


Knowledge, acceptance, motivators and barriers of booster dose of COVID-19 vaccination among dental patients

A cross-sectional study

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Abstract

Given the lingering threat of COVID infection, questions are being raised if coronavirus disease 2019 (COVID-19) vaccine needs annual or regular boosters to maintain high levels of immunity against both the original virus and variants. This study was designed to evaluate the knowledge, acceptance, motivators and barriers of the booster dose of COVID-19 vaccine among the dental patients of District Lucknow, India. A total of 297 respondents were selected by a convenience sampling method in this cross-sectional study from various dental clinics. An anonymous, self-administered, closed-ended questionnaire was used. Overall 37.7% respondents reported to have taken all 3 doses and 57.9% had taken single/double doses. Correct information about booster doses shows a significant association with the number of doses taken. The majority had information about the availability of the Pfizer booster vaccine (69.0%). About 58% of participants had information about the technology used in booster doses. The hesitancy for booster doses and the development of natural immunity by infection show significant associations with the number of doses taken. Only 18.2% patients had hesitation about the booster dose and most of them 78.8% recommended others to take the booster vaccine as soon as possible. The majority assumed that previous COVID-19 vaccines can help them get immune (21.5%) followed by not much research has been done on the booster vaccines (15.5%) and their chronic diseases warn them against the booster dose administration (12.5%). Nearly 18.2% of respondents had hesitation about booster dose and less than one third of the respondents trusted a government source for information about booster dose of COVID vaccine. Nearly 36% did not know that the booster dose of COVID vaccine is available at health centers. Dental health professionals and policymakers should implement and support strategies to ensure people are vaccinated for COVID-19 booster doses.

Abbreviations: COVID-19 = coronavirus disease 2019, WHO = World Health Organization.

Keywords: acceptance, barriers, booster, COVID-19 vaccine, dental clinics, knowledge, motivators

1. Introduction

It is well established that Coronavirus disease which is caused by coronavirus 2 (SARS-CoV-2) resulting in severe acute respiratory syndrome is an ongoing pandemic, which has affected 76 million confirmed cases and more than 6.9 million deaths all over the world as on June 7, 2023.^[1,2] The World Health Organization (WHO) recommended coronavirus disease

2019 (COVID-19) booster dose vaccination after completing the primary vaccination series for individuals ≥ 18 years and most at-risk populations.^[3] Now, researchers have come up with newer technologies and shown that booster doses of the COVID-19 vaccine in non-human primates neutralize antibody levels against all variants. So, the booster dose is effective in preventing infection as well as the complications of COVID-19 Disease.^[4] A recent study indicated that the effectiveness

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The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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of 2-dose BNT162b2 (mRNA) and ChAdOx1 (adenovirus vector) vaccines remained as high as 88% and 67%, respectively, among patients with the Delta variant.^[5] In the other laboratory study, it revealed that the antibodies produced by mRNA vaccines still offered protection against the B.1.351 (beta) and B.1.1.7 (alpha) variants, but the protection was much less strong.^[6] The World Health Organization (WHO) has also considered annual boosters for high-risk individuals and boosters every 2 years for the general population.^[7] The recipient of a booster dose should have received 2 doses of vaccination prior to receiving the booster shot. In India, booster doses became available from January 10, 2022, beginning with frontline workers, and residents over the age of 60 with comorbidities. Within this cohort, doses were prioritized to those who had received their second dose at least 9 months prior. Booster eligibility were later in April 10, 2022 extended to all adults 60 years and older and all adults 18 years and over via private vaccination centers initially followed by government centers.

Fortunately, there are many studies assessing public acceptance of COVID-19 booster vaccination that showed that acceptance varied substantially globally.^[8–10] A declining trend of COVID-19 vaccination acceptance rates has been found in China^[11] and the United States.^[12,13] Meanwhile, multiple variants have emerged globally, including 5 variants of concern that have been identified, and many countries have seen another outbreak with breakthrough cases reported from time to time.^[14,15] It is a known factor that the success of any vaccination program in any country or region deeply depends upon the acceptability of that particular vaccine among the community. Not only community acceptance but also their knowledge and attitude also play an important role in the success of vaccination programmes.^[16] Given the lingering threat of COVID infection, there are concerns amongst the public if there is a need for annual (or regular) booster doses to maintain high levels of immunity; against both the original virus and variants, similar to annual seasonal influenza shots.^[8,9] The overall pooled estimate of dental care utilization in Indian adult population has been estimated as 23.96% (CI: 16.81%–31.11%), with significant heterogeneity ($P < .001$).^[17] The small 35 to 40 cm distance between patient oral cavity and the dentist during work, and time-consuming procedures put the dentist at higher risk of contracting COVID-19.^[18] Reports from Japan and America indicate that dentists are actively involved in the ongoing vaccination efforts.^[19,20] As per the National Health Profile 2018, the dentist population ratio is 1:10,271 in India.^[21] Using the actual population and dentists registered in 2019 suggests that in Uttar Pradesh the dentist to population ratio is 1: 12,304.^[22] Thus, these dental providers can play an important role by administering both vaccines and booster shots that will protect the communities from the virus or new variants and also encouraging their patients to be vaccinated. The role of dentists in the fight against COVID-19 is of utmost value, not only in terms of safe provision of oral/dental care during the pandemic, but also in educating and motivating the public to accept COVID-19 vaccines and obeying preventive measures.^[23] Thus dentists as well as the dental patients need to be vaccinated for COVID-19. Therefore, there is an urgent need to understand the acceptance of COVID-19 boosters among the dental patients to prepare and assist in running effective public health program on this issue. With this background, we have designed a study to find out the knowledge, acceptance, motivators and barriers of the booster dose of COVID-19 vaccine among the patients visiting the various dental clinics in the District Lucknow, India.

2. Methodology

The present cross-sectional investigation was conducted among individuals seeking dental care at both government and private

dental clinics within the Lucknow District of India. The study was carried out during the timeframe of September 1, 2022, to November 30, 2022, utilizing a method known as convenience sampling. Approximately 10 to 15 participants were chosen from various outpatient clinics to be part of the study. Each participant was included only once, and they retained the autonomy to decline participation if they so wished.

The survey instrument was developed in 2 languages, English and Hindi, and was divided into 4 distinct sections to comprehensively gather information:

Demographics and General Characteristics: This section aimed to capture a range of participant information, including age, gender, place of residence, marital status, educational background, nationality, occupation, health insurance coverage, and frequency of clinic visits.

Knowledge and Awareness of Booster Dose: Participants' understanding and awareness regarding booster doses were assessed through questions in this section.

Perception, Motivators, and Barriers: Participants' viewpoints on booster doses were explored in this segment, investigating factors that motivated or hindered their acceptance.

Participants' Acceptance for a Booster Dose: The final part of the questionnaire gauged participants' willingness to receive a booster dose.

Additionally, participants were asked to self-report any chronic medical conditions they had, including blood pressure, diabetes, heart disease, overweight, asthma, lung disease, and kidney disease.

Data collection was conducted through 2 means: electronic communication and face-to-face interactions. To ensure the effectiveness and clarity of the questionnaire, it underwent a pilot test. Feedback, suggestions, and comments from the pilot test were used to refine and modify the questionnaire, making it more comprehensive and easily understandable for participants. Responses from participants were evaluated using a 5-point Likert scale that ranged from 1 (indicating "strongly disagree") to 5 (indicating "strongly agree").

Before commencing the study, ethical clearance was obtained from the Institutional Review Board (IRB) to ensure adherence to ethical standards. The study utilized a self-administered, pre-designed, and pretested pro-forma that had been previously used in a study conducted in the Kingdom of Saudi Arabia⁴ (Annexure). The data collection procedures adhered to the principles outlined in the Declaration of Helsinki.

Prior to their engagement in the survey, written informed consent was obtained from all participants. This step involved ensuring that individuals were fully informed about the purpose of the study, its procedures, potential risks and benefits, and their voluntary participation. Participants were given the opportunity to ask questions and clarify any concerns before formally providing their consent.

To uphold the confidentiality of participant data, stringent measures were implemented throughout the study duration. This prevented the linkage of responses to specific individuals, thereby safeguarding their privacy. By obtaining informed consent and prioritizing data confidentiality.

Sample size was calculated using the formula $n = \frac{Z^2 p(1-p)}{d^2}$

Where, Sample size = n, $P = 50\%$, Confidence level 95%, so Z score = $1.96 \approx 2$, Margin of error (d) = 6% and Non-response = 7%. Thus Sample size = 297.

2.1. Statistical analysis

After complete data collection, the collected data was cleaned, coded, and entered into Microsoft Excel. The analysis was carried out using SPSS 16.0 version (SPSS Inc., Chicago, IL). The quantitative results are presented in frequency, percentages

graphs such as bar diagrams. Baseline characteristics cases were compared using chi-squared or Fisher exact tests (when more than 20% of cells have expected frequencies <5) for categorical variables. $P < .05$ were considered statistically significant.

3. Results

There were 297 study subjects included in the present study, of which 127 were males and 170 were females. Table 1 shows the association between the sociodemographic and behavioral profiles of the study subjects according to the number of vaccine doses taken. The proportion of study subjects who took all 3 doses and single/double doses were 112 (37.7%) and 172 (57.9%), respectively. All the sociodemographic and behavioral

profiles of study subjects except marital status displayed a statistically significant association with the number of vaccine doses.

Table 2 depicts that presence of chronic medical conditions like blood pressure, diabetes, heart disease, overweight, asthma, lung disease, kidney disease as well as occurrence of any severe adverse reaction in response to previous doses, or any vaccine allergy experienced in the past, shows a statistically significant association with the number of doses taken by study subjects.

Table 3 illustrates that the association of information about booster doses shows a statistically significant association with the number of doses taken by study subjects. Among all booster doses, the majority of study subjects had information about the availability of Pfizer 205 (69.0%). About fifty

Table 1

Association of sociodemographic and behavioral profile of study subjects with the number of doses.

		Number of doses			Total	P value
		All three doses (n = 112)	Not vaccinated (n = 13)	Single or double (n = 172)		
Gender	Female	88 51.8%	6 3.5%	76 44.7%	170 100.0%	.00
	Male	24 18.9%	7 5.5%	96 75.6%	127 100.0%	
Age group (in yr)	≤50	56 30.9%	5 2.8%	120 66.3%	181 100.0%	.00
	>50	56 48.3%	8 6.9%	52 44.8%	116 100.0%	
Area of residence	Rural	72 30.0%	8 3.3%	160 66.7%	240 100.0%	.00
	Urban	40 70.2%	5 8.8%	12 21.1%	57 100.0%	
Marital status	Married	105 39.2%	12 4.5%	151 56.3%	268 100.0%	.56
	Unmarried	6 24.0%	1 4.0%	18 72.0%	25 100.0%	
	Others	1 25.0%	0 0.0%	3 75.0%	4 100.0%	
Education	Diploma (1 yr)	31 37.8%	2 2.4%	49 59.8%	82 100.0%	.00
	Graduate (3 yr)	24 22.6%	4 3.8%	78 73.6%	106 100.0%	
	Postgraduate	15 65.2%	0 .0%	8 34.8%	23 100.0%	
	Primary school	18 58.1%	1 3.2%	12 38.7%	31 100.0%	
	Secondary school	24 43.6%	6 10.9%	25 45.5%	55 100.0%	
Nationality	Bangladeshi	13 76.5%	1 5.9%	3 17.6%	17 100.0%	.00
	Indian	80 31.4%	9 3.5%	166 65.1%	255 100.0%	
	Saudi	19 76.0%	3 12.0%	3 12.0%	25 100.0%	
Occupation	Employed	101 44.7%	12 5.3%	113 50.0%	226 100.0%	.00
	Housewife	8 14.5%	0 .0%	47 85.5%	55 100.0%	
	Unemployed	3 18.8%	1 6.2%	12 75.0%	16 100.0%	
Health insurance coverage	No	57 26.5%	6 2.8%	152 70.7%	215 100.0%	.00
	Yes	55 67.1%	7 8.5%	20 24.4%	82 100.0%	
Which clinics are you visiting?	Government clinic	89 34.6%	11 4.3%	157 61.1%	257 100.0%	.01
	Private clinic	23 57.5%	2 5.0%	15 37.5%	40 100.0%	

Table 2

Motivators and barriers of study subjects with the number of doses.

		Number of doses			Total	P value
		All three doses (n = 112)	Not vaccinated (n = 13)	Single or double (n = 172)		
Do you have any chronic medical conditions like blood pressure, diabetes, heart disease, overweight, asthma, lung disease, kidney disease?	No	91 34.3%	9 3.4%	165 62.3%	265 100.0%	.00
	Yes	21 65.6%	4 12.5%	7 21.9%	32 100.0%	
Did you experience any severe adverse reactions that required hospitalization from the last vaccine dose?	No	95 34.8%	12 4.4%	166 60.8%	273 100.0%	.00
	Yes	17 70.8%	1 4.2%	6 25.0%	24 100.0%	
Allergy to the vaccine?	No	78 30.7%	12 4.7%	164 64.6%	254 100.0%	.00
	Yes	34 79.1%	1 2.3%	8 18.6%	43 100.0%	

Table 3

Knowledge related to booster dose among respondents.

		Number of doses			Total	P value
		All three doses (n = 112)	Not vaccinated (n = 13)	Single or double (n = 172)		
Have you heard that booster dose of COVID vaccine is available at health centers?	Don't know	4 16.0%	0 .0%	21 84.0%	25 100.0%	.00
	No	48 60.8%	7 8.9%	24 30.4%	79 100.0%	
	Yes	60 31.1%	6 3.1%	127 65.8%	193 100.0%	
Is the technology used in booster dose, similar to the 1 st and 2 nd dose of the vaccine?	Don't know	3 4.3%	0 .0%	67 95.7%	70 100.0%	.00
	No	29 53.7%	4 7.4%	21 38.9%	54 100.0%	
	Yes	80 46.2%	9 5.2%	84 48.6%	173 100.0%	
Currently, which of the booster dose is available?	Covishield	0 .0%	0 .0%	7 100.0%	7 100.0%	.00
	Covaxin	28 80.0%	1 2.9%	6 17.1%	35 100.0%	
	Pfizer	49 23.9%	9 4.4%	147 71.7%	205 100.0%	
	Sputnik	35 70.0%	3 6.0%	12 24.0%	50 100.0%	
	Is a booster dose required for additional protection against a variant of COVID-19?	Don't know	4 6.8%	0 .0%	55 93.2%	
No	11 44.0%	1 4.0%	13 52.0%	25 100.0%		
Yes	97 45.5%	12 5.6%	104 48.8%	213 100.0%		
Does a previously infected (COVID-19) person need a booster dose?	Don't know	12 19.0%	2 3.2%	49 77.8%	63 100.0%	.00
	No	46 71.9%	0 .0%	18 28.1%	64 100.0%	
	Yes	54 31.8%	11 6.5%	105 61.8%	170 100.0%	
Do you know someone who ever had a bad side effect to the booster dose?	Don't know	5 29.4%	0 .0%	12 70.6%	17 100.0%	.00
	No	87 34.3%	12 4.7%	155 61.0%	254 100.0%	
	Yes	20 76.9%	1 3.8%	5 19.2%	26 100.0%	

percent of study subjects had information about the technology used in booster doses is similar to the 1st and 2nd doses of vaccine.

Table 4 depicts that the hesitation for booster dose, development of natural immunity by infection, provide a recommendation to others to get booster vaccine at the earliest

shows statistically significant association with the number of doses taken by study subjects. Only 54 (18.2%) study subjects had hesitation about booster dose and most of them 234 (78.8%) recommended others to take booster vaccine as soon as possible.

Table 5 shows the study subjects, whom they trusted the most for information about booster vaccines. A statistically significant association was found with the number of doses taken by them. The present study observed that the Media, Internet, Social-media such as Facebook, Twitter, WhatsApp, and YouTube (30.9%), and government records (30.9%) were the most trusted sources for the study subjects

Table 6 shows the barriers to booster dose for the study subjects. A statistically significant association was found with the number of doses taken by them. The present study observed that the majority of study subjects assumed that previous COVID-19 vaccines can help them get immune 64 (21.5%) followed by their lack of understanding if booster dose was really required as per research, 46 (15.5%) and their refusal to take the booster dose owing to their suffering from any chronic disease 37 (12.5%).

Table 7 shows the motivators for booster dose to the study subjects. A statistically significant association was found with the number of doses taken by them. The present study observed that

the majority of study subjects expected that vaccines will help in the resolution of the pandemic situation worldwide (32.3%). Government rules also compel them to take the booster dose (23.6%) and also vaccine allows them to international travel (13.5%) and continue their job (13.5%).

Table 8 describes the 5-point Likert scale, in which, the majority of them strongly disagree 164 (55.2%), that adverse reaction is expected to the booster dose and 174 (58.6%) strongly agree that it is safe and effective. The majority of the study subjects 158 (53.2%) were neutral about the optimal time interval for a booster dose is every 6 months. Most of the study subjects 184 (61.9%) strongly agreed that the government should give the booster vaccine for free. Only 28 (9.4%) were shown agreement toward a willingness to pay for a COVID-19 booster vaccine privately.

4. Discussion

The COVID-19 pandemic brought about a drastic change not only in the medical field but also in each aspect of life. The second wave of COVID-19 in India has had severe consequences in the form of spiraling cases, reduced supplies of essential treatments, and increased deaths particularly in the young population.^[24] The highly infectious C, possessing the

Table 4
Attitudes about booster dose among respondents.

		Number of doses			Total	P value
		All three doses (n = 112)	Not vaccinated (n = 13)	Single or double (n = 172)		
Do you have any hesitation in getting the booster dose?	No	84 34.6%	8 3.3%	151 62.1%	243 100.0%	.00
	Yes	28 51.9%	5 9.3%	21 38.9%	54 100.0%	
Do you recommend others to get the booster dose at the earliest?	No	31 49.2%	2 3.2%	30 47.6%	63 100.0%	.00
	Yes	81 34.6%	11 4.7%	142 60.7%	234 100.0%	
Do you prefer to develop natural immunity by infection?	No	42 61.8%	1 1.5%	25 36.8%	68 100.0%	.00
	Yes	70 30.6%	12 5.2%	147 64.2%	229 100.0%	

Table 5
Perceived Trustworthiness of different sources of information about booster dose of COVID vaccine.

		Number of doses			Total	P value
		All three doses (n = 112)	Not vaccinated (n = 13)	Single or double (n = 172)		
Whom do you trust the most for information about booster dose of COVID vaccine?	Family members and friends	7 36.8%	0 .0%	12 63.2%	19 100.0%	.00
	Government	11 12.0%	2 2.2%	79 85.9%	92 100.0%	
	Health care providers: Physicians, nurses, dentists, etc	48 63.2%	7 9.2%	21 27.6%	76 100.0%	
	I do not trust any source	1 25.0%	0 .0%	3 75.0%	4 100.0%	
	Media, Internet, Social media (Facebook, Twitter, WhatsApp, YouTube)	35 38.0%	4 4.3%	53 57.6%	92 100.0%	
	Scientific articles	7 77.8%	0 .0%	2 22.2%	9 100.0%	
	The pharmaceutical company reports	3 60.0%	0 .0%	2 40.0%	5 100.0%	
Total		112 37.7%	13 4.4%	172 57.9%	297 100.0%	

Table 6**Perceived Barriers to booster dose uptake.**

	Number of doses			Total
	All three doses (n = 112)	Not vaccinated (n = 13)	Single or double (n = 172)	
Conspiracy theories in social media against vaccination	1 50.0%	0 .0%	1 50.0%	2 100.0%
It may alter my body immune system	3 3.8%	4 5.1%	71 91.0%	78 100.0%
It may have adverse effects on my pregnancy	0 .0%	0 .0%	2 100.0%	2 100.0%
My chronic disease(s) warns me against the booster dose	24 64.9%	1 2.7%	12 32.4%	37 100.0%
My previous COVID-19 vaccine can help me to get me immune	25 39.1%	3 4.7%	36 56.2%	64 100.0%
No barriers	30 76.9%	1 2.6%	8 20.5%	39 100.0%
Not much research has been done on the booster vaccines	29 63.0%	4 8.7%	13 28.3%	46 100.0%
Religious and personal beliefs	0 .0%	0 .0%	3 100.0%	3 100.0%
Any other	0 .0%	0 .0%	26 100.0%	26 100.0%
Total	112 37.7%	13 4.4%	172 57.9%	297 100.0%

Table 7**Perceived motivators for the booster dose update.**

	Number of doses			Total
	All three doses (n = 112)	Not vaccinated (n = 13)	Single or double (n = 172)	
Due to my chronic diseases, I need the booster dose	6 54.5%	1 9.1%	4 36.4%	11 100.0%
It is allow me for international travel	1 2.5%	1 2.5%	38 95.0%	40 100.0%
It will allow me to continue my job	4 10.0%	2 5.0%	34 85.0%	40 100.0%
It will allow me to have normal social & family get-togethers	12 50.0%	1 4.2%	11 45.8%	24 100.0%
It will help in the resolution of the pandemic situation worldwide	34 35.4%	1 1.0%	61 63.5%	96 100.0%
The government rules compel me to take the booster dose	50 71.4%	7 10.0%	13 18.6%	70 100.0%
Any other	5 31.2%	0 .0%	11 68.8%	16 100.0%
Total	112 37.7%	13 4.4%	172 57.9%	297 100.0%

Table 8**The 5-point Likert scale regarding Booster dose queries.**

Queries	Agree	Disagree	Neutral	Strongly Agree	Strongly Disagree
Adverse reaction is expected to the booster dose n(%)	20 (6.7)	80 (26.9)	22 (7.4)	11 (3.7)	164 (55.2)
Booster dose of vaccine is safe and effective n(%)	95 (32.0)	5 (1.7)	16 (5.4)	174 (58.6)	7 (2.4)
Optimal time interval for booster dose is every 6 mo n(%)	83 (27.9)	26 (8.8)	158 (53.2)	24 (8.1)	6 (2.0)
The government should give the booster vaccine for free n(%)	52 (17.5)	2 (0.7)	56 (18.9)	184 (62.0)	3 (1.0)
Willingness to pay for a COVID-19 booster vaccine privately n(%)	28 (9.4)	108 (36.4)	119 (40.1)	6 (2.0)	36 (12.1)

key structural mutations Glu484Gln and Leu452Arg in the spike protein, was less affected by current vaccine responses, and was a central cause of the COVID-19 surge in India.^[2,5] Organizing a national immunization program for preventing

COVID-19 has been challenging because of India large population and fragile health infrastructure. India rolled-out the COVID-19 vaccination program in January 2021. The state governments have developed plans for the storage and

distribution of the vaccine and for the implementation of the vaccination program. Important elements within the program are communications and advocacy that aim to inform the people about the vaccine and its benefits and to encourage them to get vaccinated so that the problem of vaccine hesitancy, a major deterrent, can be prevented.^[26] There is a plethora of research in different areas of life and health found now since the emergence of COVID-19. The invention of the COVID-19 vaccine is the 1 area that remains under focus not only by scientists but also by common people as well.^[27] At the time of the pandemic, the only treatment given to COVID patients was symptomatic so there was a dire need of the present time to invent something which protects all the people, in this regard, the entire focus of all the researchers and scientists was to invent a vaccine that was capable of preventing the development of infection and severity of the disease.^[28] For some vaccines, a booster dose is also required which makes that programme even more challenging to implement among the community and the COVID-19 booster dose for the vaccine is testing any program ability in this era.^[29,30] Therefore, in this study, we tried to assess the knowledge, perception and acceptance of the booster dose of the COVID-19 vaccine. In this study, a total of 297 study subjects were included, of which 127 (42.7%) were males and 170 (57.23%) were females. These numbers are almost similar to 1 study conducted in Saudi Arabia in which female participants represent about 52.4%. In the current study, 48.3% of people > 50 years received all 3 doses of COVID vaccine which is almost similar to another study where 40% of people > 60 years have no hesitancy toward COVID-19 booster dose.^[4] In a recent survey administered with a web-based form to 614 Italian dentists and hygienists, a higher number of the respondents interviewed (99.9%) received the COVID-19 vaccine.^[31] In the present study, 70% of participants living in urban areas received all 3 doses of the vaccine. Another study supported a higher percentage of vaccine coverage in urban areas as well.^[32] Participants with lower income, lower educational attainment, and those living in rural areas were more hesitant to take the booster dose as per the findings of another study from India.^[33] These disparities in vaccine acceptance between urban and rural areas might hinder efforts to reduce transmission of infection, morbidity and mortality from COVID-19 in any population. Moreover, people living in rural areas are at increased risk for severe COVID-19-associated illness and death because of a lack of good healthcare infrastructure.^[34,35] Another reason could be the high level of education in urban areas as well the accessibility to information via electronic and digital media apart from the facility of registering for the dose appointment via mobile applications.^[36] In the present study, the ratio of married persons who received 3 doses of vaccine was higher than unmarried. This is also reflected in a study conducted in China as well.^[37] Our study also showed that those who are more educated are more receptive towards the third dose of vaccine- 65.2% of postgraduates received the third dose of vaccine in our study. In a study conducted in China, those educated till high school had a vaccine hesitancy off 15%.^[37] Though the current study is based on the percentage of those receiving booster doses is 44.7% among employed as compared to 18.8% amongst unemployed. In a study in Turkey, 56.1% of the people who were employed showed intention to get vaccinated.^[38] Around 31.4% of the Ethiopian population was also willing to take the COVID-19 vaccine.^[39] That is slightly higher than our addressed population. In our study population, most of those (57.5%) who attended private clinics received a third dose-the reason might be the trust they have in the private sector as compared to the government sector. In a study it was found that booster-hesitant people were significantly more likely to have less trust in the information provided by the government agencies about the vaccines.^[40] A study conducted in Singapore also suggested the lack of trust in health authorities was a factor for vaccine hesitancy among their population.^[41]

Of those with health insurance, 67.1% had all 3 doses. Of those with multiple comorbidities, 65.5% had all 3 doses. This could be because of the success of the information campaign by government and public health agencies that those having such co-morbidities have a higher risk of complications. Similar findings were obtained from a study in Beijing where those who had chronic diseases were more likely to get the vaccine dose.^[42] A study conducted in Malaysia also reported vaccine booster acceptance among 40.9% of people who have chronic diseases, which is lower than the findings in our study population.^[43] Although multiple studies showed that the association between chronic diseases and acceptance of the COVID-19 vaccine was not established in the studies conducted in the earlier phases of the pandemic.^[44-47] The cited studies were done in the earlier part of the pandemic when there was a lack of awareness and confidence regarding the vaccines and understandably especially so amongst those suffering from chronic conditions. However, as more people worldwide opted from vaccination, other populations became more aware of the risk-free nature of the vaccine doses. In our study, 8 % of those vaccinated had a severe adverse reaction, of these, 70.8% had received all 3 doses. A recent scoping study revealed that the adverse reactions to COVID-19 vaccines are mild to moderate in severity, with no significant influence or interference in individual daily activities and no unique patterns in cause of death among vaccine-related deaths.^[48] In another observational study, important results were yielded regarding the incidence of AEFI post-booster dose of the mRNA COVID-19 vaccine and the risk of repeated AEFI. Overall, 4 out of 5 booster recipients reported at least 1 AEFI after their booster dose, the more frequent of which were pain at injection site, tiredness and fatigue, muscle pain, and headache.^[49] About 14 % of the participants in the present study have an allergy to a vaccine. However, with the invention of rapid development of COVID-19 vaccines of different types, there was a possibility of having allergic reactions, although BNT162b2 was associated with a few severe cases of anaphylaxis.^[50,51] However severe allergic reactions were also possible from newly developed vaccines.^[52] A CDC (center for disease control) report of the VAERS monitoring database indicates that from 14th to 23rd December 2020, with mRNA BNT162b2 COVID-19 vaccine 21 cases of anaphylaxis were reported (11.1 cases per million doses), 71% of these reactions occurred within 15 minutes of vaccination.^[53] Similarly, the CDC reported that between December 21, 2020 and January 10, 2021, 10 cases of anaphylaxis were reported with the first doses of the mRNA-1273 vaccine (2.5 cases per million doses administered). In 9 cases, the onset occurred within 15 minutes of vaccination. However, no anaphylaxis-related deaths were reported.^[54] Still, the fear of allergic reactions from the COVID-19 vaccine among people has caused hesitancy in the mentioned studies. Around 51.9% of study participants who received booster doses still have a hesitancy to take the vaccine, only 34.6% recommended booster dose to others and 30.6% preferred to get natural immunity after infection.^[4] Parents of young children also have hesitancy about the COVID-19 vaccine for their children.^[55] A study conducted in the US also showed that 75.5% of parents were hesitant to vaccination of their children.^[56] In a recent global survey of 23,000 respondents including 1000 participants from each of the 23 countries surveyed (Brazil, Canada, China, Ecuador, France, Germany, Ghana, India, Italy, Kenya, Mexico, Nigeria, Peru, Poland, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Turkey, the United Kingdom, and the United States) the booster hesitancy reported among those vaccinated was 12.1% (range 1.1% in China to 28.9% in Russia).^[57] A vast majority of study subjects trusted more on Government

sources (30.9%) regarding information about booster doses, and Media, Internet, social media (30.9%) whereas in another study 56.6% of postgraduates were trusting health care providers and 39% of Kuwaiti trust more on social media regarding vaccine information.^[58] There are certain barriers too regarding booster doses of the COVID vaccine. Of those who believed that the booster dose may impair their body immune system, 91% have had a single/double dose, 39.1% of people who received booster doses believe that previous doses getting help in boosting the immune system of the body whereas another study showed that booster doses can provide better immunity. Three people who had taken 1 or 2 COVID-19 doses cited religious beliefs as a barrier to vaccination. In a study conducted in Israel and Japan it was found that intentions of getting vaccinated depend on people level of religiosity in a non-linear way. Those who had strong religious beliefs were less likely to become vaccinated than those who said they were less religious.^[59] Some factors favor the acceptance of the vaccine as well, very few 2.5% of participants who received booster doses believe that the third dose helps in international travel, 10% believe it allows them to continue the job, 50% believe that it allows resuming social gatherings, 35.4% believe that it helps resolution of the pandemic. A study conducted in the United States showed that 36% population was motivated to take vaccines because of travel restrictions, schooling, and job continuation.^[60] Around 71.7% of current study participants believe that a booster dose is required for additional protection against COVID-19, whereas 81.4% of participants in a study from Indonesia believe that booster dose increases immunity, this percentage is quite higher than our study participants.^[61] It is suggesting that knowledge perception and acceptance of the COVID-19 vaccine differs among different populations all over the world. It depends upon their sociodemographic and cultural factors as well.

Our study strength is that it has made a unique attempt to assess the acceptance of a booster dose for COVID-19 in a subpopulation of India and also tried to identify the related barriers. However, the study has certain limitations such as it is a cross-sectional study and involves only a particular region and subpopulation of Northern India. Hence, further nationwide multicenter studies with a larger sample size involving different regions and subpopulations are recommended. The strength of our study was that representative samples were taken of people attending various private and government dental clinics that were widely dispersed in the city, making it heterogeneous and all-encompassing. Also, some factors may have not been included in the present study. Without additional data (interviews, for example), there may not be a lot of clarity as to why certain populations, were less likely to have received the booster than other populations. Understanding people beliefs about the booster and who they share those perspectives with is only half of the story. It is necessary to understand why people act the way that they do. People may have the knowledge and attitude, but fail to engage in the desired practice (getting a booster shot for example) because they were not available, required time off work, were only available by appointment in limited places. Understanding these material and agency barriers is important to help public health practitioners do a better job of serving populations, as opposed to expecting populations to just do what they are told to do.

5. Conclusion

In this study, overall 37.7% respondents had taken all 3 doses and 57.9% had taken single/double doses which is suboptimal. Nearly 36% did not know that the booster dose of COVID vaccine is available at health centers. Although booster dose hesitancy was less amongst the study population, still the trust

in government agencies and healthcare providers as sources of information regarding COVID-19 Booster was found to be low. It is a matter of great concern as the study included dental patients who generally have a better health seeking behavior as compared to the general population having a mix of individuals with varied health seeking behaviors.

5.1. Recommendations

In similar pandemic or emergency situations, government should make a comprehensive strategy involving health care professionals and media to communicate authentic information timely to the masses. Dentists should have candid conversations with their patients in a manner that is empathetic and supported by evidence, while emphasizing the overall benefits of vaccination. Community mobilization efforts are further needed to provide awareness and widespread access to healthcare facilities. More research may be required to aid the development of optimal communication strategy in the target population.

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