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## Vaccine hesitancy among university students of healthcare

Ozden Gokdemir<sup>1</sup>, Selda Yorok<sup>2</sup>, Bennur Koca<sup>3</sup>, Ayla Acikgoz<sup>4</sup>

<sup>1</sup>Izmir University of Economics, Faculty of Medicine, Department of Family Medicine, Izmir, Türkiye

<sup>2</sup>Balikesir University, School of Health, Department of Midwifery, Balikesir, Türkiye

<sup>3</sup>Dokuz Eylul University, Vocational School of Health Services, Department of First and Emergency Aid, Izmir, Türkiye

<sup>4</sup>Dokuz Eylul University, Vocational School of Health Services, Medical Documentation and Secretariat, Izmir, Türkiye

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### Abstract

The World Health Organization defines vaccine hesitancy as "the refusal or delay in accepting vaccines despite the availability of immunization services." When a person rejects all vaccines, it is referred to as vaccine rejection. Vaccine hesitancy stems from a lack of trust in the vaccine and apprehension about side effects, as well as a lack of knowledge about vaccines and sociocultural factors. The research aims to determine the COVID-19 vaccine indecision and attitudes of students studying in the field of health. This study is a cross-sectional research project. Vaccine rejection is among the independent variables included in the logistic regression model developed to determine the factors influencing trust in the content of the COVID-19 vaccine. When compared to medical school students, vaccine rejections were found to be 3.05 times greater for vocational school students and 2.47 times for midwifery-nursing students. The majority of the participants had been vaccinated at the time of the study, but only 9.5% of them stated that they trusted the vaccine's active ingredient. In conclusion, even though the majority of students reported that they did not trust vaccine ingredients, the decision to become fully vaccinated during the school year had a positive effect on the overall health situation.

**Keywords:** Healthcare students, vaccine hesitancy, COVID-19

### Introduction

Vaccine hesitancy is defined by the World Health Organization (WHO) as "the refusal or delay in accepting vaccines notwithstanding the availability of immunization services." It is described as a rejection of all vaccines [1]. The world's second pandemic of the twenty-first century, caused by the SARS-CoV-2 virus, spread quickly and killed millions in a short period. The development of a vaccine against SARS-CoV-2 became a global aim as the COVID-19 epidemic rapidly developed. While vaccine trials continue, several vaccines developed have acquired FDA approval, and vaccination studies of healthcare personnel and populations against SARS CoV -2 have begun in many countries [2].

COVID-19 vaccine acceptability surveys among students are more common in countries with varying acceptance. For instance, in a Saudi Arabian study of students (n=407), half had either received the vaccine or were registered to do so, and 90% of unvaccinated and unregistered students were eager to get the shot [3]. This level of acceptance was comparable to that of students in central and southern Italy (91.9% and 94.7%, respectively) [4,5]. It is critical to understand vaccine hesitancy in both developed and developing countries [5].

All these findings highlight the significance of pre-professional training for future healthcare workers to improve immunization services in the fight against the COVID-19 pandemic. Healthcare and medical undergraduates' knowledge, attitudes, and behaviors about COVID-19 immunization services are critical for themselves, their families, and the society in which they will work. Students who access immunization services will be vaccinated and it is thus important to assess their knowledge, attitudes, and behaviors about vaccine rejection and indecision. The WHO recommends that the current situation be assessed [2]. These students are at risk for

\*Corresponding Author: Ozden Gokdemir, Izmir University of Economics, Faculty of Medicine, Department of Family Medicine, Izmir, Türkiye  
E-mail: [gokdemirozden@gmail.com](mailto:gokdemirozden@gmail.com)

COVID-19 mortality and morbidity during their internships and practical work at health institutions. To limit occupational risk, they should have COVID-19 vaccines, due to the presence of high-risk patients in the patient population they serve, and the risks of them themselves becoming a source of illness for these patients.

The research aims to determine the COVID-19 vaccine indecision and attitudes of students studying in the field of health.

## Material and Methods

The type of this study is cross-sectional. The study's participants are students from Izmir University of Economics Faculty of Medicine (n=834), Dokuz Eylul University (n=1392), and Balikesir University (n=300), all of whom are pursuing degrees in health-related fields (midwifery, nursing, vocational school of health services, medicine). There were a total of 2526 students in these classes. The sample size was calculated using the open-source calculator OpenEpi, Version 3. The prevalence was 32.8 percent when the Type-1 error level was set at 5% [6], the design effect was 3, and the sample size was calculated to be 965 for a 95 percent confidence interval (CI). The non-responder rate was estimated to be 20%, and the minimum sample size was set at 1159. There were 1238 people in the sample. Only those who voluntarily agreed to participate in the study attended the above-mentioned schools and completed all of the survey questions were included in the study.

Ethical permissions from the Izmir University of Economics Medical Faculty Clinical Research Ethics Committee (B.30.2.EÜSB.0.05.05-20-129) were obtained for the study's conduct. The research was carried out following the Helsinki Declaration. Written permission was obtained from the universities of the participants before starting to collect the data for the study. To conduct the research, permission was obtained from the Ministry of Health's COVID-19 Scientific Research Evaluation Commission. After the approval of the ethics committee, the data collection phase of the study was started. The data of the study were collected between 15 March and 20 June 2021.

## Data Collection

Students over the age of 18 who voluntarily agreed to participate and answered the whole questionnaire were included; those who did not agree to participate or did not answer all questions were excluded.

The students were informed by the researchers before the distribution of the questionnaire that they were free to refuse to participate in the study, that their names and data would be kept confidential, and that their consent would be obtained. Each school's student affairs unit sent the questionnaire, delivered via Google Survey program, to students' e-mail addresses. Considering the COVID-19 outbreak, the data was converted into an online survey via a Google Form. Online surveys have significant advantages during pandemics and were used in the first stage of this research. The survey was sent to Google Drive's online service system in an electronic format. The ethics working committee of the Association for Internet Research (AoIR) was used when conducting internet research. On the first page of the questionnaire, there was a consent form with information about the research,

including the assurance of the right to refuse to participate in the study, and of the anonymity of all of the responses and identity information provided. The students declared that they had read and understood the consent information and voluntarily agreed to participate by selecting the "I agree" option, after which they were given access to the rest of the survey. Google Form adheres to privacy principles such as protecting data and not sharing it with third parties, as well as never selling personal information. The study was conducted following the Declaration of Helsinki.

## Measurements and Definitions

The study's data was collected using a questionnaire form created after reviewing the literature in this field [1,7-14]. Before collecting data, the questionnaire form was reviewed by experts. The questionnaire was pre-tested by 20 students before the final version was created. Before data collection, the questionnaire was reviewed by three academicians who are experts in the fields of public health, family medicine, and infectious diseases. The data for the study was gathered from a socio-demographic data form, as well as a COVID-19 vaccine and attitude form. The first section consists of nine questions designed to determine the socio-demographic characteristics of health students: age, gender, divisional class, mother's education level, mother's occupation, father's educational status, father's occupation, family economic status, and occupation. The second part consisted of questions to determine COVID-19 vaccine indecision, COVID-19 information status, and COVID-19 diagnosis status. The third part was the COVID-19 vaccine attitude form, consisting of 11 questions about the pandemic's effects on students' health (including own and family's diagnosis, contact with COVID-19, and any COVID-19-related deaths in the family), COVID-19 vaccine attitude, trust in the vaccine's content, reasons for vaccine hesitancy, and vaccine knowledge status. Finally, opinions on the COVID-19 vaccine (10 questions) were elicited using a three-point Likert scale of "I agree," "I disagree," and "I am hesitant."

## Statistics

SPSS version 28.0 was used for the statistical analysis of the research. Descriptive statistical findings from the study were expressed as an arithmetic mean, standard deviation, number, or percentage. The data showed normal distribution. Pearson's Chi-square test was used to assess students' confidence in the content of the COVID-19 vaccine and COVID-19 vaccine ambivalence, as well as sociodemographic characteristics (gender, department, maternal education, and employment status, father's education and employment status, economic status), and COVID-19-related factors. COVID-19 vaccine content reliance and COVID-19 vaccine instability were predicted using logistic regression analysis.

The logistic regression model was constructed using univariate analysis of independent variables that were found to be significant. Gender, department, mother's education and employment status, father's education and employment status, economic status, COVID-19 information status, and self-diagnosis of COVID-19 vaccine. Variables modeled in COVID-19 vaccine instability were paternal education, COVID-19 information status, COVID-19 diagnosis of the participant and family, and the existence of a

COVID-19 deceased person in the family. In logistic regression analysis, the enter method was used, and OR values and 95% confidence intervals were presented. The difference was considered significant if the p-value obtained in the analyses was less than 0.05.

## Results

The students' average age was 19.93±1.93 (min:18, max:45), 69.1% were female, 33.6 % were vocational school students, and 37.3 percent were midwifery-nursing students. 45.4 % were in their first year, 26.6 percent in their second year, and 6.6% were seniors (Table 1).

Female students are more likely than males to mistrust vaccines (p<0.05). Confidence in the vaccine's content was higher in medical students and lowest in vocational students, and it was determined

that there was a significant relationship among departments (p<0.05). Students with at least a high school education and a working mother and/or father have significantly higher confidence in the vaccine's content (p<0.05). As the students' economic status improved, there was an increase in their confidence in the vaccine's content, and this relationship was found to be significant (p<0.05). Vaccine mistrust is significantly higher in students who had already had COVID-19 (p<0.05). Students who report insufficient or low knowledge of COVID-19 have significantly higher vaccine insecurity (p<0.05, Table 2).

COVID-19 vaccine hesitancy is significantly higher in students whose father has a high school education or higher, who have COVID-19 diagnosis themselves or in the family, who have a person who died from COVID-19 in his family, and who have insufficient-low knowledge of COVID-19 (p<0.01, Table 2).

**Table 1.** Distribution of students' some sociodemographic and attitude-behavioral characteristics towards COVID-19 infection (n=1238)

Variables	n	%	Variables	n	%		
Age (mean±SD)	19.93±1.93		Healthcare worker	15	1.2		
Gender	Female	855	69.1	Status of Employment	Unemployed	1212	97.9
	Male	383	30.9		Other jobs	11	0.9
Department	Vocational School of Health Services	416	33.6	COVID-19 diagnosis	Yes	168	13.6
	Nursing-Midwifery	462	37.3		No	1070	86.4
	Medical Faculty	360	29.1	The severity of disease in COVID-19 patients (n=168)	Extremely severe	18	10.7
University	Dokuz Eylul University	707	57.1		Moderate severity	68	40.5
	Balikesir University	323	26.1		Mild severity	82	48.8
	Izmir University of Economics	208	16.8	Having COVID-19 diagnosis in one's family	Yes	352	28.4
	Class	1. Grade	562		45.4	No	886
2. Grade		329	26.6	COVID-19 is the cause of death in the family.	Yes	53	4.3
3. Grade		264	21.3		No	1185	95.7
4. Grade		69	5.6	Information status about COVID-19	Very good-good	470	38
5. Grade		14	1.1		Partly sufficient	704	56.9
Mother's education	Elementary and lower levels	722	58.4		Insufficient-low	64	5.2
	High school	264	21.3	Source of information	Ministry of Health-WHO	842	68.0
	University	252	20.4		Healthcare worker	591	47.7
Mother's profession	Housewife	821	66.3	Do you trust the vaccine's active ingredient	TV radio	396	32.0
	Employed	374	30.2		seminary conference	34	2.7
	Unemployed	43	3.5		Social media	133	10.7
Father's education	Elementary and lower levels	558	45.0	Vaccine hesitancy	Yes	609	49.2
	High school	328	26.5		No	118	9.5
	University	352	28.4		Indecisive	511	41.3
Father's profession	Employed	824	66.6	The family's financial situation	No	1204	97.3
	Unemployed	135	10.9		Yes	34	2.7
	Retired	279	22.5				
The family's financial situation	High	180	14.5				
	Medium	841	67.9				
	Low	217	17.5				

**Table 2.** Vaccine content confidence and evaluation of vaccine hesitancy, and some sociodemographic and COVID-19-related factors

		Confidence on vaccine					Vaccine Hesitancy				
		Yes		No		p*	Yes		No		p
		n	%	n	%		n	%	n	%	
<b>Gender</b>	Female	402	47.0	453	53.0	0.022	836	97.8	19	2.2	0.092
	Male	207	54.0	176	46.0		368	96.1	15	3.9	
<b>Department</b>	Vocational School of Health Services	170	40.9	246	59.1	<0.001	402	96.6	14	3.4	0.553
	Nursing-Midwifery	196	42.4	266	57.6		452	97.8	10	2.2	
	Medical Faculty	243	67.5	117	32.5		350	97.2	10	2.8	
<b>Mother's education</b>	Elementary	304	42.1	418	57.9	<0.001	701	97.1	21	2.9	0.41
	High school and higher	305	59.1	211	40.9		503	97.5	13	2.5	
<b>Mother's profession</b>	Housewife	363	44.2	458	55.8	<0.001	796	97.0	25	3.0	0.438
	Employed	222	59.4	152	40.6		365	97.6	9	2.4	
	Unemployed	24	55.8	19	44.2		43	100.0	0	0	
<b>Father's education</b>	Elementary	239	42.8	319	57.2	<0.001	549	98.4	9	1.6	0.035
	High school and higher	370	54.4	310	45.6		655	96.3	25	3.7	
<b>Father's profession</b>	Employed	564	51.1	539	48.9	<0.001	1075	97.5	28	2.5	0.256
	Unemployed	45	33.3	90	66.7		129	95.6	6	4.4	
<b>The family's financial situation</b>	High	100	55.6	80	44.4	0.004	175	97.2	5	2.8	0.886
	Medium	423	50.3	418	49.7		819	97.4	22	2.6	
	Low	86	39.6	131	60.4		210	96.8	7	3.2	
<b>COVID-19 diagnosis</b>	Yes	68	40.5	100	59.5	0.015	153	91.1	15	8.9	<0.0001
	No	541	50.6	529	49.4		1051	98.2	19	1.8	
<b>Having a COVID-19 diagnosis in one's family</b>	Yes	162	46.0	190	54.0	0.160	335	95.2	17	4.8	0.006
	No	447	50.5	436	49.5		869	98.1	17	1.9	
<b>COVID-19 is the cause of death in the family</b>	Yes	26	49.1	27	50.9	0.984	48	90.6	5	9.4	0.013**
	No	583	49.2	602	50.8		1156	97.6	29	2.4	
<b>Information status about COVID-19</b>	Very good-good	313	66.6	157	33.4	<0.001	466	99.1	4	0.9	0.001**
	Partly sufficient	289	41.1	415	58.9		679	96.4	25	3.6	
	Insufficient-low	7	10.9	57	89.1		59	92.2	5	7.8	

\*Chi-square p value, \*\*Fisher's Chi-square p value

Among the independent variables included in the logistic regression model was trust in the content of the COVID-19 vaccine, which was 3.05 times greater (95% CI: 2.16-4.32) for vocational school students, and 2.47 times greater (95% CI: 1.73-3.53) for midwifery-nursing students compared to medical school students. When compared to students who had been diagnosed with COVID-19, the risk of mistrust for vaccine content was 1.50 times higher (95% CI: 1.04-2.16) among students whose fathers were not employed. When compared to students who ranked their understanding of COVID-19 as very good, mistrust in the vaccine's contents is 2.74 times greater (CI 95% 2.12-3.53), and it is 17.60 times higher (CI 95% 7.67-40.35) for students who considered it inadequate (Table 3).

According to the COVID-19 vaccine uncertainty, logistic regression found the following: a father's education above high school is

2.68 times greater (95% CI: 1.21-5.93), 4.72 times greater (95% CI: 2.01-11.04) for students diagnosed with COVID-19, and 4.40 times greater (95% CI: 1.51-12.83) for having a family member who died from COVID-19. COVID-19 vaccine indecision is 4.61 times greater (95% CI: 1.56-13.60) in students who rated their knowledge of COVID-19 as very good (95% CI: 1.56-13.60) and 12.54 times greater (95% CI: 3.10-50.63) in those who rated it inadequate (Table 3).

COVID-19 vaccine uncertainty was found in 2.7% of the students who took part in the study. Table 4 summarizes the most important causes of COVID-19 vaccine uncertainty. The following are the most frequently reported reasons: "I am concerned that the COVID-19 vaccine may cause other serious diseases," "I believe the COVID-19 vaccine may be harmful," and "COVID-19 vaccine may have serious side effects" (Table 4).

**Table 3.** Factor affecting vaccine content confidence and vaccine hesitancy based on logistic regression analysis

Variables	Confidence on vaccine			Vaccine Hesitancy		
	OR	95% CI	p	OR	95% CI	p
<b>Gender</b>	Female	1.04	0.78-1.39	0.757		
	Male	1 <sup>a</sup>				
<b>Department</b>	Vocational school of health services	3.05	2.16-4.32	<0.0001		
	Nursing-Midwifery	2.47	1.73-3.53	<0.0001		
	Medical Faculty	1 <sup>a</sup>				
<b>Mother's education</b>	Elementary	1.18	0.87-1.59	0.280		
	High school and higher	1 <sup>a</sup>				
<b>Mother's profession</b>	Housewife	1.23	0.63-2.42	0.53		
	Employed	1 <sup>a</sup>				
	Unemployed	0.93	0.46-1.85	0.83		
<b>Father's education</b>	Elementary	0.94	0.71-1.26	0.71	1 <sup>a</sup>	
	High school and higher	1 <sup>a</sup>			2.68	1.21-5.93 0.014
<b>Father's profession</b>	Employed	1 <sup>a</sup>				
	Unemployed	1.60	1.05-2.46	0.029		
<b>The family's financial situation</b>	High	1 <sup>a</sup>				
	Medium	0.84	0.52-1.34	0.46		
	Low	0.82	0.57-1.17	0.27		
<b>COVID-19 diagnosis</b>	Yes	1.50	1.04-2.16	0.027	4.72	2.01-11.04 <0.001
	No	1 <sup>a</sup>			1 <sup>a</sup>	
<b>Information status about COVID-19</b>	Very good-good	1 <sup>a</sup>			1 <sup>a</sup>	
	Partly sufficient	2.74	2.12-3.53	<0.0001	4.61	1.56-13.60 <0.001
	Insufficient-low	17.60	7.67-40.35	<0.0001	12.54	3.10-50.63 <0.001
<b>Having a COVID diagnosis in one's family</b>	Yes				1.10	0.47-2.56 0.819
	No				1 <sup>a</sup>	
<b>COVID is the cause of death in the family</b>	Yes				4.40	1.51-12.83 0.007
	No				1 <sup>a</sup>	

Boldface indicates statistical significance ( $p < 0.05$ ), <sup>a</sup> Reference category

**Table 4.** Distribution of reasons for vaccine hesitancy among students (n=34)

Reason(s) selected by participants	n	%*
I am concerned that the COVID-19 vaccine may result in other serious illnesses.	16	47.1
I think the COVID-19 vaccine may be harmful.	15	44.1
The COVID-19 vaccine has the potential to cause severe side effects.	15	44.1
I do not trust the content of the COVID-19 vaccine.	14	41.2
The COVID-19 vaccine can cause allergies.	14	41.2
The COVID-19 vaccine can cause infertility.	13	38.2
COVID-19 vaccine does not appear to be very effective in my opinion.	13	38.2
I am concerned that the COVID-19 vaccine may cause death.	12	35.3
Vaccine manufacturers make a lot of money, so it can be a malicious market.'	12	35.3

\*More than one option is marked.

## Discussion

The students of healthcare are at risk for COVID-19 mortality and morbidity because their studies involve internships and providing services at health institutions. Due to the presence of high-risk patients in the population, they serve, and the risks of being a source of illness, it is important that they have COVID-19 vaccines to limit occupational risk. Our study's goal is to determine COVID-19 vaccine decision-making and attitudes among health-related students.

When the study was conducted, the majority of the participants had been vaccinated, and yet only 9.5% of them stated that they did not trust the vaccine's active ingredient. This is an interesting finding; mistrust could be caused by doubt over the ingredients, and this could be a reason for avoiding vaccination, according to research [13,15]. This mismatch between trust and levels of vaccination could be due to higher education institutions' decision to enforce vaccination policies for all students and lecturers attending classes and/or practical work [8]. Trust in the vaccines' content was among the independent variables in the logistic regression model, and vocational school students and midwifery-nursing students had lower levels than medical school students. Al-Amer et al revealed similar results, finding nurses more hesitant [12]. This result is also similar to Li et al's findings among health education students. This could be because of curriculum differences among the various branches of healthcare, and also because students believe that, despite their hesitancy, the specific circumstances of the study or work environment made vaccination necessary [7]. Therefore, the perceptions of non-medical students could be a new research area.

In our study, the following are the most frequently reported reasons for vaccine mistrust: "I am concerned that the COVID-19 vaccine may cause other serious diseases," "I believe the COVID-19 vaccine may be harmful," and "The COVID-19 vaccine may have serious side effects." These findings are also consistent with previous studies, which reported feelings of anxiety and insecurity, as well as the added stress of being exposed to contradictory information and holding contradictory viewpoints [10,11,16]. According to Lucia et al., medical students who were averse to vaccinations gave the statement "Vaccines are crucial for someone like me to maintain good health as a future physician" a perfect score. The objective of this research is to enhance future doctors' abilities to counsel patients about vaccines and inform the public about the COVID-19 vaccine. Previous studies have shown that medical students who have received vaccinations have favorable attitudes toward vaccines. It is hoped that they will be able to share their vaccination experiences with their patients, which will promote vaccine uptake [9]. This should also be considered in the education curriculum for all health workers.

The remaining three-quarters, according to Lockyer et al., "had friends, family members, coworkers, or neighbors who had tested positive for COVID-19 and had personally encountered symptoms varies from minor illness to inpatient treatment and even death." The COVID-19 virus seemed more "real" to them after learning that someone close to them had developed severe illness from it [10]. In our study, however, vaccine mistrust was significantly higher in students who were themselves or had family members diagnosed with COVID-19, as well as in those who had a family member

who died from COVID-19. This could be due to the belief that, despite the virus's reality, vaccination cannot prevent COVID-19 diagnosis. Despite the high response rate, Boccolini et al. reported that participants in their study were recruited from those attending in-person activities on the main campus and participating in the SARS-CoV-2 screening campaign [11]. Participating in campaigns could be another way to overcome vaccine hesitancy.

The sociodemographic data were similar to recent studies on vaccine hesitancy among health students [17,18]. While the family physicians and nurses were at the frontline for the vaccination programs of the countries; family-oriented approaches could also be another solution to fight against vaccine hesitancy not only for students but also for their families to reach the community [13].

The roles of governments and health ministries are also critical for public safety. Despite inequity in vaccination policy, at the time of the study, a high level of vaccination was sustained during pandemics in TT [19-22]. This is seen in the high levels of those with vaccination status.

Another possible reason for the high level of vaccination dated status was that most participants reported that their sources of knowledge were the ministry of health, the WHO, and/or healthcare workers. Elliot et al reported that the CDC or other public health agency (34.3%) and social media (20.7%) were the most popular sources of health or COVID-19 information, followed by television and family or friends [14]. According to Yörük et al, "those who use social media as a source of knowledge" are more hesitant about vaccination. [23] These results accord with previous studies revealing the importance of health literacy and vaccination acceptance. In addition, students who reported insufficient or low knowledge of COVID-19 have a significantly deeper level of mistrust in the vaccine [12,24,25].

According to the study of Saied et al, when students are hesitant, they postpone the vaccination. [15]. This study revealed similar beliefs to ours about the barriers to vaccination, i.e., "adverse effects" [15]. The trust in vaccine content is significantly higher in students whose mothers and/or fathers have a high school degree or higher, and those whose mothers and/or fathers work. As the students' economic status improved, there was an increase in confidence in the vaccine's content, and this relationship was found to be significant. These results correlate to the social economic determinants of health [14,23,26].

The main limitation of this study is that, as it is a cross-sectional study, it is not able to shed light on the cause-effect relationship between vaccine content confidence and vaccine hesitancy factors. Data were gathered through self-report via questionnaire. The variables of the study relate to vaccine content confidence and vaccine indecision, and because these can change rapidly depending on conditions, the results can only reflect the situation at the time the data were collected.

Because this research was conducted with healthcare students approximately 6 months after the start of the COVID-19 vaccination program, it can be classified as a cross-sectional descriptive study to determine the prevalence of the investigated variables. The study's findings suggest that COVID-19 immunization services

should be continued as part of the student's education.

## Conclusion

In conclusion, the decision to fully vaccinate students during the school year had a positive effect, even though most reported that they did not fully trust the ingredients of vaccines. Higher education curricula should be revised in a way to provide not only knowledge but also the right attitude and awareness on vaccination issues. During their education, students can visit the "healthcare worker vaccination unit" of the institution where they practice/ intern and obtain information about the vaccines they should have, which may also be effective in reducing vaccine hesitancy.

## Conflict of interests

*The authors declare that there is no conflict of interest in the study.*

## Financial Disclosure

*The authors declare that they have received no financial support for the study.*

## Ethical approval

*Ethical permissions from the Izmir University of Economics Medical Faculty Clinical Research Ethics Committee (B.30.2.EÜSB.0.05.05-20-129) were obtained for the study's conduct. The research was carried out following the Helsinki Declaration.*

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