Original Article

COVID-19 Vaccine Hesitancy among Medical Students of North Delhi, India

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ABSTRACT

India has managed to successfully develop and approve two vaccines for COVID-19, namely COVAXIN and Covishield. The vaccine hesitancy phenomenon is seen even among healthcare professionals. Acceptance of vaccination by healthcare or medical students is also of paramount importance. To find out the prevalence of vaccine hesitancy and associated factors in medical students of North Delhi, India, a cross-sectional study was conducted among 210 undergraduate students from a medical college in New Delhi. The questionnaire consisted of questions about identification data, history of COVID-19 infection, and vaccine hesitancy. The collected data was analyzed in SPSS software (version 21.0), and Chi-square test was used for categorical data analysis. Among the study participants, the majority of them (77.6%) belonged to the age group of 20-25 years, and most of them were males (63.3%). The prevalence of vaccine hesitancy was 27.6% among the study participants. Factors such as semesters, mother's education, and mother's occupation of the study participants were significantly associated with vaccine hesitancy regarding COVID-19 ($P<0.05$). Serious side effects, vaccine effectiveness, and recent events in the past were the reasons for vaccine hesitancy. Based on the findings of the present study, about one-fourth of the participants were vaccine-hesitant. Semesters, mother's education, and mother's occupation of study participants were significantly associated with vaccine hesitancy regarding the COVID-19 vaccine ($P<0.05$). About one-fourth of the participants mentioned serious side effects as the reason for vaccine hesitancy. Introduction to an education curriculum in the Bachelor of Medicine and Bachelor of Surgery (MBBS) can enhance students' knowledge regarding COVID-19 vaccines and their preventive aspects for the future.

Keywords: COVID-19, Delhi, Medical students, Vaccine hesitancy

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1. Introduction

Coronavirus disease 2019 is an acute respiratory disease caused by SARS-CoV-2 virus[1]. In December 2019, Wuhan, Hubei province, China, became the center of an outbreak of pneumonia of unknown cause, which raised intense attention not only within China but internationally[2]. SARS-CoV-2 (COVID-19) infection has spread rapidly worldwide, which led to severe economic and public health burden[3]. This alarming rate of spread of COVID-19 infection led to lockdowns in many nations worldwide, including India. The COVID-19 infection was declared a pandemic by the World Health Organization (WHO) on March 12th 20204. The second wave of the COVID-19 pandemic has affected European countries, with the total number of confirmed cases exceeding 33.5 million and 0.74 million deaths until now (April 2021)[5]. In the second wave, India's case rate was growing much faster than previously seen even during the worst of the first wave. In less than a year since COVID-19 reached Indian borders, India has managed to successfully develop and approve two vaccines and commence what is likely to be the world's largest immunization exercise. According to a study, healthcare workers, including medical students, were 11.6 times more likely to get infected with COVID-19 than the general community[6]. The COVID vaccine was launched in India on 16th January, 2021 for healthcare workers, including medical students[7]. The first group included healthcare and frontline workers, as it ensured an adequate workforce to deal with infected patients.10 The second groups to receive the COVID-19 vaccine were people over 60 years and between 45-59 years with co-morbid conditions. The availability of vaccines does not guarantee the acceptance of vaccines in the population. Attitudes towards COVID-19 vaccines vary greatly and have been changing over time. The vaccine hesitancy phenomenon is present even among healthcare professionals. In addition, acceptance of vaccination by healthcare or medical students is also of prime importance, as they act as information providers to patients. However, there is a paucity of literature regarding the reasons for vaccine hesitancy and the associated factors among medical students in India. Therefore, the present study aimed to investigate the prevalence of vaccine hesitancy and associated factors in medical students of North Delhi.

2. Materials and Methods

2.1. Study design and area

This cross-sectional study was planned among medical students of North Delhi Municipal Corporation Medical College and Hindu Rao Hospital, Delhi, India. It is a prominent medical institution in India and is well-known for its quality of health services to all strata of society. The present study was conducted by the Department of Community Medicine, North DMC Medical College and Hindu Rao Hospital, among undergraduate medical students. The duration of the study was three months, from July 2021 to August 2021.

2.2. Inclusion and exclusion criteria

All the undergraduate medical students of the 1st, 3rd, 6th, and 8th semesters were included in the study. Students who were absent on the day of the study and those who did not give consent were excluded from the study.

2.3. Sampling

According to the list from the Dean's office of the college, the total number of currently enrolled undergraduate medical students was 224 in the institute who are divided among four semesters i.e. 1st, 3rd, 6th, and 8th and each semester has a strength of 50-60 students. A complete enumeration of all these students of the four semesters was done to participate in the study. A total of 210 students gave the consent and filled up the self-administered questionnaire in their respective lecture halls.

2.4. Data collection tools

Data was collected using a pre-designed, semi-structured pre-tested and self-administered questionnaire containing various socio-demographic variables along with its association with vaccine hesitancy among the study participants. Vaccine hesitancy is defined as reluctance or refusal to vaccinate despite the availability of vaccines[8]. The questionnaire also includes questions on the level of agreement of participants on specific statements related to COVID-19 vaccines using a Likert scale. A pilot study to test the questionnaire was performed in May 2021 on medical students of other medical colleges in Delhi.

2.5 Statistical Analysis and ethics

The data was exported into a Microsoft Office Excel spreadsheet and analyzed using SPSS (version 21). Qualitative data were presented in frequencies and percentages, and the Chi-square test was used for analysis. Quantitative data were presented as mean and standard deviation, and t-test was used for analysis. Permission was obtained from the administrative authorities, and approval was sought from the Institutional Ethics Committee. Informed verbal consent was taken from all the participants after explaining the purpose of the study.

3. Results

A total of 210 participants were included in the study results, with a response rate of 93.75%. Among the study participants, the majority of them 163 (77.6%), belonged to the age group of 20-25 years (Table 1). The range for the age group among study participants was from 18-32. Males (63.3%) were more, as compared to 133 (36.7%) females. An almost equal number of students were present in each year. The majority of fathers 91 (43.3%), and 75 (35.7%) mothers of the participants were graduates.

Table1. Distribution of study participants according to socio-demographic characteristics (n=210)

Characteristics	Frequency (n)	Percentage (%)
Age		
<20	42	20
20-25	163	77.6
>25	5	2.4
Gender		
Male	133	63.3
Female	77	36.7
Batch		
1st Semester	55	26.2
2nd Semester	54	25.7
3rd Semester	53	25.2
4th Semester	48	22.9
Father's education		
Professional degree or Honors	61	29
Graduate	91	43.3
Intermediate or diploma	41	19.5
High school	13	6.2
Middle school	0	0
Primary school	3	1.4
Illiterate	1	0.5
Father's occupation		
Professional	106	50.5
Semi professional	60	28.6
Clerical/shop/farm	29	13.8
Skilled worker	7	3.3
Semi-skilled worker	0	0
Unskilled worker	4	1.9
Unemployed	4	1.9
Mother's education		
Profession or Honors	52	24.8
Graduate	75	35.7
Intermediate or diploma	35	16.7
High school certificate	16	7.6
Middle school certificate	2	1.0
Primary school certificate	11	5.2
Illiterate	19	9.0
Mother's occupation		
Professional	27	12.8
Semi professional	11	5.2
Clerical/shop/farm	4	2.0
Skilled worker	0	0
Semi-skilled worker	0	0
Unskilled worker	0	0
Homemaker	168	80
Previously infected with COVID-19		
Yes	64	30.5
No	146	69.5
Anyone in family infected with COVID-19		
Yes	77	36.7
No	133	63.3

Any relative/neighbor died due to COVID-19		
Yes	121	57.6
No	89	42.4
Involved in taking care of COVID patient		
Yes	55	26.2
No	155	73.8
Type of vaccine		
COVAXIN	103	49.0
Covishield	38	18.0
Others	7	3.3
None	62	29.2

Almost half the fathers of the participants were professionals 106 (50.5%). Among the mothers of the participants, the majority 168 (80%) were homemakers. About one-third 64 (30.5%) of the study participants had COVID-19 infection, and family members of two-fifths of 77 (36.7%) participants were infected with COVID-19 infection. Almost one-fourth of 55 (26.2%) study participants were involved in taking care of COVID-19-infected patients. About half (49.0%) of participants had received the COVAXIN vaccine, while about one-fifth (18.0%) had received the Covishield vaccine. Table 2 shows that the majority (87.6%) of study participants agreed that the COVID-19 vaccine will be effective in combating the COVID-19 disease. The majority (93.3%) of the participants also agreed that COVID-19 vaccines offered by the government in my community will be beneficial. The majority (84.7%) of participants believed that the information they had received about vaccines from the vaccine programs was reliable and trustworthy. Only (11.9%) of study participants agreed that new vaccines carry more risks. Almost half (51.9%) of study participants were of the opinion that they would take the COVID-19 vaccine only if it is required for international travel. The majority (85.7%) of the participants disagreed that vaccines given in immunization schedules are not effective. Only (5.2%) of participants did not think that vaccines would keep them healthy. About one-tenth (13.3%) of participants were not worried about COVID-19 disease. Only (6.6%) of study participants were of the opinion that they would get vaccinated only if it is mandatory.

Table 2. Distribution of study participants based on their level of agreement regarding specific statements on COVID-19 (n=210)

Statements regarding COVID-19 vaccines	Strongly agree or agree	Neither agree nor disagree	Strongly disagree or disagree
COVID-19 vaccine will be effective in combating the COVID-19 disease	184(87.6%)	16(7.6%)	10(4.7%)
COVID-19 vaccines offered by the government in my community are going to be beneficial	196(93.3%)	9(4.2%)	5(2.3%)
The information I receive about vaccines from the vaccine programs are reliable and trustworthy	178(84.7%)	25(11.9%)	7(3.3%)
New vaccines carry more risks	25(11.9%)	100(47.6%)	85(40.4%)
I will take it, if it will be required for international travel	109(51.9%)	42(20.0%)	59(28.0%)
Vaccines given in immunization schedule are not effective	9(4.2%)	21(10.0%)	180(85.7%)
I don't think vaccines are important for keeping me healthy	11(5.2%)	20(9.5%)	179(85.2%)
I am not worried about the COVID-19 diseases	28(13.3%)	41(19.5%)	141(67.1%)
I will get vaccinated only if it is mandatory	14(6.6%)	25(11.9%)	171(81.4%)

According to Table 3, among the study participants, about one-fourth (27.6%) of them were found to be vaccine hesitant for the COVID-19 vaccine. On analyzing the association of vaccine hesitancy with the associated factor, it was observed that semesters, parent's education, and mother's occupation of study participants were statistically significantly (P<0.05) associated with vaccine hesitancy regarding the COVID-19 vaccine. Factors such as age, gender, father's occupation, previous infection with COVID-19, infection in family, or death in family or neighbors had no statistically significant association with vaccine hesitancy among the study participants.

Reasons for COVID-19 vaccine hesitancy

Among the study participants one-fourth (24.7%) of them had mentioned that serious side effects of vaccines were the reason for their vaccine hesitancy. About one-tenth (10.9%) had mentioned that health-related events in the past in the family had discouraged them from taking COVID-19 vaccines. Only (3.3%) of study participants mentioned that their religion prohibits them from taking vaccines. Effectiveness in preventing COVID-19 diseases was mentioned by about one-tenth (13.3%) of study participants as a reason behind their hesitancy regarding vaccines.

4. Discussion

In our study, the majority (77.6%) of the participants belonged to the 20-25 years age group. In similar research conducted by Biswas B et al.[9] in Bangladesh, the majority (86.3%) of study participants were aged between 21 to 25 years. More males (63.3%) compared to females (36.7%) were found in the present study. A study conducted by Biswas B et al.[9] in Bangladesh had a greater number of females (51.6%) compared to (48.4%) males. In the current study, more than two-third (69.5%) of the study participants were not infected with COVID-19. In another similar study conducted by Saied SM et al.[10] among Egyptian medical students, it was found that more than half of respondents (56.4%) were not infected with COVID-19. In the present study, about one-third (36.7%) of study participants had COVID-19 infection in their family, and about one-fourth (22.1%) of them had vaccine hesitancy. Whereas, in a study performed on Egyptian medical students by Saied SM et al.[10], it was found that almost half (51.5%) of respondents had confirmed COVID-19 infection in their close social network, and about half (46.1%) had vaccine hesitancy. The reason for this difference may be due to differences in study settings. In our study, vaccine hesitancy was observed in about one-fourth (27.6%) of the study participants. Similar findings were seen in the study conducted by Lucia VC (23%) et al.[11] in Southeast Michigan, Kelekar AK (23%) et al. in US[12], and Alali (24.2%) et al.[13] in Kuwait, where nearly one- quarter of the allopathic medical students were vaccine hesitant. While almost half (46%) of the study participants had vaccine hesitancy in the study conducted by Saied SM et al.[10] among Egyptian medical students. The reason for this difference may be due to differences in prevalence and incidence rate in different countries. In our study, almost half (51.9%) of study participants were of the opinion that they would take the COVID-19 vaccine only if it is required for international travel. In a similar study conducted by Jain J et al.[7] among undergraduate medical students, about three-fourths (75.0%) of the study participants had a similar opinion regarding COVID-19 vaccine. Only (4.7%) of our study participants believed that COVID-19 vaccine would not be effective in combating the COVID-19 disease. Similarly, only (10.6%) of the participants had the same opinion in a study conducted by Jain J et al.[7] among medical students. In our study, serious side effects of vaccines, effectiveness in the prevention of diseases, and health-related events in the past among family members were the main reasons behind vaccine hesitancy. Similarly, concerns about vaccine safety and effectiveness were also reported as reasons for COVID-19 vaccine hesitancy in a study conducted by Raja SM et al.[14] among medical students in Sudan. In another similar study by Omer I et al.[15] among medical students in Saudi Arabia, factors such as vaccine safety and prior COVID-19 infection were found to be main reasons for vaccine hesitancy. Our study has some strengths that make it more reliable, including pilot-tested questionnaires and fair representation from each semester with a high response rate. Additionally, we have a questionnaire that can be successfully used in medical colleges on vaccine hesitancy and associated factors of medical students all over the country. The first limitation is that the result of our study cannot be generalized to the entire population of undergraduate medical students across India due to the differences in demographic, psychological, sociological, and cultural characteristics. In addition, since the study used a self-reported questionnaire, the potential underreporting or over-reporting is another limitation. The present study concluded that about one-fourth of the study participants were vaccine-hesitant. Semesters, mother's education, and mother's occupation of the study participants were statistically significantly (P<0.05) associated with vaccine hesitancy regarding the COVID-19 vaccine. There is a need to implement trainings to undergraduate medical students to enhance their knowledge regarding COVID-19 vaccines and their preventive aspects. A higher percentage of COVID-19 vaccine coverage among healthcare workers can bridge the gap of healthcare worker shortage to combat COVID-19 in India.

Table 3. Distribution of study participants based on the factors associated with vaccine hesitancy (n=210)

Characteristics	Vaccine hesitancy		*P*-value
	No	Yes	
Age			
<20	30 (71.4%)	12 (28.6%)	0.877
>20	122 (72.6%)	46 (27.3%)	
Gender			
Male	92 (69.2%)	41 (30.8%)	0.172
Female	60 (77.9%)	17 (22.1%)	
Batch			
1st year	38 (69.1%)	17 (30.9%)	**0.007**
2nd year	44 (81.5%)	10 (18.5%)	
3rd year	30 (56.6%)	23 (43.4%)	
4th year	40 (83.3%)	8 (16.7%)	
Father's education			
Professional degree or Honors	48 (78.7%)	13 (21.3%)	**0.021**
Graduate	70 (76.9%)	21 (23.1%)	
Below graduate	34 (58.6%)	24 (41.3%)	
Father's occupation			
Professional or Semi-professional	122 (73.4%)	44 (26.5%)	0.483
Not professional	30 (68.1%)	14 (31.8%)	
Mother's education			
Profession or Honors	46 (88.5%)	6 (11.5%)	**0.001**
Graduate	60 (80%)	15 (20%)	
Below graduate	46 (55.4%)	37 (44.5%)	
Mother's occupation			
Professional or semi professional	35 (92.1%)	3 (7.8%)	**0.002**
Not professional	117 (68.0%)	55 (31.9%)	
Previously infected with COVID-19			
Yes	43 (67.2%)	21 (32.8%)	0.265
No	109 (74.7%)	37 (25.3%)	

Anyone in family infected with COVID-19			
Yes	60 (77.9%)	17 (22.1%)	0.172
No	92 (69.2%)	41 (30.8%)	
Any relative/neighbor died due to COVID-19			
Yes	91 (75.2%)	30 (24.8%)	0.286
No	61 (68.5%)	28 (31.5%)	
Involved in taking care of COVID patient			
Yes	42 (76.4%)	13 (23.6%)	0.666
No	110 (71%)	45 (29%)	

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None

Authors' Contribution
ND, SKS and SJ conceived the idea and conducted the literature search. ND, SKS and KR prepared the data extraction sheet and compiled the data. BK, SJ and PA did the quality assessment of the studies. SKS and ND performed the analysis. SKS and ND drafted the manuscript. All the authors read and approved the final manuscript.

Ethics
We hereby declare all ethical standards have been respected in preparation of the submitted article.

Conflict of Interest
The authors declare that they have no conflict of interest.

Data Availability
The data that support the findings of this study are available on request from the corresponding author.

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