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SARS-CoV-2 Vaccine Hesitancy and Acceptance Among Medical Students in Helmand, Afghanistan

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Abstract
Background/Objective: This study aimed to identify COVID-19 vaccine hesitancy among medical students in Helmand, Afghanistan, and its contributing factors. The findings will be presented to key healthcare organizations for peer review and used to develop a regional Risk Communication and Community Engagement (RCCE) strategy to increase national vaccine acceptance among medical students. Methods: This study employed a structured approach consisting of three steps. First, a paper-based Knowledge, Attitude, and Practice (KAP) questionnaire was developed and tested for efficacy and understanding. Second, using Yamane's formula to determine the appropriate sample size, a population-based stratified sampling method was employed to select 200 respondents from 937 medical students in 21 classes. Results: A survey conducted in February 2022 revealed a high percentage (38.6%, or 56 out of 145) of medical students hesitant to receive SARS-CoV-2 vaccination in Helmand, Afghanistan. Factors contributing to this hesitancy include a lack of information about COVID-19 vaccination, doubts about its adverse effects, and fear of long-term sequelae associated with immunization. Conclusion: The results of this study provide valuable insights for professors, policymakers, and health organizations to address factors contributing to COVID-19 vaccine hesitancy among medical students. Approaches such as RCCE campaigns, public awareness initiatives, and incorporating a dedicated vaccination chapter into the medical curriculum can minimize hesitancy and increase vaccine acceptance. Addressing vaccine hesitancy is crucial to prevent the spread of COVID-19 and protect the health of medical students at higher risk due to their proximity to infected populations.

Keywords: COVID-19, Vaccine Hesitancy, Medical Students, Vaccine Acceptance, COVID-19 Afghanistan

1. Introduction

In December 2019, a new virus, the severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2), was discovered in Wuhan, China. This discovery was linked to a possible zoonosis-like event in a contaminated seafood market (Yang et al., 2020). The disease caused by SARS-CoV-2 was named "coronavirus disease 2019" (COVID-19) (Zahorec R, 2020). Despite control procedures such as restrictions, lockdowns, case tracking, and active

surveillance, the virus has rapidly spread worldwide (Yang et al., 2020). On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic (Cucinotta & Vanelli, 2020). Unfortunately, as of October 3, 2023, SARS-CoV-2 still infects humans with severe or less severe variants. According to a report based on data from the Johns Hopkins University Coronavirus Resource Center, there have been a total of 676,609,955 confirmed cases of COVID-19 and 6,881,955 deaths worldwide (*COVID-19 Map - Johns Hopkins Coronavirus Resource Center*, n.d.)

The first case of COVID-19 in Afghanistan was reported on February 24, 2020, in Herat, a western province bordering Iran. The patient was a 35-year-old man who returned from Qom City in Iran (Nemat, Asady, et al., 2021). Notably, SARS-CoV-2 entered Qom City in the third week of February 2020 (Delirrad & Mohammadi, 2020). According to the WHO COVID-19 dashboard, from January 3, 2020, to October 12, 2023, there have been 226,220 confirmed cases of COVID-19 in Afghanistan, with 7,950 deaths (Afghanistan: WHO Coronavirus Disease (COVID-19) Dashboard with Vaccination Data | WHO Coronavirus (COVID-19) Dashboard with Vaccination Data, n.d.-a).

However, no comprehensive management is currently available for COVID-19. Scientists have developed and tested several vaccines to activate the immune system against SARS-CoV-2 (Bian et al., 2021). The aim of these vaccines is twofold: first, to protect individuals from severe COVID-19 infections, hospitalization, and death; and second, to prevent and control the spread of the virus. Vaccine discovery has historically played a crucial role in public health by significantly reducing disease morbidity, mortality, and transmission (Bian et al., 2021; Plotkin & Plotkin, 2011). However, despite the importance and effectiveness of vaccines, there are barriers to achieving this purpose, such as vaccine hesitancy, which remains a significant challenge (MacDonald et al., 2015). Vaccine hesitancy refers to a delay in accepting or refusing vaccines despite their availability(MacDonald et al., 2015). It is considered a significant barrier to eradicating vaccine-preventable diseases and was declared as one of the ten significant threats to global health by the WHO in late 2019; addressing vaccine hesitancy is crucial for global public health, individual well-being, and overall social and economic prosperity (*Ten Threats to Global Health in 2019*, n.d.).

To fight hesitancy, targeting medical students is essential for several reasons. They are the future of the medical field, frequently interact with patients and their families, play a vital role in addressing vaccine hesitancy, and are uniquely positioned to bridge the gap between the medical community and the public (Lucia et al., 2021). Therefore, understanding vaccine hesitancy levels and factors among medical students can improve vaccination acceptance and campaign success (Machingaidze & Wiysonge, 2021; Venkatesan et al., 2022).

1.1 COVID-19 Vaccine Acceptance in Afghanistan and Other Countries

The acceptance rate of COVID-19 vaccines varies significantly across countries, with China reporting a high % acceptance rate of 90% compared with Russia's 55% (Lazarus et al., 2020). Moreover, studies in low-income countries have reported an average vaccine acceptance rate of 80.3% among the general population (Machingaidze & Wiysonge, 2021).

Medical students also exhibit varying degrees of vaccine hesitancy in different regions, including 10.6% in India, 13.9% in Italy, 23% in the USA, 41.2% in Ethiopia, 46% in Egypt, and 58.2% in Wuhan, China (Barello et al., 2020; Gao et al., 2023; Jain et al., n.d.; Lucia et al., 2021; Mose et al., 2022; Saied et al., 2021).

Afghanistan, one of the world's poorest countries, faces a high incidence of vaccine hesitancy for complex reasons (Harapan et al., 2022; SAMADİ et al., 2023). It is worth mentioning that Afghanistan is one of the two countries that are still endemic to polio, with cases primarily concentrated in rural areas bordering Pakistan (Ahmadi et al., 2020; Bjork et al., 2023; O'Reilly et al., 2012). Immunization coverage of polio and other vaccines is challenging in these regions, contributing to high vaccine hesitancy (Ahmadi et al., 2020). A recent population-based study in Afghanistan revealed that 63% of the general population was willing to receive the COVID-19 vaccine, whereas 37% expressed hesitancy (Nemat, Bahez, et al., 2021). Factors contributing to vaccine refusal or delay in

Afghanistan include illiteracy, lack of awareness, security concerns, mistrust in efficacy, misinformation, safety concerns, and fear of adverse effects (Ahmadi et al., 2020; Nemat, Bahez, et al., 2021; Wardak et al., 2021).

According to the World Health Organization (WHO), as of October 25, 2023, the following COVID-19 vaccination data have been reported for Afghanistan (*Afghanistan: WHO Coronavirus Disease (COVID-19) Dashboard With Vaccination Data | WHO Coronavirus (COVID-19) Dashboard With Vaccination Data*, n.d.-b):

- In total, 21,893,320 vaccine doses were administered.
- 18,3385,310 people were vaccinated at least once.
- A total of 17, 607, 688 individuals were fully immunized.

In this study, we aimed to identify vaccine hesitancy levels and factors among medical students in Helmand, Afghanistan. We aimed to support vaccination acceptance and campaign success by focusing on this group. Health organizations can develop strategies to improve vaccine acceptance and public health outcomes in Afghanistan by identifying factors contributing to vaccine hesitancy.

2. Materials and Methods

A cross-sectional study was conducted using stratified sampling to collect data. This method was chosen because of the heterogeneous nature of the population and the need to estimate parameters within different subgroups, compare them, and reduce the sampling errors. The study participants were from 21 other classes or subgroups of medical students at Bost University in Helmand, Afghanistan, the largest university in the country's southern region. This provided a convenient setting for our research.

The sample size for this study was calculated using Yamane's formula (Adam, 2020). With a confidence level of 95%, margin of error of 6.3% (Suresh & Chandrashekara, 2012), and population proportions of 50%, a sample size of 200 was determined from 937 students. Among the 200 participants, 45 (22.5%) were female and 155 (77.5%) were male.
Yamane's Formula 1967: n = N/{1+N(e)(2)}
Where:

- n is the sample size
- N is the population size, which is 937
- e is the margin acceptable error, 6.3% (Suresh & Chandrashekara, 2012)

$$n = \frac{937}{1 + 937(6.3)^2} = 198.6 \approx 199$$

After calculating the sample size, a Knowledge, Attitude, Practice (KAP) questionnaire assessed the medical students' knowledge, attitude, and practice regarding vaccination. The questionnaire was initially created in English with the Medical Student Council. It was then translated into the local language (Pashto) and presented to and approved by the University of Bost Ethical and Research Committee on Meeting Number 7, dated January 31, 2022; Registered #: BostEthic-0744.

Before the data collection, a pilot study was conducted to test the questionnaire. The data collection process involved paper-based questionnaires distributed to the respondents for self-reporting. The survey lasted three weeks, every Saturday, from February 05, 2022, to February 26, 2022. Of the 200 self-reported questionnaires distributed, 55 were flagged and excluded from the analysis. The overall survey universe consisted of 145 correctly answered questionnaires. For analysis, an Excel database was created by an IT consultant. The database was crucial for analyzing the 16 knowledge, attitude, and practice questions. Before analyzing the complete dataset, a pilot test was conducted to ensure accuracy and identify potential issues.

In addition to the Excel database, a Google Form survey was used to analyze the collected data further. This versatile survey form facilitated the organization and interpretation of the dataset, allowing for a comprehensive

evaluation of the responses. By employing a multidimensional approach that incorporated the Excel database and Google Forms survey, the IT consultant ensured efficient analysis and enhanced the overall effectiveness and reliability of the research findings.

2.1 Ethical consideration

Before the data collection, the participants were given a brief orientation, and the study's objectives were explained. Additionally, the participants were assured that their confidentiality would be protected. Written consent was obtained from all participants, and those unwilling to participate had the right to refuse and were not obligated to participate in the study. No financial or other incentives were provided to students to complete the survey.

3. Results and Discussion

The overall goal of the survey was to identify hesitancy and the factors and circumstances that caused hesitancy among medical students. A total of 200 participants were targeted, but unfortunately, there were 55 flagged records among the sample results, resulting in only 145 records being considered for the analysis; the survey response rate was 72.5%.

3.1 Demography of the students in the sample

Of the 145 respondents, 117 were male, and 28 were female (80.7% male and 19.3% female). In terms of age, 84.13% (122 out of 145) (were aged between 19 and 26 years, while the remaining 15.8% (23 out of 145) were below 19 or above 26 years.

The study revealed that 55.2% (80 participants) of the medical students were not vaccinated (Table 1), and 44.8% (65) of the students responded that they had been vaccinated with the SARS-CoV-2 vaccine.

Table 1: Percentage of vaccinated students by sex.

Total Participants (145 students)	Male	Female	Total
	117 (80.7%)	28 (19.3%)	145 (100%)
Non-Vaccinated	68 out of 117	12 out of 28	80 (55.2%)
Vaccinated	49 out of 117	16 out of 28	65 (44.8%)

3.2 Hesitancy of students under the sample

The study also showed that for multiple reasons, 56 of 145 surveyed (38.6% of the total surveyed) medical students hesitated with the SARS-CoV-2 vaccine. The hesitant students were from pre-clinical (1-3 years of medical faculty) and clinical (4–7 years of medical faculty) backgrounds.

- Pre-clinical studies students: 44
- Clinical studies students: 12

The study showed that 44 out of 56 hesitant students in their pre-clinical studies were more willing to be vaccinated, and 12 out of 56 hesitant students were in their clinical studies. Hence, we can infer that the clinical studies students (with more years of study) were more eager to receive the vaccine than the pre-clinical students. This may be because the latter group had less medical knowledge.

3.3 Information regarding COVID-19 attitudes of students in the sample.

Of the 145 respondents, 88 (60.7 %) received information regarding the SARS-CoV-2 vaccine at non-biased, non-anti-vax sites. Hence, they had positive attitudes toward vaccination, while 39.3% (57 out of 145) responded that they did not have sufficient overall information about SARS-CoV-2. Hence, they were hesitant about vaccination

(Fig. 1). According to their attitudes and practices, they may receive the SARS-CoV-2 vaccine if they obtain complete and comprehensive information regarding the SARS-CoV-2 vaccine.

Most of the respondents got their information and understanding regarding the COVID-19 vaccine as well as anti-Vax propaganda against the vaccine from 1) social media such as Facebook, Twitter, and radio, 2) information through healthcare workers, and 3) information through community people.

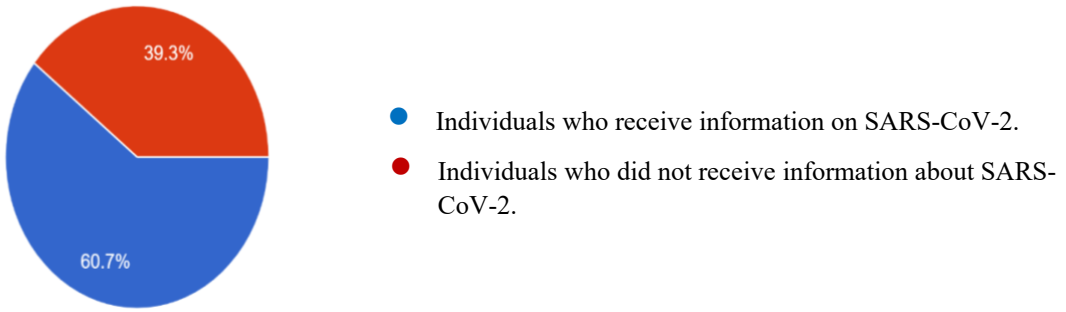

Figure 1: Information about SARS-CoV-2 vaccination

Half of the sample students (73 out of 145) were trying to decide whether to reject or accept the vaccination; they responded that it may be vital for them to be health workers. Still, they were not confident enough, and the study showed that i) 37.2% of students agreed that vaccination is vital for them, and ii) 12.4% were against the vaccination and selected the "No, it's not important for me as a health care worker" option. (Fig. 2)

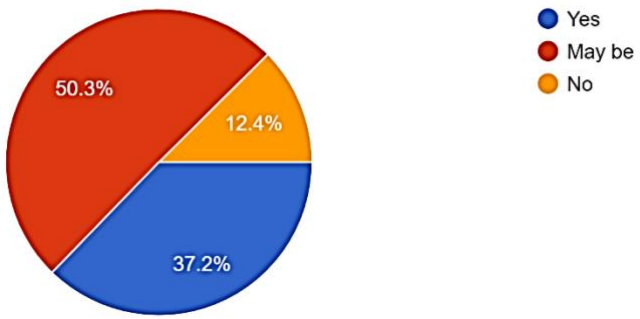

Figure 2: Importance of SARS-CoV-2 Vaccination in Participants.

Comparing the study findings with similar studies conducted globally, medical students in southeast Michigan, USA exhibited a 23% unwillingness to receive the COVID-19 vaccine (Lucia et al., 2021). Comparable hesitancy rates have been observed among medical students in Italy (13.9%), Egypt (46%), and India (10.6%) (Barello et al., 2020; Jain et al., n.d.; Saied et al., 2021). Likewise, research conducted in Wuhan, China, and Ethiopia revealed vaccine hesitancy rates of 58.2% and 41.2 %, respectively (Gao et al., 2023; Mose et al., 2022). Surprisingly, our study's data revealed a concerning rate of vaccine hesitancy of 38.6%, highlighting the difficulties in achieving adequate vaccination coverage and controlling the spread of COVID-19.

Of the 56 hesitant students surveyed, 18 students rejected the SARS-CoV-2 vaccine. This accounted for 12.2% of the 145 surveyed students, while the rejection rate among Egyptian students was 6% (Saied et al., 2021). The remaining 38 out of 56 hesitant students (26.2%) did not respond clearly, stating that they may have considered getting the vaccine after obtaining unbiased information (Table 2).

Table 2: Vaccine acceptance and rejection among students

Total survived students	Hesitant students		Non-hesitant students
145 (100%)	56 (38.6%)		89 (61.4%)
	18 (12.4%)	38 (26.2%)	
	Will not get vaccine after information, complete rejection	Maybe get a vaccine after getting the information	

3.4 Reasons behind Hesitancy and Rejection of the COVID-19 Vaccination

The reasons for hesitancy and rejection of the COVID-19 vaccination varied (Fig. 3). Still, the most prevalent were i) a lack of public awareness and information about SARS-CoV-2, ii) adverse and side effects after vaccination (particularly the severe fever that is equivalent to COVID-19's fever), and iii) propaganda about unhealthy sequelae that SARS-CoV-2 may cause after vaccination. Other less common reasons made the students hesitant.

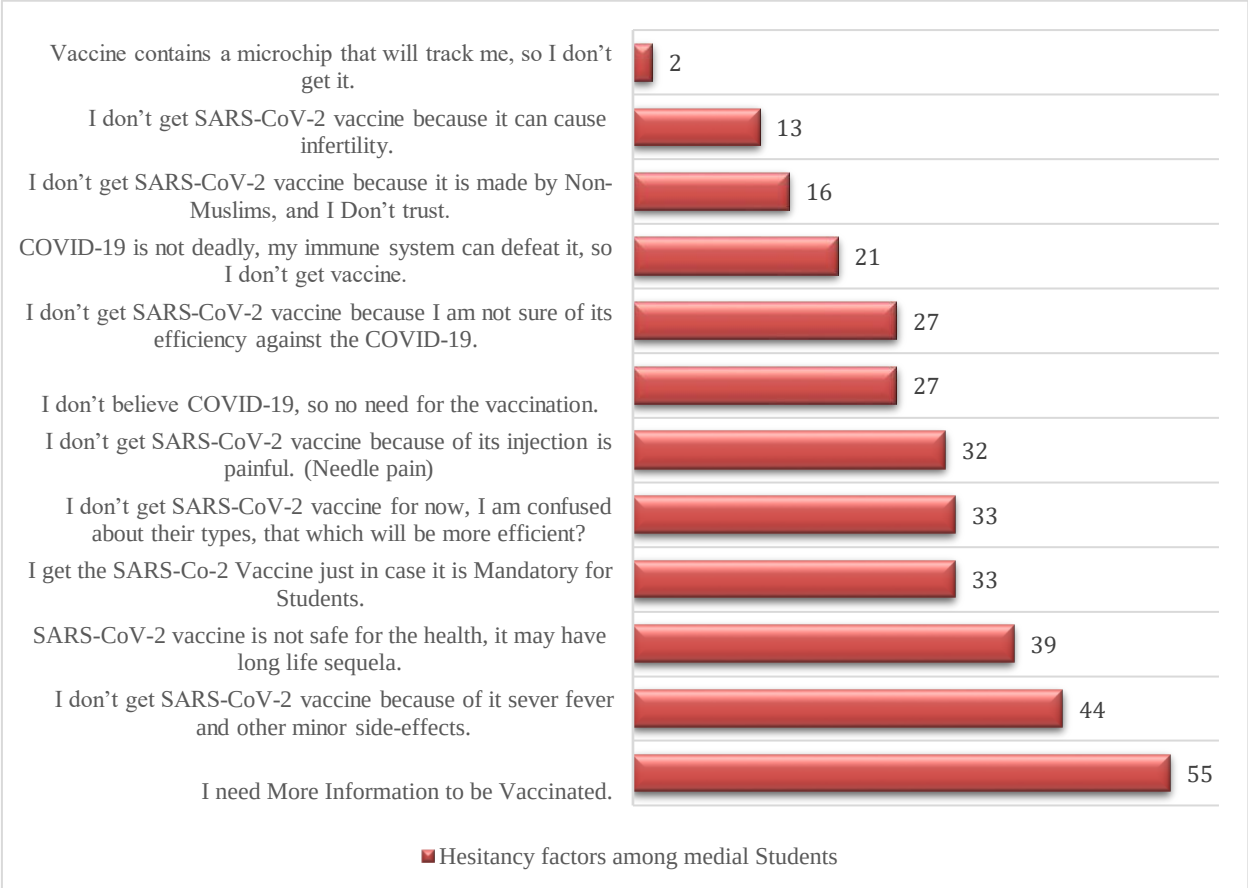

Figure 3: Reasons behind vaccine hesitancy

The reasons for vaccine hesitancy were similar to those in studies conducted in India and Egypt. In India, factors include a lack of awareness, vaccine safety and efficacy concerns, and distrust in government agencies (Jain et al., n.d.). In Egypt, hesitancy is due to doubts about vaccine safety, fear of adverse effects, effectiveness, long-term genetic effects, insufficient trust in vaccination sources, and fear of COVID-19 infection (Saied et al., 2021). Our study found that media campaigns on SARS-CoV-2 greatly influenced vaccine hesitancy and acceptance. Students who were educated about the virus and relied on trusted social media were more willing to receive vaccination

than those exposed to anti-vax propaganda. Social media was the primary source of anti-vaccine information for hesitant students, followed by negative rumors regarding side effects and effectiveness.

Several limitations may have affected the results of the study. First, the findings apply only to medical students and may not be generalizable to other populations. Additionally, the sample size could have been larger because of the lack of participation from some students. Moreover, 55 questionnaires were flagged and excluded from the analysis because of incomplete or improper answers, reducing the overall sample size. Finally, the study was conducted when COVID-19 vaccines were not widely accessible in all healthcare facilities.

4. Conclusion

In conclusion, this research highlights a concern (38.6%) of hesitant students towards SARS-CoV-2 vaccination, attributed to factors such as lack of information, concerns about adverse effects, and fear of long-term sequelae. It is crucial to address this hesitancy by incorporating a dedicated chapter on vaccine hesitancy in the educational public health curriculum, specifically targeted toward students, to promote informed decision-making and prevent unintentional participation in anti-vax groups. Achieving a high coverage of the SARS-CoV-2 vaccine is essential for combating the pandemic and managing it as an endemic event. Medical students play a significant role in convincing individuals to be vaccinated, necessitating the study of hesitancy factors and implementing a strong risk communication and community engagement (RCCE) strategy to increase vaccination coverage. Failure to address this issue may jeopardize the effective implementation and monitoring of COVID-19 vaccination programs. We urge professors, health policymakers, the Afghanistan Ministry of Public Health, the health cluster, and other relevant health organizations to proactively address hesitancy towards the SARS-CoV-2 vaccine, aiming for a healthy Afghanistan population by reducing COVID-19 incidence, disease severity, and related deaths.

List of Abbreviations:
COVID-19: Coronavirus disease 2019
SARS: Severe acute respiratory syndrome.
RCCE: Risk communication and community engagement
MD: Doctor of Medicine
WHO: World Health Organization
KAP: Knowledge, Attitude, and Practice

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Data Availability: The dataset is available and is presented upon request.

Conflict of interest: The authors declare no conflict of interest.

Ethical consideration: Before the data collection, the participants were given a brief orientation, and the study's objectives were explained. Additionally, the participants were assured that their confidentiality would be protected. Written consent was obtained from all participants, and those unwilling to participate had the right to refuse and were not obligated to participate in the study. No financial or other incentives were provided to students to complete the survey.

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