ORIGINAL ARTICLE

A Regional Cross-sectional Study: Insight for Covid-19 Booster Dose Acceptance in Kolkata, India

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ABSTRACT

Background: The COVID-19 pandemic, declared a global health crisis by the WHO in March 2020, accelerated vaccine development. Despite widespread availability, vaccine hesitancy remains a challenge. This study examines factors influencing acceptance and preference for COVID-19 booster doses in Kolkata, India. **Methods:** A cross-sectional study was conducted from March 2022 to March 2023 using a self-administered online questionnaire distributed via social media platforms, including WhatsApp and Facebook. Participants aged 18 and above in Kolkata responded through Google Forms. Descriptive analyses and multivariable logistic regression assessed factors influencing booster dose acceptance. Sampling was conducted through professional and community networks, though individuals with limited digital access were excluded. **Results:** Among 503 participants, 93.4% accepted the booster dose, and 63.8% had received it. Participants preferred vaccines with effectiveness thresholds below 90%, prioritizing protection lasting ≥12 months with minimal side effects. The most influential factor in vaccine choice was effectiveness (48.7%), followed by concern about side effects (37.6%). Logistic regression indicated occupational group and gender significantly impacted booster acceptance. A limitation was the overrepresentation of younger, male, and highly educated individuals, potentially affecting generalizability. **Conclusion:** High acceptance of the COVID-19 booster dose was observed. Vaccine effectiveness and side effects were key in decision-making. However, self-reported data and limited inclusion of older or rural populations highlight the need for broader studies. Tailored communication strategies are essential to boost uptake and ensure vaccination programs evolve from government initiatives into inclusive public health efforts.
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Keywords: Acceptance, Booster Dose, COVID-19, Effectiveness Threshold, Occupational Group

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INTRODUCTION

The World Health Organization (WHO) has reported over 44 million confirmed cases of COVID-19 in India (1). Kolkata, one of the hardest-hit cities in the country, recorded more than 120,000 infections and 9,700 deaths in 2020 (2). The region's disproportionately high number of cases can partly be attributed to the poor public health infrastructure and the dense population, with approximately 30% of its residents living in slums (3,4).

In the early stages of the pandemic, the West Bengal State Government implemented strategies to identify and contain areas with heightened COVID-19 cases, aiming to break the chain of transmission (5). Following a surge in cases in 2021, the introduction of vaccination on January 16, 2021, led to a significant reduction in new infections and fatalities. By December 2022, Kolkata reported only 155 new cases and 3 deaths, marking the lowest levels since the pandemic began (6). Initial containment efforts, which focused on social isolation and hygiene practices, later evolved to prioritize vaccination as a more effective public health measure (7).

In Kolkata, about 98% of the eligible population is fully vaccinated, yet only 30% have received the COVID-19 booster dose (7). This acceptance rate is considerably lower than in New Delhi, where 58% of the population has received the booster, and other surveys report a

booster dose acceptance rate of around 50% (8). Factors contributing to booster dose hesitancy in Kolkata include a lack of awareness about vaccine availability, the perception that the pandemic is over, the belief in lower infection risk after recovery, previous side effects from vaccines, and doubts regarding the effectiveness of the booster (9). Hesitancy is particularly pronounced among the tribal population in West Bengal, influenced by factors such as limited knowledge, low economic status, attitudes toward the health system, and access issues. Inadequate vaccine availability and insufficient public health campaigns contribute to the unfavorable attitudes toward vaccination (10).

At the global level, the acceptance of COVID-19 booster doses ranges from 51.6% to 97.9% (11). A review of these studies identified several predictors of hesitancy, including younger age, low confidence in the vaccine, adverse reactions to previous doses, and concerns about severe side effects from the booster (11). Furthermore, uncertainties about vaccine effectiveness have been a consistent theme. Studies from various countries report COVID-19 vaccine efficacies ranging from 50% to 95%, significantly influencing public trust and vaccine decision-making (12). A substantial percentage of participants in similar studies also preferred locally produced vaccines, highlighting the impact of vaccine characteristics such as dosing regimens, manufacturing technology (mRNA vs. inactivated virus), and country of origin on public confidence (13). Distrust in vaccines from certain countries has exacerbated hesitancy, leading to misconceptions about vaccine development and efficacy. These complexities underscore the need to understand how the availability of multiple vaccine options influences individual preferences.

Global vaccine supply constraints further complicate vaccine acceptance, limiting individuals' ability to choose their preferred vaccine and introducing variability in vaccine efficacy, dosing regimens, manufacturing platforms, and effectiveness against viral variants (14). Booster hesitancy, along with waning immunity and the emergence of new SARS-CoV-2 variants, poses a significant risk for increased morbidity and mortality (9). To date, however, there has been no study examining the factors associated with vaccine booster acceptance in Kolkata.

Given the urgency of this issue, this baseline cross-sectional study was conducted to provide preliminary insights and address policy gaps. The objective of this regional study in Kolkata is to investigate the acceptance of COVID-19 booster doses and explore the factors influencing vaccine choice and uptake. As vaccines become more accessible, understanding these factors will be essential in shaping effective strategies to increase booster dose acceptance and coverage, thereby contributing to efforts aimed at ending the COVID-19 pandemic.

Materials & Methods

A selected group of researchers affiliated with academic and research networks in Kolkata were invited to participate in this study. Researchers from Kolkata responded positively to these invitations. A cross-sectional survey was conducted within the Kolkata region using a self-administered online questionnaire, carried out from March 2022 to March 2023.
The sample size for the study was calculated using the formula:

$$n = \frac{Z^2 P\,(1 - P)}{d^2}$$

Assuming a margin of error of 0.05, a 95% confidence interval (CI), and a 50% response distribution, the required sample size was 384 based on a similar study (16). Considering an inflation rate of 20%, the final sample size was adjusted to 503. Participants were selected using a purposive sampling approach, with eligibility criteria including individuals aged 18 or older, residents of India, and those willing to provide informed consent electronically. Data collection was conducted via Google Forms, shared across various social media platforms, including WhatsApp, Facebook, and Instagram.[AL1.1] To enhance response rates, participants were encouraged to forward the survey links to their contacts after completing the questionnaire.
The survey was structured into four sections:

Section A: Socio-demographic information, including age, gender, religion, education level, and employment status.

Section B: COVID-19 vaccine acceptance, measured by a single item using a Likert scale (1 = Extremely likely, 2 = Likely, 3 = Unlikely, 4 = Extremely unlikely).

Section C: Factors influencing the acceptance of the COVID-19 booster dose. This section included five items with multiple-choice options. Participants were asked to assess their reasons for vaccine uptake, including the number of doses beyond the primary injection. Additional items addressed participants' willingness to accept vaccines based on their effectiveness threshold (below or above 90%), concerns regarding vaccine side effects, the duration of protection, the technology used in vaccine production (e.g., mRNA vaccines), and whether the vaccine's country of origin influenced their acceptance.

Section D: Participants were asked to rank the attributes influencing their choice of a COVID-19 vaccine. This section included two items with multiple-choice options (Supplementary S1). All questions were close-ended, with tick boxes for responses.

The questionnaire was adapted from Wong et al. (2021),

initially developed in English and validated by content experts for content validity (16). It was then translated into Hindi through a rigorous back-to-back translation process to ensure accuracy. Both the English and Hindi versions were pilot tested with 30 participants across various settings, achieving a Cronbach's alpha reliability score of 0.70 to 0.85.

In the initial section of the online survey, participants were provided with detailed information about the study's objectives and background. To proceed, participants were required to affirm their willingness to participate by answering a yes/no consent question. Upon consent, participants were directed to complete the self-administered questionnaire. Ethical clearance for the study was obtained from the Noida International University Ethics Review Board Committee (NERB/SON/PH/21/101), ensuring adherence to ethical standards and protocols (Supplementary file: Ethical Approval).

Statistical Analyses

Descriptive analyses were performed to assess the distribution of explanatory variables. Continuous data, such as age, was transformed into categorical data according to the methodology described by Krishna et al. (2023), and occupational and education variables were collapsed for easier interpretation (17). Multivariable logistic regression was used to identify determinants influencing the likelihood of accepting the COVID-19 vaccine booster dose in India. The dependent variable for booster acceptance was coded as 1 (Extremely likely/Likely) and 0 (Unlikely/Extremely unlikely). Following the Hosmer-Lemeshow criterion, variables with a p-value < 0.25 in univariate logistic regression were included in the full multivariable logistic regression model (18). Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for each independent variable. The absence of multicollinearity was confirmed by ensuring that the Variance Inflation Factor (VIF) was below 5. Model fitness was assessed using the Hosmer-Lemeshow test for goodness-of-fit and the Omnibus Chi-square test (19). A p-value below 0.05 in the Hosmer-Lemeshow test and a p-value above 0.05 in the Omnibus test indicated appropriate model fit.
All statistical analyses were conducted using SPSS version 22.0 (SPSS Inc., Chicago, IL, USA), with p-values of 0.05 or less considered statistically significant.

Results

Socio-demographic Distribution

A total of 503 participants completed the survey, resulting in a 100% response rate. The mean age of participants was 21.2 (±1.8) years. The majority of participants were male (82.3%), followed by those identifying as Hindu (52.5%). Educational attainment was predominantly at the certificate/A-level (47.3%), and 47.3% of participants were employed full-time.

Descriptive Statistics

A significant proportion of participants (72.4%) had either delayed acceptance or outright refused vaccines despite the availability of vaccination services. The overall acceptance rate for the COVID-19 booster dose was 93.4% (95% CI: 0.9088, 0.9526), with 63.8% of participants having received the booster dose. The full details of participants' characteristics are shown in the first and second columns of Table 1.

Table I: Socio-demographic of participants

Participants Characteristic	n	(%)
Total	503	100
Age group (years)		
<=30	26	5.2
31-40	325	64.6
41-50	101	20.1
>50	51	10.1
Gender		
Male	414	82.3
Female	89	17.7
Religion		
Hindu	264	52.5
Christian	43	8.5
Muslim	196	39.0
Highest educational attainment		
Primary school	42	8.3
Secondary school/ O-level	95	18.9
Certificate/ A-level	238	47.4
Bachelor degree/ Postgraduate	128	25.4
Employment status		
Full time	238	47.3
Part time	73	14.5
Self-employed	121	24.1
Home maker	27	5.4
Student/ Retired/ Unemployed	44	8.7

Frequencies of A1 - Transform 1

A1 - Transform 1	Counts	% of Total	Cumulative %
<=30	26	5.17%	5.17%
31-40	325	64.61%	69.78%
41-50	101	20.08%	89.86%
>50	51	10.14%	100.00%

Figure 1 illustrates the distribution of participants' preferences regarding various COVID-19 vaccine characteristics. More than half of the participants (52.3%) indicated willingness to accept a vaccine even if its effectiveness fell below the 90% threshold. A substantial majority (75%) stated they would only accept a vaccine that offers protection lasting no less than 12 months. Additionally, nearly 60% of participants expressed unwillingness to accept vaccines developed using mRNA technology, and 56% preferred vaccines produced by specific countries.

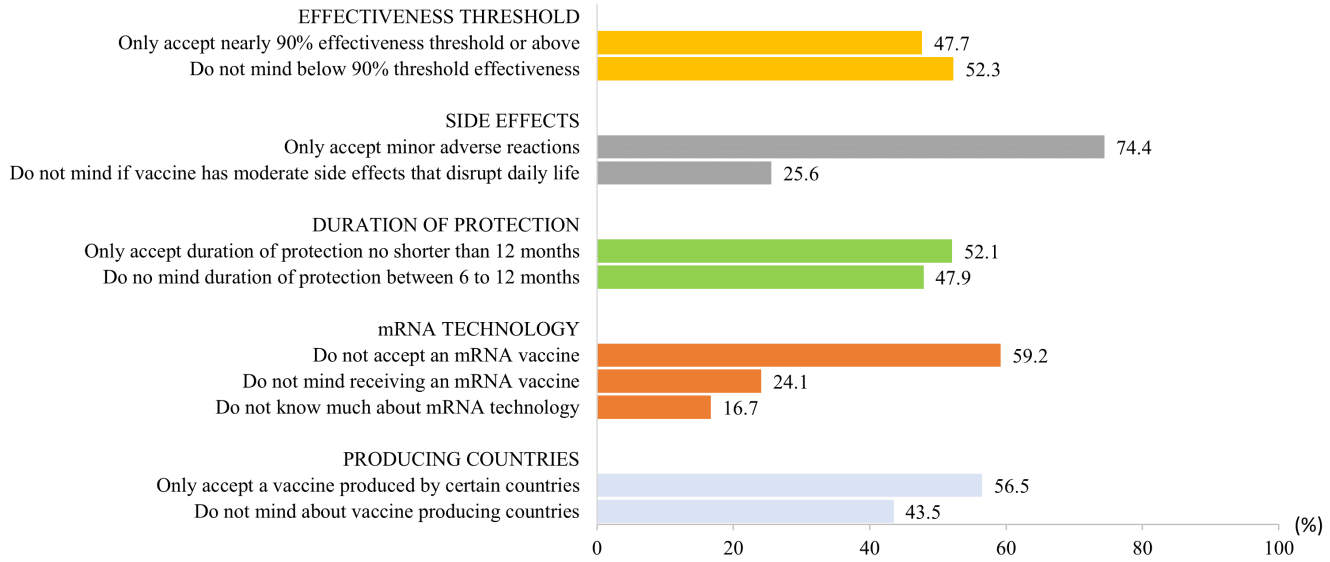

Figure 1: the proportions of participants' preferences regarding various covid-19 vaccine characteristics

Figure 2 presents the primary and secondary factors influencing the participants' choice of COVID-19 vaccine. The most important factor influencing vaccine choice was the vaccine's effectiveness threshold, with 48.7% of respondents prioritizing it. Side effects were the second most important factor, with 30.2% of participants highlighting it. For the second most crucial factor, side effects remained significant for 37.6% of respondents, followed closely by the duration of protection (28.6%).

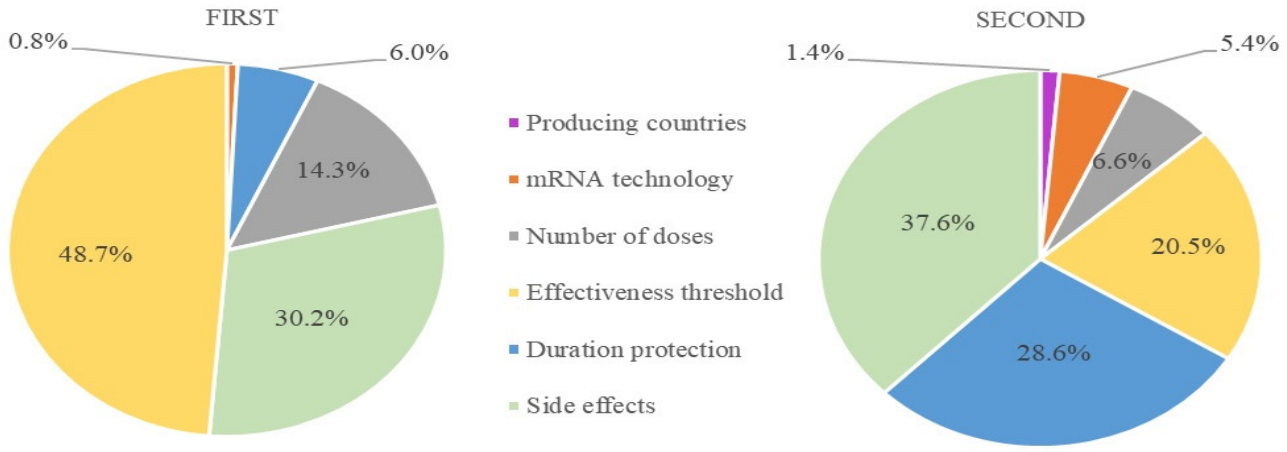

Figure 2: regarding the first and second most important factors influencing the choice of COVID-19 vaccine.

Inferential Statistics

Univariate analysis revealed that gender significantly influenced booster dose acceptance, with males having twice the odds of accepting the booster compared to females. Participants with a bachelor's or postgraduate degree were four times more likely to accept the booster than those with only a primary education. Full-time workers were also more likely to accept the booster dose compared to non-full-time workers (OR 3.75, 95% CI: 1.82, 7.70). No significant associations were found between vaccine-related factors and the likelihood of receiving the COVID-19 booster dose.

Following the Hosmer-Lemeshow criteria, six variables from the univariate analyses with p-values <0.25 were included in the full multivariable logistic regression model (Tables 2 and 3). The final model revealed that full-time workers and self-employed participants (AOR = 3.15, 95% CI: 1.50, 6.58) were significantly more likely to accept the COVID-19 booster dose compared to those who were students, retirees, or unemployed. Being male was also significantly associated with higher acceptance of the COVID-19 booster dose compared to females (AOR = 2.50, 95% CI: 1.15, 5.43). Education level, particularly non-bachelor's or postgraduate degree versus bachelor's degree or higher, was another important factor retained in the final model, demonstrating improved model fitness indicators in terms of R , AUC, and the Classification table (Table 4).

Table II: Univariate analyses of the socio-demographic factors and the acceptance of the COVID-19 vaccine booster dose (n= 503)

Socio-demographic characteristics	n (%)	Acceptance of the COVID-19 vaccine booster dose if it is available in India and recommended by the government			Univariate Logistic Regression	*P*-value
		Extremely likely/ Likely n (%)	Unlikely/ Extremely unlikely n (%)	Chi-square	Crude OR (95% CI)	
Total	503(100)	470 (93.4)	33(6.6)			
Age group (years)						
<=30	228 (45.3)	213 (93.4)	15 (6.6)	1.05	Reference	
31-40	197 (39.2)	186 (94.4)	11 (5.6)		1.19 (0.53, 2.66)	0.670
41-50	78 (15.5)	71 (91.0)	7 (9.0)		0.71 (0.28, 1.82)	0.481
>50						
Gender						
Female	89 (17.7)	77 (86.5)	21 (5.1)	8.45	Reference	
Male	414 (82.3)	393 (94.9)	12 (3.5)		2.92 (1.38, 6.18)	**0.005
Religion						
Hindu	264 (52.5)	248 (93.9)	16 (6.1)	0.64	Reference	
Christian	43 (8.5)	39 (90.7)	4 (9.3)		0.63 (0.20, 1.98)	0.428
Muslim	196 (39.0)	183 (93.4)	13 (6.6)		0.91 (0.43, 1.93)	0.803
Highest educational attainment						
Primary						
Secondary	42 (8.3)	37 (88.1)	5 (11.9)	4.65	Reference	
Certificate	95 (18.9)	88 (92.6)	7 (7.4)		1.70 (0.51, 5.70)	0.391
Bachelor degree/	238 (47.4)	221 (92.9)	17 (7.1)		1.76 (0.61, 5.05)	0.296
Postgraduate	128 (25.4)	124 (96.9)	4 (3.1)		4.19 (1.07, 16.41)	**0.040
Employment status						
Full time						
Part time	238 (47.3)	229 (96.2)	9 (3.8)	21.6	Reference	
Self-employed	73 (14.5)	67 (91.8)	6 (8.2)		0.44 (0.15, 1.28)	0.131
Home maker	121 (24.1)	116 (95.9)	5 (4.1)		0.91 (0.30, 2.78)	0.871
Student/ Retired/Unemployed	27 (5.4)	21 (77.8)	6 (22.2)		0.14 (0.04, 0.42)	***<0.001
	44 (8.7)	37 (84.1)	7 (15.9)		0.21 (0.07, 0.59)	**0.003

**p<0.01, ***p<0.001

Table III: Univariate analyses of the vaccine-related factors and the acceptance of the COVID-19 vaccine booster dose (CONT.)

Vaccines Related Factors	n (%)	Acceptance of the COVID-19 vaccine booster dose if it is available in India and recommended by the government			Univariate Logistic Regression	*P-value*
		Extremely likely/ Likely (n=470)	Unlikely/ Extremely unlikely (n=33)	Chi-square	Crude OR (95% CI)	
Vaccination history ever delayed acceptance/ refused vaccines despite the availability of vaccine service						
Yes	364 (72.4)	345 (94.8)	19 (5.2)	3.86	Reference	0.053
No	139 (27.6)	125 (89.9)	14 (10.1)		0.49 (0.24, 1.01)	
Factors influence vaccines booster acceptance						
Effectiveness						
>90 %	240 (47.7)	226 (94.2)	14(5.8)	0.40	Reference	
=<90%	263 (52.3)	224 (92.8)	19(7.2)		0.80(0.39, 1.62)	0.530
Side effects						
minor effects	374 (74.4)	351(93.9)	23 (6.1)	0.40	Reference	
moderate effects	129 (25.7)	119 (92.2)	10 (7.8)		0.78(0.36, 1.69)	0.527

Table III: Univariate analyses of the vaccine-related factors and the acceptance of the COVID-19 vaccine booster dose

Vaccines Related Factors	n (%)	Acceptance of the COVID-19 vaccine booster dose if it is available in India and recommended by the government			Univariate Logistic Regression	*P-value*
		Extremely likely/ Likely (n=470)	Unlikely/ Extremely unlikely (n=33)	Chi-square	Crude OR (95% CI)	
Duration of Protection	262(52.1)	246 (93.9)	16 (6.1)			
> 12 months				0.18	Reference	0.668
Between 6-12 months	241(47.9)	224 (93.0)	17 (7.1)		0.86 (0.42, 1.73)	
Vaccine developed using mRNA technology						
Yes	121(24.1)	112 (92.6)	9(7.4)	5.75	Reference	
No	298(59.2)	284 (95.3)	14(4.7)		1.63(0.67, 3.87)	0.268
I don't know	84(16.7)	74 (88.1)	10(11.9)		0.59(0.23, 1.53)	0.282
Vaccines produced by specific country						
Yes	284 (56.5)	263(92.6)	21 (7.4)	0.74	Reference	
No	219(43.5)	207 (94.5)	12(5.5)		1.38(0.66, 2.87)	0.390

**p<0.01, ***p<0.001

Table IV: Multivariable analyses of the factors regarding the acceptance of the COVID-19 vaccine booster dose

Factors	B	Crude OR (95% CI)	P-value	B	Adjusted OR (95% CI)	P-value
Gender						
Female		Reference			Reference	
Male	1.07	2.92 (1.38, 6.18)	**0.005	0.92	2.50 (1.15, 5.43)	**0.021
Occupation Group						
Non-full time		Reference	***< 0.001		Reference	
Full-time/Self-employed	1.32	3.75(1.82, 7.70)		1.15	3.15 (1.50, 6.58)	**0.002
Education Level						
Non-Bachelor /None Postgraduate		Reference			Reference	
Bsc /Postgraduate	0.95	2.60(0.90, 7.54)	0.079	0.87	2.4 (0.81, 7.02)	0.116

Model Development: The Hosmer-Lemeshow strategy 4, entry criterion of *P*-values <0.25 backward in purposive variables exclusion with *P*-value > 0.05 guided by the likelihood-ratio test. All the models were assessed for good model fitting (AUC: 0.70, R N: 0.1048 VIF <5 classification table 0.9763). Full-time: As declared by the participants as a permanent job with formal employment. Non- full time =Student/Retired/Unemployed/Part-time/Homemaker; Non-bachelor level = Primary school /Secondary school/O-level/Certificate/A-level. Bsc = Bachelor
**p<0.01, ***p<0.001

Discussion

In India, the approval of COVID-19 booster doses began on January 10, 2022, for frontline workers, later expanding to the broader population. This study aimed to assess the acceptance of COVID-19 booster doses among the adult population in Kolkata, West Bengal, providing valuable insights for policymakers in shaping health awareness campaigns and communication strategies aimed at the target beneficiaries.

The study revealed an acceptance rate of 93.4% for the booster dose, which significantly exceeds the findings of Achrekar et al. (8), who reported a 58.28% booster coverage rate in an urban slum and resettlement colony in Delhi, one year after the vaccine rollout. A subsequent online survey across various states in India during the second quarter of 2022 found an even lower acceptance rate of 28.4% (20). Moreover, a surge in vaccine hesitancy (44.1%) was noted during the initial phase of booster vaccine deployment, as observed by Achrekar GC et al. (8). Globally, a systematic review of 48 studies on COVID-19 booster acceptance reported an average rate of 81% (21), while another review found rates ranging from 51.6% to 97.9% (11). The markedly higher acceptance rate in this study may be attributed to the participant pool's demographic characteristics, particularly their higher educational qualifications, with most participants having education levels beyond certificate or pre-university. This contrasts with other Indian studies where participants generally had lower education levels, especially those from socio-economically disadvantaged areas such as slums (9), which likely influenced their vaccine acceptance.

The study also found that males were more likely to accept the booster dose compared to females, a result consistent with similar studies (8, 22, 23). However, a study by Raja SM et al. among medical students in Sudan found no significant demographic correlations with vaccination uptake (24). Lower participation rates among females in some studies could be attributed to gender disparities in digital access, as noted by Dhalaria et al. The increasing digital connectivity among

males likely facilitated better access to health-related information, including vaccines, which may have contributed to their higher acceptance. This highlights the importance of considering digital equity in public health strategies, especially in vaccine dissemination and education campaigns (25).

Further analysis revealed that full-time workers and self-employed individuals were more likely to accept the booster dose. This aligns with the findings of Harapan et al., who found a significant association between self-employment and vaccine acceptance (26). In contrast, a Malaysian survey did not identify a significant link between occupation type and vaccine uptake (27). The higher acceptance among full-time workers could be due to their perceived higher risk of COVID-19 exposure, particularly in roles that require interaction with the public, increasing their perceived need for vaccination.
Education level was a significant predictor of vaccine acceptance in our study, consistent with previous research (9). Sharma N et al. found that older adults, higher education, and higher per-capita income were associated with higher booster dose uptake among older adults from low socio-economic backgrounds in India (9). Similarly, Achrekar GC et al. identified low-income individuals, rural residents, and those without vulnerable household members as less likely to receive the booster (8).

Beyond socio-demographic factors, the study also found that vaccine effectiveness, side effects, duration of protection, and the number of doses were the top reasons influencing booster dose acceptance. While no direct correlation was found between these factors and vaccine uptake, concerns about side effects and vaccine effectiveness remain critical in influencing public perception. Studies elsewhere have highlighted similar concerns, with people expressing doubts about vaccine effectiveness, side effects, and the duration of protection (28–31). In a study by Zimmerman T et al., 12% of hesitant participants expressed mistrust regarding the vaccine's benefits, and Gautier S et al. found that vaccine safety was a primary concern for 75% of hesitant participants (23, 30). Similarly, Raja SM et al. and Jain J et al. found that around 39.6% and 36.5% of participants, respectively, were uncertain about vaccine safety and effectiveness (24, 32).

The study also revealed that approximately 60% of participants were hesitant to accept mRNA vaccines, which contrasts with findings by Tay WC et al., who reported a preference for mRNA vaccines among younger demographics (31). This hesitancy may be due to widespread misinformation about mRNA vaccines, including concerns about DNA alteration and severe adverse effects (33, 34). These findings underscore a significant communication gap that needs to be addressed by health authorities and healthcare providers. To reduce vaccine hesitancy, efforts must focus on enhancing public understanding of vaccine efficacy, side effects, and expected immunity duration. Inconsistent messaging, especially during the booster campaign, may have fostered complacency, leading some individuals to believe that the pandemic was over prematurely (9, 20, 35). Clear and consistent communication is vital for dispelling myths and promoting informed decision-making.

In West Bengal, the available vaccines include Covaxin (BBV152), Covishield (AZD1222), and Sputnik V. Participants' preferences were influenced by factors such as the country of origin of the vaccines. Samanta et al. found that vaccines produced in India were more readily accepted, though this preference did not significantly affect overall vaccine acceptance (36).
Comparing our study to a qualitative multi-state study by Godbole S et al., we observe that while our study focused on individual-level factors like gender, occupation, and education, Godbole et al. identified community-level and systemic barriers to booster dose uptake. These barriers included pandemic fatigue, limited access to vaccination centers, and complacency, while facilitators included perceived risk and concerns about future vaccine shortages. Media was both a tool for initial vaccine awareness and a source of misinformation. These findings align with our results and emphasize the need for targeted, decentralized, and community-driven strategies to reduce vaccine hesitancy in India (37). [AL2.1]

Several limitations of the study should be noted. First, the recruitment method via Google Forms may have preferentially attracted tech-savvy and educated individuals, potentially skewing the demographics. The overrepresentation of male participants may reflect societal trends where males are more likely to own IT devices than females, leading to an overestimation of vaccine acceptance. The use of convenience sampling may have also introduced selection bias, limiting the generalizability of the findings. Lastly, factors such as the influence of religion and specific issues related to mRNA vaccines were not considered, warranting further research into these aspects.

Conclusions

This study demonstrated a high acceptance rate of 93.4% for the COVID-19 booster dose among participants in Kolkata, with socio-demographic factors playing a significant role in vaccine acceptance. The findings also highlight that concerns about side effects and vaccine effectiveness are key determinants of booster dose preference. To ensure sustained vaccine uptake, it is crucial to provide clear, accurate information regarding vaccine side effects, effectiveness, duration of protection, and the overall necessity of vaccination. Addressing these factors through transparent communication will help dispel misconceptions and foster trust among the

public. Without such efforts, the vaccination program risks remaining solely a government initiative rather than one embraced by the people. Tailored communication strategies and targeted information campaigns are essential to increase both acceptance and coverage of COVID-19 booster doses.

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