

Acceptability of a COVID-19 vaccine and role of knowledge, attitudes and beliefs on vaccination willingness among medical students

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ABSTRACT

Objectives: Vaccination to the population is the most effective way to get rid of the COVID-19 pandemic, which currently has no effective treatment. For the high vaccine acceptance rate, it is important to determine the vaccine willingness of individuals and the barriers to vaccination. We aimed to determine the acceptability of the COVID-19 vaccine and the effect of attitudes, perception and beliefs on vaccination willingness among medical students.

Methods: In February 2020, a cross-sectional survey was conducted online among medical student. A total of 734 medical students out of 980 medical students answered the questionnaire forms (response rate: 75.4%). The online questionnaire collected socio-demographic characteristics, attitudes, risk perception and beliefs about the COVID-19 pandemic and vaccine. Vaccine hesitancy, rejection and acceptance were determined by self-report of medical students.

Results: Total of 739 medical students included study. Students declared that 60.1% (n = 444) of them to be willing to vaccinated, 14.2% (n = 105) refused and 25.7% (n = 190) were not sure. Covid-19 willingness to be vaccinated was higher in female ($p = 0.005$), clinical students ($p < 0.001$), those who ever tested for COVID-19 ($p = 0.002$), those who had covid-19 infection history in the family ($p = 0.043$), those who had COVID-19 and COVID-19 vaccine education ($p = 0.001$). Positive attitudes skor and higher knowledge scores were related with highly willingness to be vaccinated. High beliefs score (positive beliefs) was found to be associated with a higher willingness to be vaccinated ($p < 0.001$).

Conclusions: Although the majority of the study population willingness to be vaccinated, one-third of medical students are hesitant about vaccination. Education, positive attitude and beliefs are related to higher willingness to vaccination. The COVID-19 pandemic immunization programs should be designed to remove barriers to negative vaccine beliefs and perception.

Keywords: COVID-19 vaccines, medical students, vaccination awareness, perception, beliefs

Received: March 31, 2021; Accepted: April 25, 2021; Published Online: July 4, 2021



How to cite this article: Kaya MO, Yakar B, Bakay E, Pamukçu E, Önalın E, Akkoç RF, Pirinçci E, et al. Acceptability of a COVID-19 vaccine and role of knowledge, attitudes and beliefs on vaccination willingness among medical students. Eur Res J 2021;7(4):417-424. DOI: 10.18621/eurj.907213

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e-ISSN: 2149-3189

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Coronavirus diseases 2019 (COVID-19) caused by the new type of coronavirus (SARS-COV2) was first reported in December 2019. It caused a pandemic in a short time and posed a significant threat to the whole world. Despite more than 1 year, humanity still suffers from COVID-19. Although more than 114 million cases have caused more than 2.5 million deaths worldwide, an effective treatment against COVID-19 has still not been found [1, 2].

The COVID-19 pandemic has caused disruptions in almost all areas of life all over the world. Education, especially medical education, is one of the areas negatively affected by the pandemic. Medical schools have been suspended during the pandemic, and as such, many students are stayed at home. This has disrupted the medical education process. Currently, medical education is tried to be given online in Turkey. There have been problems in bedside and practical training with online medical education. Although time is needed to accurately predict the effects of the pandemic on education, it is predicted that it may pose important problems for the learning experience and professional development of medical students [3].

It is known that the most beneficial method for the whole world to get rid of the negative effects of the pandemic is vaccination against COVID-19. It is possible with vaccination on the return of medical education and medical faculty students to normal life [4]. The tickets of medical education and medical faculty students to return to normal life pass from vaccination. Although vaccination seems to be the way out of the pandemic, the willingness of individuals to be vaccinated is also important in combating the pandemic. During the 2009 influenza A (H1N1) pandemic, it has reported that the acceptability of influenza vaccination among adults in the USA was between 50-64%. However, there is not enough information in the literature about the COVID-19 vaccine acceptance and the factors affecting it. Such information which acceptance rate and affecting factors are may be useful for improving COVID-19 vaccine acceptability [5, 6].

The current study was aimed to determine COVID-19 vaccine acceptance and which factors are related vaccination willingness

METHODS

Study Design, Population and Sampling

We conducted a prospective cross-sectional online survey study about COVID-19 vaccination with medical students in February 2021. The study population consisted of Firat University all medical students. Online questionnaire forms were sent to the all medical students by whats-app. A total of 980 medical students who study in the period of 2020-2021 constituted the study population. Online questionnaire forms were sent to all medical students by whats-app, not using the sampling method. A total of 739 medical students who answered the questionnaire forms were included in the study (response rate:75.4%). Before applying the questionnaire, participants were asked to accept a consent form containing statements about the purpose of the study and voluntary participation of the questionnaire, and those who non-volunteers could not answer the questionnaire. The online questionnaire was sent 3 times with one week intervals and students who did not answer were asked to answer. After three weeks, unreturned questionnaires were recorded as missing. Those under the age of 18 years old, foreign students and those who are not active students were excluded from the study.

Ethical approval, informed consent and permissions

The study was approved by the Firat University Non-Interventional Ethics Committee (Approval code: 23/128/2019), and the World Medical Association Declaration of Helsinki guidance was followed. The consent of the participants was questioned with the first question of the online survey form. The questionnaire was terminated for the participants who did not declare consent to participate in the study. In addition, permission was obtained from the scientific research platform of the Turkish Ministry of Health.

Measures

The online questionnaire was designed based on previous studies which are assess vaccine acceptance. The contents of the questionnaire included (1) socio-demographic characteristics, such as; age, sex, class, family income, health status, personal and family history of COVID-19 diagnosis (2) perception and attitudes about COVID-19 pandemic; (3) beliefs about COVID-19.

We developed perception, attitude and beliefs survey items on vaccination based on previous literature data and Turkish Ministry of health suggestions for Avoiding and preventing COVID-19. Questionnaire

prepared in local language Turkish. First, a group of medical experts provided feedback on the items of the survey, where it was modified as per their comments. Next, the modified draft of the survey went through pilot testing on 30 participants to provide feedback about the clarity and comprehensibility of the items of the survey. The questionnaire was revised one more time, after feedback of the students, and then applied to the study population

Perception and Attitudes

We assessed participants' perceptions about COVID-19 by calculating the score of three items answered by participants (possible range = 1-4). The perceptions questions are: perceived likelihood of getting a COVID-19 infection in the future (possibility range = 1-4), disease progress in case of covid-19 (severity range = 1-4), how threatening covid-19 is for you (serious range = 1-4). We assessed participants' attitudes about COVID-19 by calculating the score of six items answered by participants (possible range = 0-1). Washing your hands (1 = rarely, 4 = always), Using hand sanitizer or cologne (1 = rarely, 4= always) , Wearing a mask (1 = rarely, 4 = always), Social distancing (1= rarely, 4= always), Staying away from closed area (1 = rarely, 4= always), and follow the recommended guidelines for COVID-19 (1 = rarely, 4 = always). Total score of perception and attitudes include eight questions. Participants could get a minimum of 8 and a maximum of 32 points. We coded each variable so that higher values indicate greater levels of positive perception and attitudes [7-9].

Beliefs about COVID-19

We assessed participants' perceptions about COVID-19 by calculating the score of five items answered by participants (possible range = 1-5). The beliefs questions are: difficulty to get vaccinated (possible range = 1-5); effectiveness of a COVID-19 vaccine personality (possible range = 1-5); effectiveness of a COVID-19 vaccine for your family (possible range = 1-5); effectiveness of a COVID-19 vaccine for public health (possible range = 1-5); potential harms of a COVID-19 vaccine (possible range = 1-5). Total score of beliefs include five questions. Participants could get a minimum of 5 and a maximum of 25 points. We coded each belief variable so that higher values indicate greater levels of positive beliefs [7, 8]

Statistical Analysis

Statistical analysis of the data was performed by IBM SPSS 22 statistics package program. Kolmogorov-Smirnov test was used to determine whether the data showed normal distribution. Descriptive statistics of the data were expressed as mean \pm standard deviation for variables with normal distribution in continuous data and frequency for categorical variables as percentage (n (%)). Pearson Chi-square test was used to analyse categorical data. In comparison of more than two independent groups, One-Way ANOVA and LSD test for post-Hoc test were used for normal distributed continuous data. Significance level was $p < 0.05$. Statistically significant significance values are indicated in bold in the tables.

RESULTS

Total of 739 medical students included study. The mean age of the students were 21.20 ± 2.68 years. The sample was 57% female, preclinical (65.3%) and clinical (34.7%) students. Students declared that 60.1% (n = 444) of them to be willing to vaccinated, 14.2% (n = 105) refused and 25.7% (n = 190) were not sure. COVID-19 willingness to be vaccinated was higher in female ($p = 0.005$), clinical students ($p < 0.001$), those who ever tested for COVID-19 ($p = 0.002$), those who had covid-19 infection history in the family ($p = 0.043$), those who had COVID-19 and COVID-19 vaccine education ($p = 0.001$) (Table 1).

Covid-19 willingness to be vaccinated was higher in students who declared that "I have a high possibility of getting COVID-19 in the future" ($p < 0.001$), "it can cause high progressive disease" ($p = 0.008$) and "highly threatening for my health" ($p < 0.001$). Positive attitudes skor and higher total knowledge and attitudes scores were related with highly willingness to be vaccinated (Table 2).

The relationship between students' beliefs on the COVID-19 vaccine and their willingness to be vaccinated is presented in Table 3. High beliefs score (positive beliefs) was found to be associated with a higher willingness to be vaccinated ($p < 0.001$) (Table 3).

DISCUSSION

The current study showed that 60.1% (n = 444) of

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

Variables	Do you willing to get the COVID-19 vaccine				p value
	No	Yes	Hesitant	Total	
Gender					
Female	47 (44.8)	274 (61.7)	106 (55.8)	427 (57.8)	0.005
Male	58 (55.2)	170 (38.3)	84 (44.2)	312 (42.2)	
Education level in medical school					
First year	37 (35.2)	89 (20.0)	69 (36.3)	195 (26.4)	< 0.001
Second year	29 (27.6)	84 (18.9)	66 (37.4)	179 (24.2)	
Third year	12 (11.4)	61 (13.7)	36 (18.9)	109 (14.7)	
Fourth year	18 (17.1)	70 (15.8)	7 (3.7)	95 (12.9)	
Fifth year	3 (2.9)	71 (16.0)	11 (5.8)	85 (11.5)	
Internship	6 (5.7)	69 (15.5)	1 (0.5)	76 (10.3)	
Do you have any chronic disease?					
No	95 (90.5)	410 (92.3)	171 (90.0)	676 (91.5)	0.579
Yes	10 (9.5)	34 (7.7)	19 (10.0)	63 (8.5)	
How would you describe your health condition?					
Very bad	1 (1.0)	3 (0.7)	2 (1.1)	6 (0.8)	
Bad	6 (5.7)	30 (6.8)	14 (7.4)	50 (6.8)	
Good	67 (63.8)	335 (75.5)	148 (77.9)	550 (74.4)	
Very good	31 (29.5)	76 (17.1)	26 (13.7)	133 (18.0)	
Ever tested for COVID-19					
No	84(80.0)	310 (69.8)	156 (82.1)	550 (74.4)	0.002
Yes	21 (20.0)	134 (30.2)	34 (17.9)	189 (25.6)	
Personal history of COVID-19 diagnosis					
No	89 (84.8)	389 (87.6)	164 (86.3)	642 (86.9)	0.714
Yes	16 (15.2)	55 (12.4)	26 (13.7)	97 (13.1)	
Family member/friend ever diagnosed with COVID-19					
No	72 (68.6)	256 (57.7)	102 (53.7)	430 (58.2)	0.043
Yes	33 (31.4)	188 (42.3)	88 (46.3)	309 (41.8)	
Have you ever been quarantined for COVID-19?					
No	79(75.2)	307 (69.1)	140 (73.7)	526 (71.2)	0.313
Yes	26 (24.8)	137 (30.9)	50 (26.3)	213 (28.8)	
Education for COVID-19					
No	42 (40.0)	139 (31.3)	88 (46.3)	269 (36.4)	0.001
Yes	63 (60.0)	305 (68.7)	102 (53.7)	470 (63.6)	
Education for COVID-19					
No	83 (79.0)	351 (79.1)	173 (91.1)	607 (82.1)	0.001
Yes	22 (21.0)	93 (20.9)	17 (8.9)	132 (17.9)	

Data are shown as n (%).

Table 2. Relation between perception and attitude score and COVID-19 vaccine willingness

Perception and Attitudes	Do you willing to get the COVID-19 vaccine			p value*
	No	Yes	Hesitant	
What are your possibility of getting COVID-19 in the future?	2.75 ± 0.69 ^b	3.60 ± 0.58 ^a	3.02 ± 0.63 ^a	< 0.001
How do you think the disease will progress if you get COVID-19 in the future?	2.37 ± 0.84 ^b	2.55 ± 0.70	2.66 ± 0.84 ^a	0.008
How threatening is COVID-19 to your health?	2.48 ± 0.91 ^b	2.85 ± 0.73 ^a	2.87 ± 0.76 ^a	< 0.001
Washing your hands often, especially after being in a public place or after blowing your nose, coughing, or sneezing.	2.92 ± 0.98	3.09 ± 0.89	3.02 ± 0.89	0.204
Using hand sanitizer or cologne that contains at least 60% alcohol.	2.81 ± 1.11 ^b	3.16 ± 0.90 ^a	3.01 ± 0.95	0.001
Wearing a mask when going out in public.	3.57 ± 0.76 ^b	3.87 ± 0.38 ^a	3.74 ± 0.59 ^a	< 0.001
Social distancing (keeping about 2 meters between yourself and other people)	2.52 ± 0.88	2.62 ± 0.82	2.61 ± 0.83	0.584
Staying away from closed area (situations close contact with others)	2.75 ± 0.88	2.70 ± 0.84	2.62 ± 0.86	0.371
Do you think you follow the recommended guidelines for COVID-19 adequately?	3.00 ± 0.76	3.09 ± 0.68	2.69 ± 0.79	0.121
Total score	22.18 ± 4.31^b	23.90±3.28^a	23.53 ± 3.72^a	<0.001

Data are shown as mean±standard deviation.

Higher scores indicate greater levels of positive attitudes and high knowledge.

* One-way Anova test

^{a-b}Pairwise comparisons

participants to be willing to vaccinated, 14.2% (n = 105) refused and 25.7% (190) were not sure. The current study showed that more than a third of medical students were undecided about COVID-19 vaccination. Lucia *et al.* [7] reported that 53% of medical students would participate in a COVID-19 vaccine trial and 23% were unwilling to take a COVID-19 vaccine. A previous study reported that 69% of participants were willing to get a COVID-19 vaccine among US adults [8]. Another study reported that 91.3% of the participants would accept vaccination after the vaccine becomes available, among 52.2% of them wanted to get vaccinated as soon as possible, while others 47.8% would delay the vaccination until the vaccine’s safety was confirmed [10]. It can be said that individuals still have hesitancy against the vaccine, which is the most important weapon we have to get rid of the pandemic. In the study conducted during the influenza A (H1N1) pandemic period, the vaccination rate was reported as 93.2% in medical students and 84.8% in nursing students [11]. Compared to the high acceptance vaccine

rate in the previous pandemic, the current COVID-19 vaccines hesitancy rate is unacceptable. It can be suggested to remove the obstacles to the willingness to be vaccinated as soon as possible.

The current study showed that sociodemographic factors such as gender, education level, family history of covid-19 diagnosis and having education for COVID-19 and COVID-19 vaccine are related to vaccine willingness and acceptance. Studies examining the relationship between COVID-19 vaccination willingness and sociodemographic characteristics are limited in the literature. A systematic review study reported that age, sex, occupation and educational level are associated with influenza A (H1N1) vaccination during the pandemic [12]. Wang *et al.* [10] reported that being male and believing in the efficacy of COVID-19 vaccination increase the probability of accepting COVID-19 vaccination. The striking finding in our data was that the willingness to be vaccinated was higher in students who declared having COVID-19 education and COVID-19 vaccine education.

Table 3. Relation between Beliefs score and COVID-19 vaccine willingness

Beliefs about COVID-19 vaccination	Do you willing to get the COVID-19 vaccine			p value*
	No	Yes	Hesidant	
If you have to paid for the vaccine. Does this affect your vaccine acceptance? ¹	1.86 ± 0.77 ^b	4.52 ± 0.58 ^a	3.19 ± 0.49 ^a	< 0.001
If you decide to get the COVID-19 vaccine, do you think it would be hard to getting the vaccine? ²	3.41 ± 1.12	3.47 ± 1.14 ^a	3.12 ± 0.89 ^b	0.001
How is important do you think the getting vaccine is to protect your health? ³	3.00 ± 1.04 ^b	4.41 ± 0.67 ^a	3.75 ± 0.86 ^a	< 0.001
How important do you think vaccination is in protecting the health of your family members? ⁴	3.09 ± 1.18 ^b	4.46 ± 0.72 ^a	3.82 ± 0.91 ^a	< 0.001
How important vaccination is in protecting public health and combating COVID-19 pandemic. ⁵	3.31 ± 1.05 ^b	4.61 ± 0.57 ^a	3.93 ± 0.84 ^a	< 0.001
Do the possible side effects of the COVID-19 vaccine affect your vaccine acceptance? ⁶	2.16 ± 0.81 ^b	2.56 ± 0.83 ^a	2.37 ± 0.77	< 0.001
Total score	16.83 ± 3.77 ^b	24.03 ± 2.51 ^a	20.19 ± 2.69 ^a	< 0.001

Data are shown as mean±standard deviation.

Higher scores indicate greater levels of positive beliefs.

* One-way Anova test

^{a-b}Pairwise comparisons

¹ 1 item; 5-point response scale ranging from “absolutely affects” to “absolutely does not affect” (possible range = 1-5)

² 1 item; 5-point response scale ranging from “very hard” to “very easy”(possible range=1-5)

^{3,4,5} 1 item; 5-point response scale ranging from “unimportant” to “very important” (possible range=1-5)

⁶ 1 item; 5-point response scale ranging from “absolutely affects” to “absolutely does not affect” (possible range = 1-5)

Based on our data, we can say that we should attach importance to education in order to increase the willingness to be vaccinated.

Previous studies showed that risk perception is a central predictor of protection intentions and preventive health behaviours [13]. In addition, it is known that vaccination rates are higher in those who have a positive attitude towards the disease [14]. According to our study, the willingness to be vaccinated was higher in the participants who had a positive attitude and having a high-risk perception. A COVID-19 vaccine acceptance study reported that the COVID-19 vaccine acceptance rates were lower in those with an anti-vaccination attitude and those with low-risk perception. The current study and previous vaccine acceptance studies showed that positive attitude and perception are important to vaccine acceptance. It was thought that we should increase the positive attitudes of individuals for vaccination in the fight against the COVID-19 pandemic and the pandemics that may be experienced from now on.

Health beliefs are associated with adherence to

preventive healthcare and treatment. People will not change their health behaviours unless they believe that they are at risk. Previous studies reported taht several health beliefs were also correlated with vaccine acceptability (i.e. perceived likelihood, perceived severity, perceived vaccine effectiveness, perceived potential vaccine harms) [7, 8, 10-14]. In our study, we showed once again that beliefs about the vaccine are associated with vaccination rates. Negative beliefs that especially the vaccine is not protective and the vaccine has side effects and harmful effects were found to be related to the willingness to be vaccinated in our study. Family physicians who are at the forefront of vaccine practice in Turkey, should pay attention to these negative beliefs and they must struggle to change these negative thoughts.

Implications

This study showed us that even though we were in the pandemic process, individuals' low knowledge, negative attitudes and beliefs decreased their willingness to be instilled. This study showed that even dur-

ing the pandemic period, which has no current treatment, causes thousands of deaths every day, negatively affects all of life, and we know that vaccination is the only way to escape from the pandemic, but still, individuals experience vaccination hesitation.

Limitations

We conducted cross-sectional study among medical student so obtained data may not reflect the adult population vaccination willingness. We did not use objective measurement methods for attitudes and beliefs about vaccine willingness. All data are obtained from participants' own declaration. Vaccination against COVID-19 has not yet become widespread in our country, and the lack of sufficient data about the COVID-19 vaccine may have affected the opinions of individuals about the vaccine.

CONCLUSION

Although the majority of the study population willingness to be vaccinated, one-third of medical students are hesitant about vaccination. Education, positive attitude and beliefs are related to higher willingness to vaccination. Future studies in this area should focus on the effect of vaccine education and attempts to change attitude and belief on vaccine acceptance. The COVID-19 pandemic immunization programs should be designed to remove barriers to negative vaccine beliefs and perception.

Authors' Contribution

Study Conception: MOK, BY; Study Design: MOK, BY, EO, EP; Supervision: BY, EP, MFG; Funding: NTA, AK; Materials: MOK, BY, EO, RFA; Data Collection and/or Processing: MOK, BY, EO, RFA; Statistical Analysis and/or Data Interpretation: MOK, EP, BY; Literature Review: BY, EO, MOK; Manuscript Preparation: BY, MOK, EP and Critical Review: EP, MFG, BY.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

Financing

The authors disclosed that they did not receive any

grant during the conduction or writing of this study.

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