may have multiple symptoms. Values are expressed in frequency (percentage)}.

Vaccine taken	Adverse event in first dose	Second dose within recommended gap	Second dose delayed beyond gap	Total
ChAdOx1 nCoV- 19	Fever	108 (52.4)	98 (68.5)	206 (59)
	Chills	41 (19.9)	68 (47.6)	109 (31.2)
	Body ache	65 (31.6)	80 (55.9)	145 (41.5)
	Headache	2 (1)	0 (0)	2 (0.6)
	Pain at site	34 (16.5)	44 (30.8)	78 (22.3)
	Weakness	3 (1.5)	0 (0)	3 (0.9)
	None	0	0 (0)	0 (0)
	Total	206 (100)	143 (100)	349 (100)
BBV152	Fever	33 (57.9)	21 (61.8)	55 (60.4)
	Chills	1 (1.8)	1 (2.9)	2 (2.2)
	Body pain	16 (28.1)	10 (29.4)	26 (28.6)
	Pain at site	4 (7)	4 (11.8)	8 (8.8)
	None	15 (26.3)	5 (14.7)	20 (22)
	Total	57 (100)	34 (100)	91 (100)

126 (84.5%) participants in general did not perceive the vaccine to be harmful; however, 58 (11.5%) people said that the vaccine can have long-term side-effects, 11 (2.2%) felt that it may lead to

death, and a few others believed that the vaccine caused hair loss, memory loss, laziness, weakness, and infertility. The perception of the vaccine in terms of protection and harm is depicted in Figure 1.



**Figure 1.** Perception of the vaccines among the participants (in percentage)

## Discussion

In this study, about 50.6% of the participants delayed the dosage of COVID-19 vaccine due to lack of time, followed by fear (14.8%), inaccessibility (12.7%), non-eligibility (8.3%), no specific reason (6.2%), and unawareness (1.2%). The reason for taking vaccine was mostly the resolution of the constraining issues (40.5%) such as recovery from illness, followed by compulsion for taking vaccine in 25.8% cases and improved availability of COVID-19 vaccine in 11.9% subjects. The COVID-19 vaccine acceptance behavior can be used as an example which can be applied to other interventions at mass level. With the pandemic moving towards a declining phase, the COVID-19 vaccination also may not be essential in health services provision by countries. During the start of the vaccination drive, studies have noted that the main reason for non-acceptance of the vaccine across countries was vaccine misinformation. The other reasons were vaccine safety concerns, availability, and limited perceived risk of getting COVID-19 infection (8). As per the study done by Soares et al. (5) in Portugal, at the beginning of vaccination drive i.e. from September 2020 to

January 2021, factors linked to refusal and delay included being younger, experiencing income loss during the pandemic, lacking intent to receive the flu vaccine, having low confidence in the COVID-19 vaccine and healthcare system response during the pandemic, holding a negative view of government measures, and perceiving the provided information as inconsistent and contradictory. Similarly, in the study done by Leigh et al. (16) the reasons for vaccine hesitancy were the concerns about vaccine safety, speed of development, and low perceived disease risk which was similar to this study. The mixed method study done by Inam et al (17) on Pakistani females and chronic illnesses were associated with low rates of vaccine acceptance, a finding different from this study. According to the studies regarding vaccine acceptance in countries such as Germany, Russia, France, and Sweden (14), the vaccine acceptance was more in females and in those with chronic illness, a finding similar to this study. Vaccine hesitancy was associated with the lack of trust in the vaccine's efficacy and safety as well as carelessness in this study, which was similar to the study done by Hill et al. (18).

The difference in study findings could be

attributed to several sociocultural factors and beliefs. Fear being the major factor for vaccine hesitancy in this study was similar to the study done by Tolia et al. (19).

The present study was conducted at a later stage, and therefore, most of these reasons are not evident at this time to a large extent. This may be due to the increased efforts by governments all over the world to create awareness and increase accessibility and availability of the vaccine universally. The government of India even funded the entire vaccination drive, making it available at government set-ups completely free of cost. At present, the reasons for not taking the vaccine was mainly due to lack of time and fear of the vaccine.

The results of the present study indicated that vaccine hesitancy behavior among the overall sample population was relatively low. This aligned with the findings from a study in India by Jain et al. (20), which found that greater awareness of COVID-19 vaccine correlated with reduced rates of vaccine-hesitant behaviors. Moreover, there was a strong support among individuals for receiving vaccination, reflecting a positive perception of vaccine effectiveness. These findings suggested a minimal level of vaccine hesitancy among the participants in this study. In contrast to previous surveys conducted in India (21), the current study was conducted from February 2022, coinciding with a period when the vaccination campaign was fully operational. During this time, mass vaccination was freely available to citizens at government hospitals across India, with immediate access for the elderly population.

These two factors for delay of getting the vaccine were not targeted to increase the acceptance of the vaccine. It was observed that out of the people taking the vaccine, 57.4% were employed, and the reason for not taking the vaccine was work related in 44% cases. This showed that there was lack of employee-friendly policies in many workplaces to encourage people to get vaccinated. Majority of participants took ChAdOx1 nCoV- 19 as they were not offered other alternatives of the COVID-19 vaccines, and in the beginning of vaccination drive, ChAdOx1 nCoV-

19 was widely available. In a study in Chile (9), vaccine perceived as the one with minimum side effects was opted by individuals as they preferred to choose from different available COVID-19 vaccines. In the present study, only 5.1% were hesitant for COVID-19 vaccination due to doubt about vaccine effectiveness which was much lesser than a similar study (18.1%) conducted elsewhere in earlier days of vaccination campaign (9-12). This showed that many individuals had accepted the vaccine either due to increased awareness or due to majority of individuals around them getting vaccinated, and showed no major adverse-effects. The rate of increased acceptance of vaccine in this study was similar to the study done by Lazarus (14) in 23 countries. It was observed that out of those who had completed two doses, the delay in taking second dose within the recommended interval was seen in 37.4% and 41% for BBV142 and ChAdOx1 nCoV- 19 respectively. It was not studied whether these individuals were aware of the importance of taking the second dose within the recommended duration. The primary reason for taking the vaccine was that it resolved a key issue, allowing the individual to have more free time. The compulsory factor formed 25.8% of the reason to accept the vaccine. However, the compulsion of vaccination for jobs, travel and entry into public places has not been accepted worldwide. The same top two concerns—that there should be freedom of choice to be vaccinated and freedom of movement when vaccinated- was noted by studies conducted in different countries (8,13-15). There was a sizable number (25.8%) who took the vaccine because of fear of a new variant. This showed that fear is a two-way drive for any public health policy, and can have favorable or adverse action on individual behaviors depending on the focus of the fear. Although fear cannot be advocated for the penetration of a public health policy, a healthy communication to make individuals understand consequences of not accepting public health interventions can help implement the programs. The study's results can help policymakers and program implementers plan services in a way that makes them more acceptable and convenient for

individuals. This can be achieved by integrating policies without disrupting people's daily routines and addressing safety concerns by providing clear safety data and effectively communicating the associated risks. The limitation of this study was that the reason for non-acceptance of the vaccine cannot be compared with the reasons for vaccine hesitancy and vaccine preferences that were seen at the start of the vaccination campaign as no such data has been collected from the same site.

### Conclusion

In India, COVID-19 vaccines are accessible and free, but hesitancy and delayed doses persist due to work schedules. To overcome this, vaccines could be offered at workplaces with time-off policies. Increasing public awareness through campaigns and strengthening government resources like helplines are essential. With India's large population, even a small number of hesitant individuals could lead to millions unvaccinated, risking future outbreaks and variants. Urgent strategic measures and policy decisions are needed to boost vaccination rates and curb the spread of COVID-19.

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None

### Conflicts of interest

The authors declared no conflict of interests.

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None

### Ethical considerations

Study was conducted in accordance with International Ethical Guidelines for Biomedical Research Involving Human Subjects prepared by the council for International Organization of Medical Sciences (CIOMS) in collaboration with World Health Organization.

Ethical approval was obtained from Institutional Ethics Committee before the start of the study.

### Code of ethics

HIEC/002/FEB-22/O/RP/02/02-22

### Authors' contributions

R. CM, was involved in data analysis and interpretation, conceptualization, and manuscript writing; G. P, conducted data collection and manuscript writing; P. C, did manuscript revision, submission and changes.

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