



Exploring COVID-19 Vaccine Hesitancy and Associated Factors Among Medical College Students

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ABSTRACT

OBJECTIVE: This study aimed to assess the frequency of COVID-19 vaccine hesitancy among medical college students. In response to the COVID-19 pandemic, the scientific and regulatory communities swiftly developed and approved vaccines to combat the highly contagious SARS-CoV-2 virus. However, the expedited processes to address the public health crisis led to limited time for thorough safety testing of these vaccines, resulting in doubts among the public, academia, health professionals, and scientific communities. Additionally, reports of side effects perceived to be more severe than the disease itself has contributed to vaccine hesitancy among the public. Given their role in disseminating accurate information and administering vaccinations, understanding medical science students' vaccine hesitancy is essential to the COVID-19 response.

METHODOLOGY: A cross-sectional survey using online forms observed the level of COVID-19 vaccine hesitancy in 299 medical college students of both genders from January 20 to February 20, 2023. The study was conducted at Jinnah Medical College after ethical approval was obtained from the institutional ethical review board.

RESULTS: A total of 299 (65.2% male and 34.8% female) medical students (MBBS) participated in the study. Most of the students, 274 (91.6%) marked themselves as vaccinated whereas 25 (8.4%) were not vaccinated. A series of questions were posed to identify the causes of hesitancy. Despite the 91.6% vaccination rate, the initial vaccine acceptance rate was 71.9% among the participants. Most of the initially hesitant students changed their mindset and got vaccinated. The side effects observed ranged from 28.6 to 45.1%, and no significant influence of psychological factors on the reported side effects was noted.

CONCLUSIONS: The vaccine acceptance and vaccination rates were high among the students. About half of the students observed side effects that were not influenced by psychological perceptions of COVID-19.

KEY WORDS: COVID-19, Vaccination, Vaccine hesitancy, SARS-CoV-2, COVID-19 vaccination, COVID-19 vaccination associated side effects.

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INTRODUCTION

To date, seven coronaviruses have been reported to cause human infections^{1, 2}, including the recent "Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)", the virus responsible for the COVID-19 pandemic.^{3,4} The rapid spread of COVID-19 and its associated severe illness and pneumonia have prompted an unprecedented global response to control the virulence of the virus.⁵ Numerous treatment options have

been explored, including the repurposing of existing drugs⁶ but the most promising solution is believed to be a vaccine. Due to the accelerated pace of vaccine discovery and approval, concerns were raised globally regarding the potential complications of the vaccine.⁷ This hesitancy is partly due to the short time frame for vaccine authorization, lack of prior records, and other such factors. The World Health Organization (WHO) defines vaccine hesitancy as "the delay in acceptance of vaccine or refusal of vaccine despite the availability of vaccine service".

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Until recently, the COVID-19 vaccine hesitancy has been of great concern for scientists across the globe.

Vaccine hesitancy tends to increase within the general population, with a notable decline in the uptake of childhood and flu vaccines. This trend further exacerbated in many countries since the onset of the COVID-19 pandemic.⁸ A wide range of the COVID vaccine hesitancy and acceptance rates has been reported globally. It was observed that the vaccine acceptance rate is 97.7%, 94.3%, 93.3%, and 91.3% in Ecuador, Malaysia, Indonesia, and China respectively, in healthy adults. However, the vaccine acceptance rate was reported as low as 23.6%, 28.4%, 53.7%, 54.9%, 56.3%, and 56.9% in Kuwait, Jordan, Italy, Russia, Poland, and United States respectively. Most of the surveys reported an acceptance rate of 70% for COVID-19 vaccine.⁹ A recent review reported COVID-19 vaccination rates ranging from 13.1% (95% CI, 6.9%–20.9%) to 46% (95% CI, 0.38%–0.54%), with acceptance rates varying between 46% (95% CI, 37%–54%) and 83.0% (95% CI, 71%–96%) among medical students, healthcare professionals, and workers.¹⁰ According to a survey conducted in India, 10.6% of medical students expressed hesitancy towards the COVID-19 vaccine.¹¹ In Pakistan, an even lesser number (53%) of people voted in favour of planning for vaccination.¹² In a study in Khyber Pakhtunkhwa (KP) healthcare workers (HCWs), 57% of participants in the study were registered for getting the vaccine whereas, 43% were still unregistered. Further analysis revealed that 60% of the unregistered were unwilling to get vaccinated.¹³ It is concerning and imperative to address the elevated levels of COVID-19 vaccine hesitancy and decreased acceptance rates observed among healthcare professionals and medical students.

Since healthcare workers (HCWs), medical students, and physicians are frontline healthcare providers interacting with COVID-19 patients, it is essential for them to be immunized. Achieving higher COVID-19 vaccination rates among HCWs, including medical students, is crucial not only for their protection but also for public health. Despite significant initiatives at the official, regulatory, political, and media levels, vaccine hesitancy remains a major challenge. While medical professionals are generally more aware of the benefits of vaccines, various factors can still restrain them from vaccination. This phenomenon is more prevalent in developing countries, where media, culture, and religion play prominent roles.

The current study aims to assess the frequency of COVID-19 vaccine acceptance among medical college students. Given the fact that healthcare workers and medical students serve as role models and have the potential to better educate the general population, studying vaccine hesitancy within this group may

provide valuable insights that could influence wider vaccine acceptance efforts. Additionally, the study investigates several significant factors associated with vaccine hesitancy.

METHODOLOGY

An online cross-sectional study was carried out by distributing Google Forms to various medical colleges in the KP region. The sample size of 306 participants was determined using online tools, considering a target population of 1500, with a 95% confidence interval and a 5% margin of error. The questionnaire was designed using published data¹⁴ and was pre-tested on a pilot study of a small group of medical students to refine clarity and relevance. Based on the feedback, necessary modifications were made to improve the questionnaire's applicability to the target population. A "convenience sampling" approach was followed, and 306 questionnaires were filled from January 20 to February 20, 2023, after ethical approval from the institutional ethical review board (letter no DIR/JMCP/EB/0003). During the data extraction, 7 participants were excluded based on incorrect institutional affiliations or incomplete responses.

Students from ten different colleges participated in the study. Participation was entirely voluntary, and the forms included a statement outlining the study's purpose, confidentiality measures, and the participant's right to withdraw, indicating implied consent. The study was performed at Jinnah Medical College Peshawar and the obtained data was extracted on Microsoft Excel 2013. Descriptive analysis was conducted using SPSS version 21 to summarize categorical and numerical variables, including participants' demographic characteristics, vaccination status, and reported side effects. Microsoft Excel 2013 was used for data organization. Tabulation of the data was performed using Stata version 12, while GraphPad Prism v8 was employed to construct figures for visual representations of vaccine hesitancy, acceptance rates, and associated factors.

RESULTS

A total of 299 (65.2% male and 34.8% female) medical students (MBBS) from different medical colleges participated in the study. Most of the students were in their second professional year (48.8%) and 49.2% of students had ages between 21-24 years. Many of the students also reported comorbidities as shown in Table 1.

A significant percentage (57.9%, n=173) of the participants reported not being infected, whereas 15.7% had symptoms but had not confirmed the COVID-19 infection. Similarly, 39.5% of the participants marked COVID-19 as "very serious infection" and only 8.7% reported it as "not serious". Despite hesitancy, most of the students, 274 (91.6%) marked themselves as

Characteristics (n= 299)		Frequency	Percent
Gender	Male	195	65.2
	Female	104	34.8
Age (years)	17-20	136	45.5
	21-24	147	49.2
	25-29	15	4.9
	30-33	1	0.3
Year of study (MBBS)	1st year	87	29.1
	2nd year	146	48.8
	3rd year	28	9.4
	4th year	10	3.3
	5th year	28	9.4
Comorbidity	Yes	55	18.4
	No	244	81.6

Table 1: General characteristics of participants in the study

Questions (n= 299)		Frequency	Percent
Have you had COVID-19?	I had symptoms but didn't verify them	47	15.7
	No	173	57.9
	Yes, with no symptoms	23	7.7
	Yes, with mild symptoms	42	14.0
	Yes, with severe symptoms	14	4.7
How destructive can COVID be to you (your opinion)?	Life-threatening	70	23.4
	Very serious infection	118	39.5
	Just a seasonal flu	40	13.4
	Mild infection that resolves on its own	42	14.0
	Not serious at all	26	8.7
Vaccination status	I don't even believe	3	1.0
	Vaccinated	274	91.6
Have you observed side effects (vaccinated people)?	Not vaccinated	25	8.4
	No side effects	162	54.2
	Mild side effects	88	29.4
	Moderate side effects	21	7.0
	Severe side effects	3	1.0

Table 2: COVID-19 infectivity and vaccination rate of the participants

vaccinated. The vaccinated individuals reported mild (29.4%) to moderate (7%) side effects as described in Table 2. A wide range of complications were noted (data not shown here).

To gather information on the frequency and causes of COVID-19 vaccine hesitancy, a series of inquiries were conducted. Notably, 36.1% and 32.8% of students identified official and social media platforms, respectively, as their primary sources of information (Figure 1A). Surprisingly, 71.9% of participants expressed no hesitancy towards the vaccine. Among those who were hesitant, 10% cited concerns about the long-term effects of the COVID-19 vaccine. Contrary to expectations, only 1% attributed their hesitancy to religious beliefs (Figure 1B). Furthermore, when asked about the reasons behind a change of

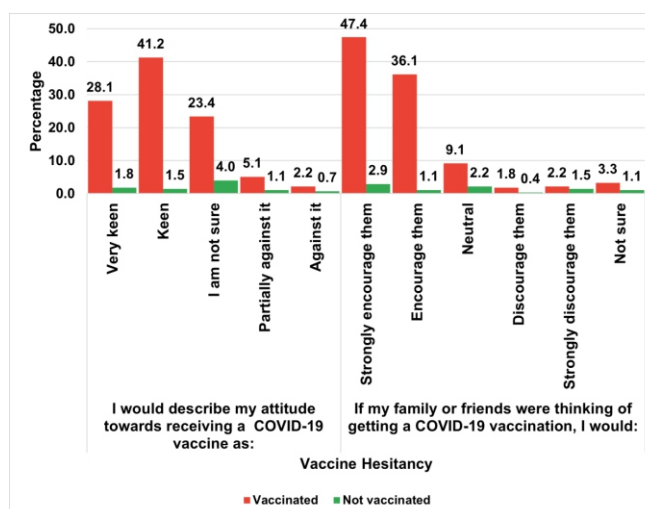


Figure 1: Percentage of participants showing their level of confidence/ hesitancy/ acceptance

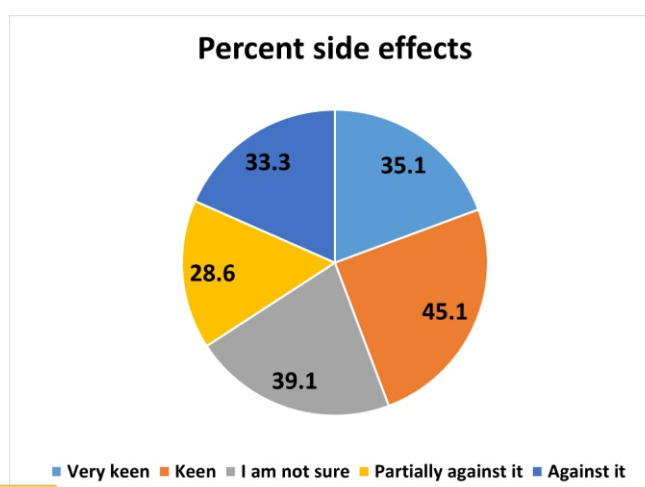


Figure 2: Percentage of participants observed side effects

perspective, 6.4%, 5.7%, and 4.7% of respondents mentioned "consulting a doctor," "seeking advice from vaccinated relatives," and "conducting personal research," respectively (Figure 1C).

Figure 2 shows the responses of both vaccinated and non-vaccinated participants to questions related to COVID-19 vaccine hesitancy. The majority of participants expressed a willingness to encourage their relatives to get vaccinated and were confident about the safety and efficacy of the vaccine.

In order to explore the potential impact of psychological factors on vaccine side effects, the occurrence of reported side effects was examined across different categories of participants' attitudes towards vaccination, ranging from "very keen" to "against it". Figure 3 illustrates that there was no statistically significant difference in the percentage of reported side effects among the various attitude categories when considering both "side effects observed" and "no side effects observed"

responses. These findings suggest that psychological factors did not influence the occurrence of vaccine side effects.

DISCUSSION

The cross-sectional survey intended to find the frequency of COVID-19 vaccine hesitancy among medical college students and subsequently explore some common reasons associated with the hesitancy. Despite the remarkable percentage of vaccination status (91.6%) in participants in the study, 27.8% of the participants reported initial hesitancy. The percentage was reduced later due to many reasons as described and most of the initially hesitant students eventually got vaccinated. In general, low benefits and high risks are contributing towards vaccine hesitancy.¹⁵

The vaccine acceptance rate is reported higher in low and middle-income countries as compared to developed countries^{16,17} as represented by our findings. Contrary to our findings, a similar study of Egyptian medical students reported that 34.9% were in the acceptance group and 45.7% in the hesitant group. However, only 19.4% of students were reported as a refused group.¹⁸ A series of meta-analyses performed reported a global prevalence of 25-42%.^{19,20,21,22,23,24} The vaccine acceptance rate among HCWs has been demonstrated to vary from 20.7%²⁵ to 81.1% in dental practitioners.²⁶ Similar to HCWs, healthcare students have reflected a slightly higher acceptance range that varies from 34%²⁷ to 82.4%.²⁸ A recently published meta-analysis also described the hesitancy in HCWs and students as 26% and 25% respectively.¹⁹ Medical students have reported a high acceptance rate as compared to other college students.²⁹ The findings support our findings where we reported a 71.9% of initial acceptance rate, 28% of hesitancy rate, and 91.6% vaccination rate in our cohort.

Congruent to our data, having faith in the government or official information provided officially, increases the willingness to vaccinate among the participants.³⁰ We observed that information produced by government and on social media were the two primary sources of information. Similarly, confidence in government decisions has a positive impact on vaccine acceptance^{31,32} however, the role of social media has been correlated with both, positive and negative vaccine acceptance rates.^{29,33,34} Facebook, on the other hand, also an integral part of social media, has been positively correlated with the vaccine acceptance rate.^{35,36} The findings support our results partly in the case of social media and fully in terms of faith in government officials as a source of information.

A more recent review by McCready and colleagues³⁷ extensively demonstrated the correlation of various factors with COVID-19 vaccine acceptance and hesitancy. Many published studies related vaccine acceptance with HCWs (medical, pharmacy,

dentistry, and faculty) and vaccine hesitancy with side effects and safety.³⁷ Adverse events or side effects have been among the major factors of COVID-19 vaccine hesitancy.^{29,32,38,39,40} We observed at least one side effect (mild, moderate, or severe) in 45.1% of our study participants. Further, grouping them into five different groups (very keen, keen, not sure, partially against, and totally against vaccine) based on their attitude towards vaccine acceptance, 28.6 to 45.1% of them reported to have conferred side effects. The published data vary greatly in terms of the frequency of side effects observed in post-vaccinated subjects. Dewau and colleagues observed 56.98% of side effects in their study participants.^{41A} much higher percentage of 91.3% has also been reported⁴² and the findings are supported by other reports.^{43,44} However, none of them has taken into account the impact of psychological factors like our study.⁴⁵ Our data showed that there is no significant difference between the percent of side effects reported by either of the five groups. It might be appropriate to mention that medical students have a minimum to no impact of psychological factors on their reporting regarding vaccine-associated side effects as compared to other populations reported by the studies.

Limitations of the study

This study has several limitations. As a cross-sectional study, it cannot establish causal relationships between variables. Data were self-reported rather than collected through interviews, introducing potential social desirability bias. Additionally, voluntary participation may have led to response bias, with students with strong opinions about vaccination potentially being overrepresented. Moreover, reliance on descriptive statistics prevents statistical inference about associations between factors.

Recommendations

Future studies should include dentistry, allied health students, and non-medical students to improve the generalizability of findings. A longitudinal approach could help assess changes in vaccine hesitancy over time. Additionally, incorporating qualitative insights through interviews or open-ended questions may provide a deeper understanding of the psychological and social factors influencing hesitancy. A comparative analysis between medical and non-medical students could further highlight differences in vaccine perceptions. Expanding the study to multiple regions and institutions would also enhance the external validity of the findings.

CONCLUSION

The study evaluated the frequency of COVID-19 vaccine hesitancy, vaccination status, acceptance rate, and psychological impact on the post vaccination side effects

observed among medical college students. The study found that the COVID-19 vaccine acceptance and vaccination rate was high among the students. About half of the students observed side effects that were not influenced by psychological perceptions of COVID-19. Further studies evaluating prevalence and severity of the side effects associated with individual vaccines are required.

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CONFLICT OF INTEREST

Author declare no conflict of interest.

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AUTHORS CONTRIBUTIONS

NA: Conception, Design of the work, Data collection, and Drafting, Reviewed, Final approval, Agreement to be accountable.

MZ: Conception, Design of the work, Acquisition, Data Analysis, and Drafting, Reviewed, Final approval, Agreement to be accountable.

ZS: Conception, Design of the work, Interpretation of data for the work, and Drafting, Reviewed, Final approval, Agreement to be accountable.

DATA SHARING POLICY

The data that support the findings of this study are available from the corresponding author upon reasonable request



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