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Original Article

Assessing the Favourability of COVID-19 Vaccine and the Influence of Knowledge, Attitudes, and Beliefs on Vaccination Readiness Among Medical Students in Tehran

Running Title: *Knowledge, Attitude, and Practice of Iranian Medical Students Regarding COVID-19 Vaccine*

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Abstract

Background: Vaccines are highly effective tools to combat COVID-19. Public vaccination in Iran began in February 2021. Healthcare personnel, constitute a priority for vaccination.

Objectives: This study aimed to investigate the willingness of medical students to accept the COVID-19 vaccine and explore the impact of attitudes, perceptions, and beliefs on their vaccination readiness.

Methods: A cross-sectional study was conducted among medical sciences students at Tehran Medical Sciences Islamic Azad University, Iran, between October and November 2021. An online anonymous questionnaire was used to collect socio-demographic characteristics, attitudes, and beliefs about the COVID-19 vaccine. Participants' self-reportings determined vaccine rejection and acceptance, and data was completed and analyzed using SPSS-25.

Results: Most respondents had a strong desire to get the vaccine (96.4%), while 62.6% hadn't received yet. The preferred vaccine was Sputnik-V, followed by Oxford/AstraZeneca, COV-Iran Barekat, and Sinopharm. A 84.7% of them were asked about the COVID-19 vaccine by the public, but only 54.4% had received adequate training. Also, 77.3% believed, vaccination would be the final step in eradicating COVID-19.

Conclusion: Collaboration between the government and universities is crucial to educate medical students to have a better public guide and awareness. Also, as vaccine efficacy and safety were mutual concerns, educating the medical students might greatly help.

Keywords: COVID-19, Vaccine, University, Medical Students, Knowledge, Attitude, Belief, Iran, Tehran

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Introduction

In December 2019, a cluster of four cases of pneumonia of an unknown etiologic in Wuhan, China, was reported to the World Health Organization (WHO) (1). Since then, the coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has spread rapidly throughout the world (2). Following the rapid spread of the virus worldwide, the World Health Organization (WHO) declared COVID-19 the sixth public health emergency of international concern on January 30, 2020 (3). The coronavirus was officially named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses after a phylogenetic analysis (4). By the end of October 2021, COVID-19 had infected more than 238 million cases and killed approximately 4.8 million patients.

SARS-CoV-2 shares significant phylogenetic homology with two bat-derived SARS-like coronaviruses (5). SARS-CoV-2 is one of the seven types of coronaviruses known to infect humans (6). Based on genetic characteristics, coronaviruses are classified into four genera: α-CoV, β-CoV, γ-CoV, and δ-CoV(3), and COVID-19 belongs to β-CoV(6). Like other coronaviruses, SARS-CoV-2 is an enveloped virus with a single-stranded, positive-sense RNA genome (7).

Host cell invasion is considered the first phase of viral infection. Zhou and his colleagues have shown that angiotensin-converting enzyme 2 (ACE2) expressed on the cell surface is the entry port for SARS-CoV-2 into host cells and that no other receptors (such as aminopeptidase N (APN) and dipeptidyl peptidase 4 (DPP-4), which serve as entry receptors for other human coronaviruses, namely HCoV-229E and MERS-CoV) are required for this type of coronavirus (8). The SARS-CoV-2 spike (S)-glycoprotein is critical in receptor binding, membrane fusion, and internalization (9).

Clinical features of the infection range from an asymptomatic state to severe acute respiratory disease and multiorgan failure. The most common clinical symptoms are fever, dry cough, anosmia, sore throat, shortness of breath, fatigue, headache, and myalgia (10-14). Almost all patients with severe COVID-19 have bilateral lung involvement. The acute onset of impaired oxygenation with noncardiogenic pulmonary infiltrates is characteristic of ARDS, which develops in 15% to 40% of patients with COVID-19-associated pneumonia (15, 16).

As COVID-19 is considered a new disease, we must find either a new medication or a vaccine for it and be careful about antimicrobial and antiviral resistance (17). Despite identifying available treatment targets, the only established treatments are Remdesivir, Dexamethasone, and supportive therapies, which can reduce hospitalization and help manage COVID-19 symptoms, which do not significantly affect hospital mortality (18-20). COVID-19 treatment is mainly based on the patient's symptoms, and no specific antiviral agents are proposed for SARS-CoV2 (21).

Efforts are underway worldwide to develop therapies and prophylactic vaccines against SARS-CoV2. Therapeutics aim to shorten the length of hospital stay and increase the survival rate of infected patients, while preventive

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vaccines aim to generate protective immunity against SARS-CoV2.

Remdesivir and corticosteroids have been shown to reduce mortality in moderate to severe patients (22). Studies demonstrated that high-dose corticosteroid plus Tocilizumab, interferon-a2b, Tocilizumab, sofosbuvir plus daclatasvir, anakinra, high-dose corticosteroid, convalescent plasma, and remdesivir were associated with reduced mortality in moderate-to-severe non-ICU patients compared with the control group (23-26).

In the case of SARS-CoV-2, previous experience with SARS-CoV and MERS-CoV has enabled the rapid development of vaccine candidates. In November 2020, according to the World Health Organization, more than 170 vaccines against SARS-CoV-2 were in development, 13 of which were in clinical phase III. These vaccine candidates fall into four vaccine platforms: viral vector-, RNA-, DNA-, and protein-based vaccines (27).

Public vaccination of Iranian citizens began in February 2021 with a limited number of Russian Sputnik-V COVID-19 vaccines (28). Vaccines available for injection to the general public include Sputnik-V, Sputnik Light, COVAX-19 (Vaxine/CinnaGen Co), Covaxin (Bharat Biotech), AZD1222 (Oxford /AstraZeneca), BBIBP-CorV (Sinopharm), and COVIran Barakat.

Levels of neutralizing antibodies after the different vaccine doses were elevated on day 14/21 and day 28/35 in the vaccine groups compared with controls. The total neutralizing antibody levels were also significantly elevated (29). In addition, 37 deaths were reported in long-term care facilities when 693,246 residents were vaccinated. Of 6,688,231 individuals vaccinated against COVID-19, 55 deaths were reported in the United States through January 8, 2021 (30). Several studies confirm the positive effect of vaccines on reducing mortality rates (31, 32).

Vaccine resistance is not a new problem; resistance to various vaccines has been reported in multiple communities in the past (33). In this study, we aimed to assess the knowledge, attitude, and practice of the COVID-19 vaccine among Iranian medical sciences university students in Tehran.

Method

A cross-sectional study was conducted among medical sciences students between October and November 2021 (after the fifth wave of the COVID-19 epidemic in Iran) via a structured questionnaire. An anonymous online survey was developed and applied based on previous studies. The questionnaire targeted medical sciences students at Tehran Medical Sciences Islamic Azad University. The questionnaire consisted of open- and closed-ended questions in the Persian language, and all respondents were either native Persian speakers or fluent in the Persian language as their second language. There was a total of 20 questions on socio-demographic characteristics, the tendency to use and suggest the COVID-19 vaccine, type of the most favorite COVID-19 vaccine, source of information regarding COVID-19 and COVID-19 vaccine, and their knowledge regarding available vaccines in the country (34-36). The questionnaire was validated (face and content validity) by seven experts in the pharmacy practice field, and its reliability was tested

through analysis methods. Islamic Azad University Tehran Medical Sciences has about 5400 students. To calculate the sample size for a population of 5,400 with a 5% margin of error and a 95% confidence level, we used Cochran's formula, and the sample was found to be approximately 445 students ($P < 0.05$). The Ethics Committee of Islamic Azad University Tehran Medical Sciences (registration number: IR.IAU.PS.REC.1400.292) approved the study protocol.

The questionnaire was divided into four sections:

1) Participants' demographic data (4 questions)

2) General knowledge, interest, and practices of respondents toward COVID-19 vaccines (10 questions)

3) Personal experience of COVID-19 infection (2 questions)

4) Immunization behavior and beliefs of participants (3 questions)

The data were coded, entered, and analyzed utilizing the SPSS software version 25 (produced by SPSS Inc., based in Chicago, IL, USA). Descriptive statistics included calculating frequencies and percentages to summarize the data. The Chi-square test was used to assess the association between demographic characteristics and knowledge and practices toward COVID-19 vaccines. The level with p-values < 0.05 was considered statistically significant.

Result

Socio-demographic characteristics of respondents

A total of 445 university students agreed to participate in our cross-sectional study (simple randomized sampling) and filled out our online questionnaire, giving a response rate of 100%. The questionnaire was released on September 2021, at the end of the fifth epidemic peak in Iran. 76.4% (n=340) of participants were female and 23.6% (n=105) were male. Among respondents, 40% (n=178) were studying pharmacy, 16.2% (n=72) medicine, 11.5% (n=51) nursing and midwifery, 4.4% (n=20) dentistry, and 27.9%(n=124) other medical fields. 97.5% (n=443) of the respondents to the questionnaire were studying or had a bachelor's degree or a higher one. The relation of socio-demographic characteristics of respondents and their tendency to get the COVID-19 vaccine are detailed in **Table 1.**

Table 1: Association of demographic characteristics and COVID-19 vaccine willingness

Demographic characteristics	No	Yes	P value
Gender			
Male	7.6%	92.4%	
Female	2.4%	97.6%	0.011
Field of study			
Pharmacy	3.4%	96.6%	
General Medicine	2.8%	97.2%	
Dentistry	0%	100%	0.830
Midwifery and Nursery	3.9%	96.1%	
Other paramedical fields	4.8%	95.2%	
Study in the last two years of the course			
Yes	1.2%	98.8%	0.236
No	5.1%	94.9%	

Knowledge, attitudes, and beliefs towards COVID-19 vaccine

Among our respondents, 96.4% (n=429) were willing to receive the COVID-19 vaccine, but 3.6% (n=16) were reluctant. Female respondents were significantly (P=0.011) more interested in

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taking the COVID vaccine. Among these respondents, 9%(n=40) had received both 1st and 2nd doses of the vaccine, 28.4%(n=126) had received just the 1st dose, and 62.6%(n=279) hadn't received the vaccine yet. The most favorite vaccine among students was Sputnik-V (40.7%, n=181), followed by Oxford/AstraZeneca (32.4%, n=121), COV-Iran Barekat (13.9%, n=71), and Sinopharm (11%, n=62), while 10 of our respondents (2%) were reluctant to be vaccinated. There was a significant difference (P<0.05) between genders in choosing the type of vaccine (Table 2). Another part of our study revealed that the public asked 84.7% (n=377) of respondents questions about COVID-19 vaccines, while 15.3% (n=68) of our respondents didn't have this experience. Also, we understood that 54.4% (n=242) of our respondents attended either workshops/webinars or studied some academic papers about COVID-19 vaccines to answer public questions **(Table 3)**.

In the next part of our questionnaire, respondents were asked about the effect of bad news (either fake or real) about COVID-19 vaccines on respondents' decisions regarding getting the vaccine. Our study revealed that this kind of news didn't affect 96.2% (n=428) of participants, while 3.8% (n=17) decided not to get the vaccine after contact with this kind of news. Also, our study demonstrated no correlation between the research field and respondents' hesitation to vaccination due to bad news. Among students reluctant to get the vaccine due to the negative information, 5.1% were first-year students, 4.5% were second-year students, and 1.9% were third-year or more.

Also, we understood that the essential factors in choosing a vaccine were its immunogenicity (69.4%, n=309), fewer side effects)16%, n=71), Vaccine manufacturing plant (10.3%, n=46), and more infrequent injection intervals (4.3%, n=19). There was no significant difference (P>0.05) between genders regarding the choice of vaccine **(Table 2)**. Also, our study demonstrated that for those who had lost a family member due to COVID-19 infection, the immunogenicity of the vaccine was more important (76.8%) compared to those who had not lost a family member (69.4%).

In the next part of this questionnaire, students were asked if they would like to receive a different vaccine with higher immunogenicity as their second dose or prefer to be vaccinated with the same kind of vaccine as the double dose. 31.9% (n=141) of respondents were interested in receiving a different but more potent vaccine as their second dose of vaccine (Mix and match method), while 68.1% (n=303) refused to do so. Also, there was no significant difference (P>0.05) between male and female respondents **(Table 3)**.

As the low rate of public vaccination, 82.2% (n=366) of the participants considered the lack of sufficient vaccines and vaccination facilities as the main reasons for the low vaccination rate, while 17.8% (n=79) believed that anti-vaccine resistance of the public is the main reason.

Finally77.3% (n=344) of respondents believed that universal vaccination would be the final step in the fight against the COVID-19 pandemic and would eradicate the infection **(Table 3)**.

Table 2: The Most favorite vaccine and items in choosing the vaccine

	Male	Female	Total	P value
Type of Vaccine				
Sputnik-V	44.8%	39.4%	40.7%	0.027
Oxford/AstraZeneca	30.5%	32.9%	32.4%	
COV-Iran Barekat	7.6%	15.9%	13.9%	
Sinopharm	13.3%	10.3%	11%	
Items in choosing the vaccine				
More Immunization	60%	72.4%	69.4%	0.531
Fewer side effects	18.1%	15.3%	16%	
Fewer injection intervals	3.8%	4.4%	4.3%	
The manufacturer	18.1%	7.9%	10.3%	

Table 3: Association of Gender and Attitude and Practice

	Male	Female	P value
Need of education for COVID-19 in university			
Yes	77.1%	76.8%	0.463
No	22.9%	23.2%	
Questions about COVID-19 Vaccine by the public			
Yes	82.9%	85.3%	0.437
No	17.1%	14.7%	
Mix and match the vaccine			
Yes	33.3%	31.5%	0.403
No	66.7%	68.5%	
Attending a COVID Webinar/seminar			
Yes	55.2%	54.1%	0.463
No	44.8%	45.9%	
Public vaccination can end the COVID pandemic			
Yes	74.3%	78.2%	0.237
No	25.7%	21.8%	

Discussion

The current study examined the knowledge, attitude, and beliefs about the COVID-19 vaccine among Iranian medical sciences university students in Tehran. Respondents were all Iranian and Persian-speaking medical and allied health students. So, they were young people with similar sociocultural backgrounds (35). Most respondents were strongly willing to be vaccinated by the COVID-19 vaccine, while they were not vaccinated yet. Also, the public had asked them about mentioned vaccines, but many of them had never attended a course or read an article about COVID-19 vaccines.

Vaccination is one of the most important methods of preventing infectious diseases. The World Health Organization lists accelerating access to medicines, diagnostic tests, and vaccinations against COVID-19 as one of the ten global health issues (37). Public concern about vaccine safety has often been cited as a significant barrier to vaccination, especially for newly introduced vaccines that have not been thoroughly field-tested (38). The tendency to be vaccinated against COVID-19 is relatively high (96.4%) among Iranian medical students. Among Romanian medical students, for example, the undecided group accounted for 8% of respondents. It included those who answered "Maybe" or "Not yet, I am waiting for my colleagues to be vaccinated first" when asked whether they wanted to be vaccinated. The vaccine-resistant group comprised only 4% of respondents (39). In another study conducted with an online questionnaire among medical students in Turkey, 60.1% of the participants wanted to be vaccinated, 14.2% refused, and 25.7% needed to be sure (40). Among Indian medical students, 10.6% were hesitant to be vaccinated, 64.5% were vaccinated, and 24.9% were waiting to receive the vaccine (41). In Ireland, the United Kingdom, and Germany, a significant increase in vaccine resistance, 18.1%, 10%, and 30%, was noted in 2020, spring and summer (42-44). At the same time, our study's vaccine resistance percentage was only 2%. That could be due to the passing of the fifth COVID-19 peak in the country. In the 5th peak, Although the morbidity and mortality rate were considerably high, the death toll and disease incidence were relatively lower in cities with

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higher vaccination rates, which can be why vaccine resistance in our study was much lower than in the mentioned studies.

Previous surveys of Egyptian students have shown that 67.9% believe the coronavirus pandemic will only end once they are entirely vaccinated (45, 46). According to the results of our study, this figure was 77.3% among Iranian medical students.

In our study, 97% of respondents who had experienced a death in their family due to the pandemic believed that the pandemic could end with vaccination. These people were also more likely to get vaccinated, which could be because they took the disease more seriously. A previous study in Iran also agreed with our research and showed that people hospitalized for the COVID-19 virus were 2.18 times more likely to be vaccinated (47). Another study in Iran and China also showed that people who experienced a higher severity of COVID-19 infection were more likely to be vaccinated (48, 49).

Regarding the crucial factors for vaccine acceptance, most American healthcare workers were concerned about the COVID-19 vaccines due to their side effects (69%), efficacy (69%), and rapid process of their approval and development (74%) (50). However, among Iranian medical students, higher immunogenicity (69.4%), fewer complications (16%), country of the manufacturer (10.3%), and faster immunogenicity (shorter interval between two doses) (4.6%) were more relevant.

Several types of COVID-19 vaccines are currently being developed, and the type of vaccine may influence people's attitudes toward vaccination (38). Attenuated influenza viruses as vectors, recombinant protein vaccines, and nucleic acid vaccines (including RNA and DNA vaccines) are different kinds of available vaccines. Our study in Iran showed that most respondents preferred adenovirus-type vaccines (Sputnik V and Oxford/AstraZeneca). Another study in China revealed that the Chinese believe killed virus-based vaccines have fewer side effects and prefer this type of vaccine platform (51). In another study conducted in the United States, the kind of vaccine did not matter to the respondents (38). Another study showed that 63.2% of Russians would like to be vaccinated with Sputnik V if the vaccine was licensed (52). In comparison, the inclination towards Sputnik-V was 40.7% of the population in our study. This tendency might be because Sputnik-V was first used among Iranian healthcare workers, which led the public to accept the efficacy of this vaccine. However, the scientific data on this vaccine were not as solid as those of other vaccines, and it was still not approved by the World Health Organization at the time. In addition, the public's inclination towards the Oxford/AstraZeneca vaccine could be because this vaccine was approved earlier than other vaccines available in Iran by WHO.

Studies have shown that greater trust in the healthcare system is associated with using preventive health services such as vaccinations. The greater this trust, the more people are willing to be vaccinated (53). It follows that governments and companies should first build trust (54). In our study, the most crucial reason for vaccine rejection was terrible news about the vaccine, and its side effects, which was in agreement with

another study in the United States that showed the main reason for refusing vaccinations was concerns regarding the side effects of the vaccines (55). Other studies in Iran and the US have also demonstrated that belief in vaccine efficacy indicates a willingness to accept COVID-19 (38, 48).

Medical students play a crucial role in educating the public about vaccination, as they are often sought for their expert opinion. Therefore, they must receive a thorough education on the topic to provide accurate information to their patients and the community confidently. According to our survey, 54.4% of participants attended workshops or webinars on the COVID-19 vaccine, while only 16.4% of this education had been in university. Also, 60.4% of respondents believed in voluntary university education and 16.4% in compulsory university education regarding COVID-19. A study conducted in Saudi Arabia also concluded that educating the population, especially educated people, could significantly promote a positive attitude towards COVID-19 prevention (53).

Conclusion

In conclusion, a collaboration between the government and universities in Iran is crucial to educate medical students as soon as possible in situations similar to the COVID-19 pandemic, to have a better public guide, address vaccine hesitancy, and increase awareness about vaccinations. Also, as vaccine efficacy and safety were mutual concerns, educating the medical students might greatly help. Furthermore, the public's high trust in medical sciences students was interesting. We believe in pandemics such as COVID-19, governments should accurately educate medical sciences students through professional webinars and special courses and set up online professional groups to empower them to educate the public faster and better.

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