

COVID-19 Vaccine Acceptance and its Determinants among the Dental Professionals of India: A Nationwide Survey

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Abstract

Objectives: The objective of this study was to determine the acceptance of coronavirus disease 2019 (COVID-19) vaccine and its determinants among the dental professionals of India. **Methods:** A nationwide, cross-sectional, and online survey was conducted among the 745 Indian dentists. Self-administered and structured questionnaire based on health belief model was used. Chi-square test, one-way ANOVA, and logistic regression tests were used for statistical associations. **Results:** Only 30.2% of the study population had a definite intention to receive the COVID-19 vaccination. Among the health belief components, one unit increase in perceived severity score ($P = 0.024$) and perceived benefits score ($P = 0.000$) increased the odds of intention to take COVID-19 vaccine by 1.138 times and 1.805 times, respectively. Furthermore, with one unit increase in cues to action score ($P = 0.001$), there was 0.738 times lesser odds of intention to take COVID-19 vaccine among the dental professionals. **Conclusion:** The present study demonstrated a smaller proportion of Indian dentists with definite intention to get COVID-19 vaccination. The determinants of the intention to take the vaccine were evidenced to be confidence in locally and foreign manufactured vaccine, perceived severity of COVID-19, perceived benefits of COVID-19 vaccine, and cues to action.

Keywords: COVID-19, Dentists, Health belief model, India, Vaccine acceptance.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was originally identified in Wuhan, China, in December 2019 and promptly spread its wings all around the world. On March 11, 2020, the World Health Organization (WHO) avowed COVID-19 as a universal pandemic.^[1] By the end of February 2020, the COVID-19 had infected over 110 million people causing more than 2 million mortalities worldwide.^[2]

The year 2020 has been occupied with tussle for the whole world when the contagious deadly disease with no availability of effective treatment or vaccine affected most of the nations. Various control strategies have been implemented in every country to minimize the effect of the disease to save the lives of the people. Execution of confinements and lockdowns, social distancing measures, use of facemasks, hand washing, use of sanitizers, and travel limitations resulted in the incredible weakening of physical and psychosocial well-being of people and has also affected the worldwide economy terribly. The appalling impact of the disease led to all round efforts in the development of successful preventive strategies to reduce the

burden of the disease. The prolific efforts made it possible the development and launch of numerous vaccines globally out of which, 74 are in the clinical development stage and 182 are in the pre-clinical development stage.^[3] In India, widespread vaccination against COVID-19 began in India on 16 Jan 2021. The pioneers to receive the first doses were the frontline workers of the pandemic including the doctors, paramedical staff, and workers in the hospitals as these are designated as “Corona warriors” in the country. Delivering dental care in infectious disease outbreaks brings indispensable dangers to dental health-care providers due to splashes and aerosols produced during dental procedures. Dentistry has faced utmost challenge during this pandemic and was reviewed and adapted to alleviate the probable risks from an intangible and unseen

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adversary. Being a high risk group, dental professionals are among one of the many frontline workers to be vaccinated on a priority basis.

Success of a vaccination programs depends on the intention of people getting themselves vaccinated. Vaccine hesitancy is defined as delay in acceptance or refusal of vaccines despite availability of vaccination services.^[4] Vaccine hesitancy in India is not new. The same dilemma was confronted by the British when they rolled out vaccines for plague and cholera over 120 years ago.^[5]

Vaccine hesitancy ensues in a perpetual scale ranging from complete receiving to complete denial of all vaccines. It is pretentious by factors such as self-satisfaction, suitability, and assurance.^[6] The health belief model (HBM) of human behaviors constructs has been documented as a significant predictor of influenza vaccination acceptance in the previous literature.^[7-9] The constructs of HBM closely relate to vaccination intentions. Perceived susceptibility accounts for vulnerability to disease, while perceived severity refers to the perception of individual regarding the severity of negative consequences of attaining the disease. In this context, perceived benefits refer to the perception of individual of being benefitted with vaccination. Perceived barriers are the psychosocial, physical, or financial factors which restrict the individual from being vaccinated, and lastly, the cues to action include the actions and persons who motivate an individual to be vaccinated.^[10,11]

Hence, the objectives of this study were to determine the acceptance of COVID-19 vaccine and its determinants among the dental professionals of India.

METHODS

Study design and study population

A descriptive cross-sectional survey was conducted in the month of January 2021 among the 745 dentists of India. The study population included general practitioners as well as specialists from all dental fields.

Ethical approval and informed consent

The study protocol was reviewed and approved by the Institutional Ethics Committee. Respondents were informed that their participation was voluntary, and consent was implied on the completion of the questionnaire.

Sample size calculation

Based on the results of the pilot study, 95% confidence level and 80% power of the study, minimum sample size was calculated as 697. All the 745 responses obtained in the survey were included in the final analysis.

Pre-testing of questionnaire

Assessment of content validity was done, which reflects a judgment whether the instrument samples all the relevant or important domains. Mean content validity ratio was calculated as 0.89 based on the opinions expressed by a panel of six academicians. Face validity indicates whether the instrument

appears to be assessing the desired qualities. When face validity was also assessed and it was observed that 94% of the participants found the questionnaire to be easy.

Questionnaire was also administered to a convenience sample of 15 dentists who were interviewed to gain feedback on the overall acceptability of the questionnaire in terms of length and language clarity. Cronbach's coefficient was found to be 0.88, which showed a high internal reliability of the questionnaire.

Questionnaire

The validated structured questionnaire in English language consisted of following sections:

1. Demographic questions including age, sex, location, marital status, qualification, and work status and annual income.
2. Specific research questions: The participants were also queried about their existing health and COVID status; and their intent to take local or foreign made COVID vaccine. There were 16 items based on HBM^[10] to determine the participant's perceived susceptibility to COVID 19, perceived severity of COVID-19, perceived benefits of COVID 19 vaccine, perceived barriers to get vaccinated against COVID 19, and cues to action. The participant's responses were ranked according to how much they agreed with each statement that was based on the Likert scale with five alternatives: strongly disagree, disagree, neutral, agree, and strongly agree.

Methodology

The research team used social media platform (WhatsApp and Facebook) to advertise and circulate the survey link (Google form) to their dental contacts all over India who were then requested to circulate the survey invitation to their further dentist contacts all over the country.

Statistical analysis

The recorded data were compiled and entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of IBM SPSS version 26.0 (SPSS Inc., Chicago, Illinois, USA). Frequency distribution was calculated. Each item of the health belief questionnaire was coded from 1 to 5 (strongly disagree to strongly agree) and a total score of each HBM component was calculated for each respondent by summing his or her responses. The Chi-square test and one-way ANOVA test was applied for bivariate associations. Multinomial logistic regression analysis was applied with intention to take COVID-19 vaccine as dependent variable which was dichotomized by merging three categories (Possibly yes, probably no, and definitely no). Independent variables which showed significant association in bivariate analysis were entered in multinomial logistic regression. For all tests, confidence interval and *P*-value were set at 95% and ≤ 0.05 , respectively.

RESULTS

The study population consisted of total 745 dentists from all over India. Among all, majority were in the age group

of 26–35 years (38.9%), followed by 36–45 years (32.9%) and maximum were male (55%). There was preponderance of those who were married (62.4%) as compared to those who were unmarried (36.9%). Maximum study participants were graduates (62.4%) and the remaining 37.6% were postgraduates. Around 89.3% of them belonged to upper socioeconomic status. Rural and urban distribution depicted 92.6% of them belonging to urban location. According to work status, 15.4% of them were private practitioners, 30.9% were academicians, and 40.3% were involved in both private practice and academics [Table 1].

Only 30.2% of the study population had a definite intention to receive the COVID-19 vaccination (30.2%) whereas on 5.4% of them were not willing to receive the vaccine at all. Around 44.3% of them were not sure but were possibly agreeable to receive the vaccine and also 20.1% of them were not sure but were probably disagreeable to receive the vaccine. Intention to receive COVID-19 vaccine was significantly associated with age ($P = 0.000$), highest qualification ($P = 0.000$), socioeconomic status ($P = 0.004$), and work status ($P = 0.000$). When compared according to age, greater proportion of

dentists of younger age group responded “Definitely no” as their intention to take COVID-19 vaccine as compared to older age group. Greater proportion of postgraduate dental professionals (39.3%) responded “Definitely yes” as their intention to take COVID-19 vaccine as compared to only 24.7% graduate dental professionals. Furthermore, higher proportion of those belonging to upper socioeconomic status (31.6%) had definite intention to take the vaccine as compared to 18.8% of those belonging to upper middle socioeconomic status. Furthermore, lesser proportion of those involved in only private practice (13%) had definite intention to take the COVID-19 vaccine than those involved in only academics (43.5%) and those involved in both private practice and academics (31.7%) [Table 2].

Those suffering from chronic illness responded as “Definitely yes” and “Probably yes” to their intention to take vaccine in significantly ($P = 0.007$) lesser proportion than those not suffering from any kind of chronic disease. Furthermore, significantly ($P = 0.027$) higher proportion of those who already suffered from COVID, intended to take COVID-19 vaccine as compared to those who did not get affected by the disease. Majority of those who were completely confident in local and foreign brands of vaccine responded as “Definitely yes” to their intention to take COVID-19 vaccine [Table 3].

When mean scores of HBM components were compared according to intention to take COVID-19 vaccine, it was evident that those who agreed to take the vaccine had greater mean scores for perceived susceptibility of contracting COVID-19 ($P = 0.010$), perceived severity of COVID-19 ($P = 0.000$), and perceived benefits of COVID-19 vaccination ($P = 0.000$). However, those who agreed to take the vaccine had lesser mean scores for perceived barriers of COVID-19 vaccination ($P = 0.000$) and cues to action ($P = 0.000$) [Table 4].

When compared according to age, middle age dentists (26–35 years) had 3.189 times higher odds of intention to take COVID-19 vaccine than those in older age group (>45 years) ($P = 0.018$). Non-working dentists had 0.329 times lesser odds intention to take COVID-19 vaccine than those involved in both private practice and academics ($P = 0.04$). Odds of intention to take COVID 19 vaccine was also found to be 4.937 and 2.216 times higher among those who were completely confident ($P = 0.008$) and confident ($P = 0.043$) in using local manufactured vaccine than among those who were completely not confident. Furthermore, odds of intention to take COVID 19 vaccine was evident to be 6.282 and 4.162 times higher among those who were completely confident ($P = 0.001$) and confident ($P = 0.000$) in using foreign manufactured vaccine than among those who were completely not confident. Among the health belief components, one unit increase in perceived severity score ($P = 0.024$) and perceived benefits score ($P = 0.000$) increased the odds of intention to take COVID-19 vaccine by 1.138 times and 1.805 times, respectively. Furthermore, with one unit increase in cues to action score ($P = 0.001$), there was

Table 1: Distribution of study population according to demographic variables

Demographic variables	Number	Percentage
Age (years)		
<25	160	21.5
26–35	290	38.9
36–45	245	32.9
>45	50	6.7
Gender		
Male	410	55
Female	335	45
Marital status		
Unmarried	275	36.9
Married	465	62.4
Separated	5	0.7
Highest degree		
Master of dental surgery	280	37.6
Bachelor of dental surgery	465	62.4
Socioeconomic status		
Upper	665	89.3
Upper middle	80	10.7
Lower middle	0	0
Upper lower	0	0
Lower	0	0
Location		
Rural	55	7.4
Urban	690	92.6
Work status		
None	100	13.4
Private practitioner	115	15.4
Academician	230	30.9
Both private practice and academics	300	40.3
Total	745	100

Table 2: Assessment of intention to take COVID-19 vaccine according to demographic variables

Demographic variables	Definitely yes		Possibly yes		Probably no		Definitely no		P-value
	N	%	N	%	N	%	N	%	
Age (years)									
<25	30	18.8	85	53.1	30	18.8	15	9.4	0.000*
26–35	105	36.2	100	34.5	70	24.1	15	5.2	
36–45	70	28.6	120	49	45	18.4	10	4.1	
>45	20	40	25	50	5	10	0	0	
Gender									
Male	140	34.1	175	42.7	75	18.3	20	4.9	0.066
Female	85	25.4	155	46.3	75	22.4	20	6	
Marital status									
Unmarried	65	23.6	125	45.5	70	25.5	15	5.5	0.120
Married	155	33.3	205	44.1	80	17.2	25	5.4	
Separated	5	100	0	0	0	0	0	0	
Highest degree									
MDS	110	39.3	105	37.5	50	17.9	15	5.4	0.000*
BDS	115	24.7	225	48.4	100	21.5	25	5.4	
Socioeconomic status									
Upper	210	31.6	290	43.6	135	20.3	30	4.5	0.004*
Upper middle	15	18.8	40	50	15	18.8	10	12.5	
Lower middle	-	-	-	-	-	-	-	-	
Upper lower	-	-	-	-	-	-	-	-	
Lower	-	-	-	-	-	-	-	-	
Location									
Rural	10	18.2	25	45.5	15	27.3	5	9.1	0.117
Urban	215	31.2	305	44.2	135	19.6	35	5.1	
Work status									
None	15	15	50	50	25	25	10	10	0.000*
Private practitioner	15	13	55	47.8	40	34.8	5	4.3	
Academician	100	43.5	85	37	40	17.4	5	2.2	
Both private practice and academics	95	31.7	140	46.7	45	15	20	6.7	
Total	225	30.2	330	44.3	150	20.1	40	5.4	

Test applied: Chi-square test, *indicates statistically significant difference

0.738 times lesser odds of intention to take COVID-19 vaccine among the dental professionals [Table 5].

DISCUSSION

According to the globally available data,^[3] several COVID-19 vaccines are in various stages of development and trials. To achieve herd immunity, significant vaccination levels are needed to be achieved. As dentists are among one of the most vulnerable groups for the disease, it is indispensable to study this population to understand the hesitancy and acceptance of COVID-19 vaccine to develop evidenced based interventions. Research on dentists' and dental students' acceptance of vaccinations has indicated incomplete compliance with recommended vaccinations across several countries. Research in Germany indicates that there is low influenza vaccination compliance among German dental healthcare workers.^[12] Despite a robust understanding of the benefits of vaccination, 20% of Italian dental healthcare workers were not up to date on recommended vaccinations.^[13] Understanding the underlying concerns behind vaccine hesitancy, particularly

among professionals who are highly educated, may provide areas of approach and education for public, and global health experts. Since very few studies have been conducted so far among the population of dental professionals, the present nationwide study utilized HBM components to explore the intention to receive the COVID-19 vaccine among dental professionals of India.

In the present study, only 30.2% of the total study population had definite intention to receive COVID-19 vaccine. However, 44.3% of them showed a possibility of being vaccinated but were not sure about it. Around 5.4% of them had definitely no intention to receive the vaccine and 20.1% of them responded as "probably no" intention of receiving the vaccine. In a study conducted among Israeli dentists, a higher proportion (50–95%) of the dentists showed willingness to accept the COVID-19 vaccine. Furthermore, study conducted among Israeli hospital workers revealed 94% of healthcare workers in COVID-19 wards and 61% of nurses working in non-COVID wards agreed to take COVID-19 vaccine whereas in the same study 75% of participants from general population agreed on taking

Table 3: Assessment of intention to take COVID-19 vaccine according to associated factors

Independent variables	Definitely yes		Possibly yes		Probably no		Definitely no		P-value
	N	%	N	%	N	%	N	%	
Suffering from chronic illness									
Yes	15	27.3	20	36.4	20	36.4	0	0	0.007*
No	210	30.4	310	44.9	130	18.8	40	5.8	
Sick with COVID-19									
Yes	30	40	35	46.7	10	13.3	0	0	0.027*
No	195	29.1	295	44	140	20.9	40	6	
Self-perception of overall health									
Very poor	0	0	0	0	0	0	0	0	0.313
Poor	50	40	50	40	20	16	5	4	
Average	115	25.6	205	45.6	100	22.2	30	6.7	
Good	60	36.4	75	45.5	25	15.2	5	3	
Very good	0	0	0	0	5	100	0	0	
Confidence in using local manufactured COVID-19 vaccine									
Completely confident	80	80	5	5	10	10	5	5	0.000*
Confident	105	34.4	185	60.7	15	4.9	0	0	
Not confident	25	35.7	30	42.9	0	0	15	21.4	
Completely not confident	15	5.6	110	40.7	125	46.3	20	7.4	
Confidence in using foreign manufactured COVID-19 vaccine									
Completely confident	75	78.9	10	10.5	5	5.3	5	5.3	0.000*
Confident	120	38.1	180	57.1	10	3.2	5	1.6	
Not confident	15	27.3	20	36.4	5	9.1	15	27.3	
Completely not confident	15	5.4	120	42.9	130	46.4	15	5.4	
Total	225	30.2	330	44.3	150	20.1	40	5.4	

Test applied: Chi-square test, *indicates statistically significant difference

Table 4: Assessment of intention to take COVID-19 vaccine according to Heath Belief model components

Heath Belief model components	Definitely yes	Possibly yes	Probably no	Definitely no	P-value
	(Mean±SD)	(Mean±SD)	(Mean±SD)	(Mean±SD)	
Perceived susceptibility of contracting COVID-19	9.96±1.92	10.00±3.32	9.71±2.45	9.84±1.84	0.010*
Perceived severity of COVID-19	14.33±2.82	14.66±2.12	13.83±2.13	13.25±2.61	0.000*
Perceived benefits of COVID-19 vaccination	8.31±1.03	7.41±1.14	6.40±1.56	6.00±2.02	0.000*
Perceived barriers of COVID-19 vaccination	15.51±4.03	18.00±2.72	18.06±3.82	21.25±2.56	0.000*
Cues to action	6.95±2.09	7.12±1.26	7.56±1.48	7.50±1.75	0.000*

Test applied: One-way ANOVA, *indicates statistically significant difference

the COVID-19 vaccine dose when available to them.^[14] When assessed among health-care students, the reported intentions to take the vaccine were found to be 86.1%, 44.2%, and 77% at Italy, Malta, and Southeast Michigan, respectively.^[15-17] Different surveys conducted among general populations of US,^[18] China,^[11] Europe,^[19] and Malaysia^[20] depicted around 67%, 30%, 70%, and 48.2% of study population with intent to receive the vaccine, respectively. The variable response from different countries among various populations might be the effect of the level of control on pandemic situation achieved by health authorities of the particular region, different mortality and morbidity rates due to COVID-19 and different periods of study conduction. A study from China revealed a greater proportion of willingness among participants of central and southern regions paralleling with high prevalence of COVID-19.^[11]

According to the multivariate analysis, the key determinants of intention to get vaccinated against COVID-19 in the present study were found to be confidence in locally and foreign manufactured vaccine, perceived severity of COVID-19, perceived benefits of COVID-19 vaccine, and cues to action. In a study conducted by China^[11] among general population, participants were more confident in the locally made vaccine and preferred the same. This was due to the implementation of China's new vaccine administration law that has perhaps boosted the public's confidence and increased public trust in domestic vaccines. However, in our study population, the more is the confidence in local and foreign made vaccines, the greater is the intent to take the vaccine. Furthermore, with increase in mean scores of perceived severity of COVID-19 and perceived benefits of COVID-19 vaccination, there was an increase in the odds of intention to get vaccinated in the present study.

Table 5: Multinomial logistic regression analysis with intention to take COVID-19 vaccine as the dependent variable

Independent variables	Odds ratio	P-value
Age (years)		
<25	0.897	0.859
26–35	3.189	0.018*
36–45	1.526	0.363
>45@	-	-
Highest degree		
MDS	1.747	0.099
BDS@	-	-
Socioeconomic status		
Upper	0.579	0.195
Upper middle@	-	-
Work status		
None	0.329	0.04*
Private practitioner	0.429	0.051
Academician	1.435	0.247
Both private practice and academics@	-	-
Suffering from chronic illness		
No	1.567	0.367
Yes@	-	-
Sick with COVID-19		
No	0.804	0.600
Yes@	-	-
Confidence in using local manufactured COVID-19 vaccine		
Completely confident	4.937	0.008*
Confident	2.216	0.043*
Not confident	3.645	0.12
Completely not confident@	-	-
Confidence in using foreign manufactured COVID-19 vaccine		
Completely confident	6.282	0.001*
Confident	4.162	0.000*
Not confident	4.766	0.119*
Completely not confident@	-	-
Perceived susceptibility of contracting COVID-19	0.981	0.767
Perceived severity of COVID-19	1.138	0.024*
Perceived benefits of COVID-19 vaccination	1.805	0.000*
Perceived barriers of COVID-19 vaccination	0.942	0.158
Cues to action	0.738	0.001*

@Reference category, *indicates statistically significant association

Cues to action showed an inverse relationship with definite intention to take vaccine, the odds of which decreased with increase in cues to action score. On the other hand, Chinese study among general population of China depicted that definite intention to get vaccinated was affected by perceived severity of COVID-19 and perceived barriers to COVID-19 vaccination.^[11] The contradiction in the findings may be due to the difference in the study population in two studies. Although, the perceived susceptibility to COVID-19 is not associated with definite intention to take vaccine among dentists in the present study, nonetheless, due to the occupational risk involved, perceived susceptibility of COVID-19 among dentists might have been much greater as compared to that of general population.

Based on the findings of the present study, some recommendations can be made for the health authorities, specifically Dental Council of India and policy makers. Due to the high vulnerability of the study population, efforts need to be directed toward increasing the intention to get vaccinated against COVID-19. Health programs that focus on increasing the perception of severity of the disease among the dentist population are the need of hour. Furthermore, important is increasing the perception of benefits of COVID-19 vaccine. Furthermore, adequate information about the various aspects of vaccine must be circulated to increase the compliance. Studies have shown that reluctances raised for COVID-19 vaccination are related with insufficient knowledge regarding the long-term side effects, effectiveness, efficacy, etc.^[21,22] Online panel discussions can be conducted for the dentists providing information and motivate them about the safety and effectiveness of the vaccine. This awareness will, in turn, be helpful in increasing the dentist's intentions to get vaccinated which will be a supportive step to bring the pandemic to an end.

Further studies focusing on dental professionals intentions to get COVID-19 vaccination are warranted all over the world to protect this population from sufferings of the disease.

CONCLUSION

The present study demonstrated a smaller proportion of Indian dentists with definite intention to get COVID-19 vaccination. The determinants of the intention to take the vaccine were evidenced to be confidence in locally and foreign manufactured vaccine, perceived severity of COVID-19, perceived benefits of COVID-19 vaccine, and cues to action.

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