

# Knowledge and Willingness to Accept Vaccine Against SARS-CoV-2 Among Undergraduate Medical Students in Delhi, India

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**ABSTRACT:** Vaccination against severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is the most desired solution to combat COVID-19. Understanding the willingness to accept vaccines is essential to make appropriate strategies for the vaccination programme's success. There was a lack of published literature in India among medical students. Hence, we conducted this online, cross-sectional study to assess the knowledge and willingness to accept COVID-19 vaccines among undergraduate medical students of a medical school in Delhi. A complete enumeration of all the undergraduate medical students was done. All the students were invited to participate in this online survey. The questionnaire through Google forms was shared through email and WhatsApp. The questionnaire contained questions on the socio-demographic details, questions related to the knowledge and perceptions about COVID-19 vaccines, willingness to accept the vaccine and vaccination status of the participant. Descriptive and multiple logistic regression analyses were carried out. Out of 320 students contacted, 298 consented to participate in the survey, and 274 participants (85%) completed the questionnaire. Three-fourths of the participants were male; the mean age of the study participants was 19.6 years. Only 70.4% were willing to accept the vaccine. Those who perceived COVID-19 vaccines as safe (AOR=3.946; 95% CI: 1.946 to 7.912); and effective (AOR=2.079; 95% CI: 1.054 to 4.101); and who has knowledge about the vaccines (AOR=2.206; 95% CI: 1.186 to 4.104) were more likely to accept the vaccine. There is a need for enhancing the knowledge on vaccines, and their safety and effectiveness to promote the vaccine acceptance.

**KEYWORDS:** COVID-19, vaccine acceptance, vaccine hesitancy, medical students, SARS-CoV-2, India.

## Introduction

Coronavirus disease-2019 (COVID-19) is an illness caused by the Severe Acute Respiratory Distress Syndrome Coronavirus 2 (SARS CoV-2) that emerged in December of 2019 and progressed as a pandemic. The spread of COVID-19 has resulted in an unprecedented humanitarian and economic crisis [1,2].

Worldwide, 15 vaccines have been approved for public use by various authorities [3]. In India, two vaccines COVAXIN and Covishield were approved for use in January 2021. The vaccination started on 16<sup>th</sup> January 2021 among healthcare workers all over the country. The Phase 3 trials of COVAXIN and Covishield revealed the efficacy of these vaccines as 78% [4] and 62% [5], respectively. Recently, the Russian vaccine, SPUTNIK V, has also been approved for use in India.

Many vaccines are being developed across the world. However, the ultimate success of a vaccination programme depends on the acceptance of the vaccine. With the steady increase in COVID-19 vaccine supplies, hesitancy and refusal to be vaccinated are increased in many parts of the world [6]. World Health Organization found vaccine hesitancy as a major threat to global health [7]. Vaccine hesitancy may be fuelled by health information

obtained from various sources, including new media such as the internet and social media platforms [8]. Reasons behind vaccine hesitancy are complex and encompass more than just a knowledge deficit. The reasons for vaccine hesitancy are varied and unclear because they include socio-demographic, psychological factors, and trust towards health authorities and health care professionals [9]. As a trusted source of information on vaccines, doctors play a key role in driving vaccine acceptance. Medical students, along with other healthcare workers, were among the first to get vaccinated as per the India's national COVID-19 vaccination programme. Medical Students may tend to be influential among their friends and families and thus their perceptions, knowledge, willingness and perspective may indirectly be transferred to those they influence. Hence, understanding medical students' willingness towards the COVID-19 vaccine is important. The medical students represent different levels of knowledge of the field, beliefs, and risk perception of contracting COVID-19. These factors may influence confidence in the vaccines and vaccine acceptance. Medical students are poised to become future health care providers and hence their perspectives and experience during the vaccination may determine their viewpoint for similar events in the future. Some studies are

available on the COVID-19 vaccine acceptance/hesitancy among the medical students across the world [10,11]. We could find only one study from India [12]. In this background of limited studies on knowledge and willingness to accept vaccine against SARS CoV-2 among medical students in India, we conducted an online survey to explore the perceptions, knowledge, willingness to vaccinate, and reasons for vaccine acceptance or hesitancy among the undergraduate medical students of a medical school in Delhi, the national capital of India.

## Methods

### Study Design and Setting

This is a cross-sectional study conducted online, during February 2021. The study participants were undergraduate medical students of a medical school in Delhi. There was no previous study from India on COVID-19 vaccine hesitancy among the medical students when the study was done to calculate the sample size. Instead, we choose to send the online questionnaire to all the students of this medical school. There were 320 students in the selected medical school, and all the students were invited to participate. The institute ethics committee approved the study protocol. The questionnaire was mailed in Google form; in addition, this link was shared through WhatsApp. Information about the study was provided and informed that their participation is voluntary and assured about confidentiality.

### The Data

A questionnaire was prepared based on the literature review on vaccine hesitancy in general and COVID-19 vaccine hesitancy. It consisted of questions on socio-demographic information, knowledge and perceptions regarding the COVID-19 vaccination, awareness of the available COVID-19 vaccines, willingness to accept the vaccine and COVID-19 vaccination status. The participants were asked to tick/select the response they thought was correct. To assess the perceptions on the vaccines, some statements were provided, and the respondents were requested to rate it on a 5 point Likert scale. (1=strongly disagree, 2=disagree, 3=neutral; 4=agree, 5=strongly agree). Later, these were recategorized into three categories 1=disagree, 2=neutral, 3=Agree. However, for regression analysis, these were recategorized into two by clubbing disagree and Neutral categories as one

category, and the other category being the affirmative response, i. e., agree.

### Statistical Analysis

The data were extracted in Microsoft Excel and then imported to SPSS v.21 (IBM Corp., NY) for analysis. Descriptive analysis was carried out. Multiple logistic regression was conducted to examine the association of willingness to accept the vaccine with some independent variables. The outcome variable was the willingness to accept the COVID-19 vaccine (not willing to accept the vaccine=0; willing to accept the vaccine=1). Socio-demographic variables, variables reflecting the knowledge about the vaccines, perceptions on COVID-19 vaccines were considered as independent variables. Initially, each independent variable was regressed against the dependent variable. Those variables with a minimum P-value of 0.25 were considered for multiple logistic analyses, following the recommendation of Hosmer and Lemeshow [13]. A more usual value (such as 0.05) often fails to identify variables known to be important. At the same time, using a higher P-value has the disadvantage of including variables of questionable importance [14]. All those independent variables with a p-value of <0.25 were entered for multiple logistic regression analysis. The fit of these models was tested by Hosmer and Lemeshow goodness of fit tests.

## Results

Out of 320 participants approached, 298 participants gave consent to participate and completed the online survey. Twenty-four were excluded due to missing information, finally leaving a sample of 274 for analysis. The majority of the participants were males (75.2%), reflecting the medical school composition. The mean±standard deviation age of the study participants was 19.6±1.5 years). A slightly higher proportion of the participants were from the 1<sup>st</sup> and 2<sup>nd</sup> year of MBBS (58%), and the rest (42%) represented the students from the third to final year, including interns.

The participants' knowledge was assessed based on the standard guidelines available at the time of the study [15-17].

The participants' knowledge about the optimum temperature for vaccine storage, Indian digital App Co-Win, duration to develop immunity after vaccination, adverse reaction following vaccination were assessed. The results are presented in Table 1.

**Table 1. Knowledge and perceptions on SARS CoV-2 vaccines.**

Variable	Number (%)
<b>Knowledge on the optimum temperature for vaccine storage</b>	
Knew that optimum temperature for storing vaccines ranges from -20 <sup>0</sup> C to 8 <sup>0</sup> C	198 (72.3)
<b>Knowledge about co-WIN<sup>a</sup></b>	
Co-WIN is an online monitoring application for vaccine delivery & management	154 (56.2)
<b>Knowledge on duration to develop immunity after vaccination</b>	
Reported that it takes two weeks to develop immunity/antibodies after vaccination	153 (55.8)
<b>Awareness of various available COVID-19 vaccines in India<sup>#</sup></b>	
Moderna	134 (48.9)
Covaxin	264 (96.4)
Pfizer	202 (73.7)
Covishield	247 (90.1)
<b>Source of information on COVID-19 vaccines<sup>#</sup></b>	
Television	189 (69.0)
Social media	172 (62.8)
Journal article	110 (40.1)
Information from government sources	106 (38.7)
Friends /family	156 (56.9)
<b>The behaviour ranked first by the participants to manage COVID-19</b>	
Wearing Mask	108 (39.4)
Hand hygiene	23 (8.4)
Physical distancing	24 (8.8)
Periodical lockdown	26 (9.5)
Taking vaccines	93 (33.9)
<b>“Vaccination is the only way to stop the spread of SARS-CoV-2 infection.”</b>	
Disagree	77 (28.1)
Neutral	74 (27.0)
Agree	123 (44.9)
<b>“The vaccines presently available in India are safe.”</b>	
Disagree	51 (18.6)
Neutral	103 (37.6)
Agree	120 (43.8)
<b>“The presently available COVID-19 vaccines are effective.”</b>	
Disagree	33 (12.0)
Neutral	118 (43.1)
Agree	123 (44.9)

<sup>a</sup> Co-Win is a digital platform, was created for real-time monitoring of COVID-19 vaccine delivery.

This is the web portal for COVID-19 vaccination registration, owned and operated by the Ministry of Health and Family Welfare, Government of India. <sup>#</sup> Multiple responses were given.

A 72.4% of the respondents knew that the optimum temperature for vaccine storage ranges from minus 20<sup>0</sup> centigrade to 8<sup>0</sup> centigrade. Only 56.2% of the students correctly knew about the Co-WIN App (*Co-Win is a digital platform created for real-time monitoring of COVID-19 vaccine delivery*). Regarding the awareness of the available COVID-19 vaccines, 96.4% were aware of Covaxin, followed by Covishield (90.1%), Pfizer (73.7%) and Moderna (48.9%). Television (69%), followed by social media (62.8%), family and friends (56.9%) are the major sources of information on COVID-19 vaccines. Around 40% of the students also reported scientific journals as the source of

information, and 38.7% said government press releases as the source of information.

Study participants were asked to rank the COVID-19 appropriate behaviors viz., wearing a mask, hand hygiene, maintaining physical distancing of 1-2 meters, imposing periodical lockdowns, and vaccination. While 39.1% of the students considered wearing masks as the most effective measures and 33.9% considered vaccination as the most effective way of preventing the spread of the SARS CoV-2 virus. About 9% each ranked hand hygiene, maintaining a physical distance of 1-2 meters and imposing periodical lockdowns as the most

effective ways of preventing the spread of COVID-19.

Regarding vaccine perceptions, about 45% of the participants considered that vaccination is the only way to prevent the spread of COVID-19, while 27.7% disagreed with this statement. While 44% agreed that the vaccines presently available in India are safe, 18.4% disagreed. While 45% agreed that the presently available vaccine is effective against COVID-19, 12.1% of the students disagreed.

Regarding willingness to accept the vaccine and vaccination status, 70.4% of the participants reported that they would accept the vaccine. During this survey, only 4.4% of the students received one dose of COVID-19 vaccine, 44.5% registered for vaccination and waiting for their turn to receive the vaccine. While 39.8% reported that they had not registered for vaccination, 11.3% reported that they were neither going to register and nor to get vaccinated. The further question in the questionnaire included their reasons for willingness to accept the vaccine and the reasons for unwillingness to accept the vaccine. The

main reasons cited for accepting the vaccine were-as it is recommended by the international bodies (59.6%), and the Indian government (46.1%), satisfied with vaccine safety (42.5%), and they are at high risk of contracting COVID-19 (22.3%). The reasons for unwillingness to accept the vaccine were concerned with the safety of the vaccine (85.2%), concerned with the efficacy of the vaccine (51.9%), as they were following other preventive measures (21%), there is no need for vaccination (8.6%), fear of infection during vaccination process (3.7%), and due to emergence and spread of the mutant variants of SARS-CoV-2 (2.5%).

The results of multiple logistic regression analysis are presented in Table 2. Those who were affirmative that COVID-19 vaccines are safe (AOR 3.946; 95% CI: 1.946 to 7.912); those who affirmative about that the vaccines are effective (AOR=2.079; 95% CI: 1.054 to 4.101) and those who possess knowledge about the vaccine (AOR=2.206; 95% CI: 1.186 to 4.104) were more likely to be willing to accept the vaccine.

**Table 2. COVID-19 vaccine acceptance and associated factors with acceptance of the vaccine-results of multiple logistic regression.**

Variable	Not willing to accept the vaccine Number (%)	Willing to accept the vaccine Number (%)	AOR (95% CI)	P
Willingness to accept the vaccine	81 (29.6)	193 (70.4)	-	-
<b>First behavioral priority to manage COVID-19</b>				
Hand hygiene, physical distancing, periodical lockdown	25 (34.2)	48 (65.8)	Reference	
Wearing mask	34 (31.5)	74 (68.5)	1.384 (0.691 to 2.772)	0.359
Vaccination	21 (22.6)	72 (77.4)	1.606 (0.737 to 3.501)	0.233
<b>The perception that “only vaccine can prevent the COVID-19”</b>				
No	30 (39.0)	47 (61.0)	Reference	
Cannot say	26 (35.1)	48 (64.9)	1.012 (0.492 to 2.083)	0.587
Affirmative that only vaccine can prevent COVID-19	24 (19.5)	99 (80.5)	1.705 (0.816 to 3.563)	0.594
<b>“Vaccines against COVID-19 are safe”</b>				
No	66 (42.9)	88 (57.1)	Reference	
Yes, the vaccines are safe	14 (11.7)	106 (88.3)	3.946 (1.946 to 7.912)	0.000
<b>“The vaccines are effective”</b>				
No/Not sure	62 (41.1)	89 (58.9)	Reference	
Yes, the vaccines are effective	18 (14.6)	105 (85.4)	2.079 (1.054 to 4.101)	0.035
<b>Knowledge on vaccine maintenance</b>				
Do not know the correct range of temperature to store the vaccines	31 (40.8)	45 (59.2)	Reference	
Knew the temperature to store the vaccines ranges from -20°C to 8°C	49 (24.7)	149 (75.3)	2.206 (1.186 to 4.104)	0.012

AOR=adjusted odds ratio, CI=confidence interval; Hosmer and Lemeshow test Goodness of fit:  $\chi^2=7.0$  p=0.537

## Discussion

The present study revealed that about 30% of the medical students were hesitant to accept the vaccine, which is higher than another study conducted later from India, which reported 10.6% vaccine hesitancy among the medical students [12]. Regarding the studies from other nations, while 90% of the medical students from Southern Italy were keen to receive the vaccine [18] only 37.3% of the medical students from Uganda were willing to accept the vaccine [19]. The knowledge and awareness about vaccines of the present study students were moderate. Kelekar et al. [20] reported that 77% of the medical students were willing for COVID-19 vaccine uptake, and the study concluded that being medical students was not predictive of willingness to get the vaccine. Our study finds knowledge about vaccine storage and positive concerns about vaccine effectiveness and safety are the predictors of vaccine acceptance. Other studies also found knowledge on vaccines [18,21-22], perceived safety [10,22] and perceived effectiveness [22] as significant predictors of vaccine acceptance.

The present study highlights the need for awareness programmes on the COVID-19 vaccines, their safety and effectiveness to promote the COVID-19 acceptance and uptake. These issues may also be included in their curriculum. Since medical students are future physicians, it is vital to enhance their knowledge about the vaccines, alleviating the vaccine safety and effectiveness concerns for vaccine acceptance and enhancing their skills to advocate for uptake of vaccines.

## Limitations

The limitations of our study include that this study included only students from one medical school. Hence the findings are not generalizable.

Also, due to the study's cross-sectional design, we could only find the association of willingness to accept the vaccine. Despite these limitations, the study is conducted systematically with a sufficient sample of undergraduate students from a medical school.

The study could identify the need for enhancing the knowledge on vaccines and the need for alleviating the safety and effectiveness concerns to promote the vaccine acceptance in the society.

## Conclusion

In conclusion, vaccine hesitancy is considerable among the medical students, mainly due to safety and effectiveness concerns of the vaccine.

It is vital to enhance the knowledge about the vaccines, alleviating the vaccine safety and effectiveness concerns for vaccine acceptance and enhancing their skills to advocate for uptake of vaccines.

## Conflict of interests

None to declare.

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