

VACCINATION AGAINST COVID-19 AMONG MEDICAL STUDENTS: FACTORS INFLUENCING THE DECISION

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Abstract: *Background.* Vaccination is one of the greatest advancements in medicine regarding prevention of severe infectious diseases. The current COVID-19 pandemic placed a tremendous burden on the shoulders of national and international health and governmental authorities, which fueled a common effort to produce a vaccine against this disease.

Material and method. The authors performed a prospective quantitative research, based on an on-line questionnaire, regarding the attitude of medical students studying in Romania toward COVID-19 vaccination and the factors that influence their decision.

Results. 511 students participated in the survey, both Romanian and foreign students, of which 78.3% agree with COVID-19 vaccination. The following factors influenced positively the decision to accept the vaccine: studying in Romanian language, having acquaintances suffering from COVID-19, taking care of COVID-19 patients, positive attitude towards vaccines in general, trusting the authorities, having a higher level of fear of infection and a lower level of fear of side effects.

Conclusions. The results of our study highlighted the factors that influence the attitude of medical students towards vaccination. Given that the future doctors will have a decisive role in consolidating a safer and more certain future of medicine, it is important that these factors are addressed and targeted by the strategic programs to make them understand the importance of immunization of the population against severe infectious diseases.

Keywords: COVID-19, vaccine, medical students, attitude, Romania.

INTRODUCTION

Over time, vaccination has proven to be the greatest advancement in the prevention of infectious diseases [1], playing a major role in reducing mortality and consequently, in the population growth [2]. Approximately 4-5 million lives are saved each year worldwide by vaccination [3], and in the next decade it is estimated that vaccination will save another 25 million people [4].

From the first form of smallpox immunization in 1796, the anti-vaccine trend began to grow [5]. In the ranking made by the World Health Organization (WHO) in 2019 on the biggest threats facing the medical system, one of the 10 places is occupied by vaccine hesitancy [6]. A study conducted in 2014 by the WHO Strategic Advisory Group of Experts (SAGE) found that in over 90% of countries, the percentage of hesitation about vaccination has begun to rise alarmingly [7]. The

factors influencing this decision are diverse, including compliance, convenience, and confidence in the efficacy and safety of the vaccine given by medical professionals [8]. However, the data available in the literature are not sufficient to draw relevant conclusions, and it is necessary to extend the studies in this field.

After the first case of infection with a new coronavirus- SARS-CoV-2 was identified in China at the end of 2019 [9], the rapid spread of the virus and the crossing of national and continental borders determined the WHO to declare a state of pandemic with the new coronavirus on March 11, 2020. The number of patients has risen at an alarming rate, as has the number of deaths. The new disease, known as COVID-19, has caused numerous deaths worldwide, mainly affecting the elderly and people with multiple comorbidities [10]. Measures taken since the beginning of the pandemic to prevent the spread of the disease have been physical distancing, quarantine, restriction of

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access to public events, and the wearing of a protective mask- the latter becoming mandatory both indoors and outdoors. However, the need for a vaccine to end the pandemic became obvious, and efforts to produce it came about a year after the pandemic was declared. According to the WHO, in February 2021, there were over 60 vaccines in the clinical phase of development and over 170 in the preclinical phase [11]. In February 2021, 3 vaccines were authorized in Romania, developed by BioNTech/Pfizer (Comirnaty), Moderna, and AstraZeneca respectively [12].

Educational activity at the medical faculties often involves performing internships in the clinics, at the patient's bedside. Under these conditions, medical students are exposed to risks of infection similar to other members of the medical team, and therefore students must be protected. Moreover, students and medical staff may in turn be sources of infection for patients. Given that protection against infectious diseases can be achieved through vaccination for high percentage of the community- to obtain the herd immunity (the percentage varying from one infectious disease to another), it is vital that students become aware of the importance of this form of immunization for both themselves and their families and for their future patients or for the patients they come in contact with during their studies [13,14].

In the long run, when students become doctors, they will be able to be actively involved in supporting the concept of vaccination against all diseases that endanger the population [15].

Thus, the aim of this study was to identify the attitude of medical students towards COVID-19 vaccination and the factors that may influence the decision to vaccinate. By understanding the students' perspective, it is possible to create specific educational strategies of correct information about this form of immunization, reducing the percentage of those who are reluctant to get vaccinated.

MATERIAL AND METHODS

Data collection

We conducted a quantitative prospective research, the data being collected with a questionnaire which included 38 questions for Romanian students and 37 questions for foreign students, both open and closed (yes/no questions, multiple choice questions, linear scale questions, 5-step Likert scale questions).

The questions included socio-demographic, medical and educational characteristics, as well as the

attitude towards vaccination and the reasons behind this attitude. The questions were formulated based on literature data (identifying similar studies [15-17]), followed by discussions between the team members. On the first page of the questionnaire, before being able to access the specific questions, potential participants found the informed consent form for participation in the study, which provided information on the purpose of the study, the anonymity and voluntary nature of participation, the data security and confidentiality issues, as well as the possibility of using the data for scientific purposes.

The target population was represented by Romanian and foreign students enrolled in the Romanian, English or French study programs at the Faculties of Medicine in Romania.

The questionnaire was built on-line, on the Google Docs platform, and the link was shared through social networks, within specific groups, being accessible for a period of 5 weeks, between February 8, 2021 and March 15, 2021.

Ethical approval

This research was part of a graduation thesis and received the approval of the Research Ethics Commission of the "Grigore T. Popa" University of Medicine and Pharmacy of Iasi, with no.33/18.01.2021.

Statistical analysis

Data analysis was performed using IBM's SPSS v 20 software, using percentages, means, and standard deviation (for descriptive analysis), t test (for analysis of significant differences between the means of continuous variables of two independent groups), and chi-square test (for association between categorical variables).

RESULTS

Socio-demographic and educational data

The questionnaire was completed by 511 students. Of these, 78.3% (N=400) were vaccinated or agreed with COVID-19 vaccines. The analysis of the educational data shows that 48.1% (N=246) of the participants are enrolled in the Romanian study program, 32.1% (N=164) are enrolled in English study program, and 19.8% (N=101) are enrolled in the French study program; most of the participants (21.5%, N=110) are students in the first year, and the fewest (12.7%, N=65) are students in the fourth year. The analysis of socio-demographic data shows the following: the mean age of the participants was $M=22.14\pm 2.90$ years; among

Romanian students, 80.5% (N=198) are women, and among foreign students, women and men are represented in relatively close percentages 55.5% (N=147), 44.5% (N=118) respectively; most participants live in urban areas, with 76.2% (N = 202) among foreign students and 70.3% among Romanian students (N=173). Complete socio-demographic and educational data are presented in Table 1.

Attitude towards vaccination

We analyzed the association between the decision to vaccinate or not and various characteristics of the study participants: socio-demographic and educational characteristics (age, gender, living environment, religious denomination/religion, marital status, year of study, language of study program); the level of confidence in the decisions of the Romanian Government regarding the pandemic; acquaintances infected with the new coronavirus; taking care of people with COVID-19; fear of infection; infection risk assessment; attitude towards vaccination in general. In addition, we analyzed the reasons why participants may or may not agree with vaccination and the concerns about COVID-19 vaccines. In the group of participants who agree with vaccination we included the students who answered *Yes* or *I got vaccinated* to the question about vaccination with one of the products available in

Romania, and in the group of those who disagree we included the participants who answered this question with *No* or *I am not decided yet*. Statistical associations were established using the Chi square test and the t test. The statistical significance threshold was set at 0.05, so any p with a value less than this was considered statistically significant.

The variables that were significantly associated (p<0.05) with the decision to vaccinate or not were the following:

- study program: in the group of students enrolled in the Romanian study program, the percentage of those who have been vaccinated or agree with vaccination (85.0%) is significantly higher (p<0.001) than in the group of students studying in a foreign language (72.1%);
- acquaintances who were infected with the new coronavirus: in the group of participants who have friends/relatives/colleagues/neighbors who were infected with the new coronavirus, the percentage of those who were vaccinated or agreed with the COVID-19 vaccine (81.5%) is significantly higher (p<0.001) compared to those who were not vaccinated (18.5%);
- taking care of people with COVID-19: in the group of students who cared for patients with COVID-19, the percentage of those who were vaccinated

Table 1. Socio-demographic and educational characteristics of the participants

Variable		Romanian students		Foreign students		
		N	(%)	N	(%)	
Agree with vaccine	Yes	209	85.0	Yes	191	72.1
	No	37	15.0	No	74	27.9
Year of study	I	50	20.3		60	22.6
	II	31	12.6		52	19.6
	III	23	9.3		51	19.2
	IV	27	11.0		38	14.3
	V	37	15.0		40	15.1
	VI	78	31.7		24	9.1
Age (M±SD)	22.14± 2.90					
Gender	Female	198	80.5		147	55.5
	Male	48	19.5		118	44.5
Living environment	Rural	73	29.7		63	23.8
	Urban	173	70.3		202	76.2
Religious denomination/ religion	Orthodoxy	213	86.5	Christianity	71	26.7
	Roman Catholics	11	4.4	Hinduism	3	1.1
	Greco-Catholic	1	0.4	Islam	151	56.9
	Neo-Protestant community	3	1.2	Judaism	4	1.5
	Other	18	7.3	Buddhism	6	2.2
				Other	31	11.6
Marital status	Married	9	3.6		3	1.2
	Single	120	48.8		196	73.9
	Divorced	-	-		-	-
	In a relationship	117	47.6		66	24.9

or agreed with the vaccine against COVID-19 (69.9%) is significantly higher ($p=0.004$) compared to those who were not vaccinated (30.1%);

- acceptance of influenza vaccine: in the group of students who agree with the influenza vaccine, the percentage of those who have been vaccinated or agree with the COVID-19 vaccine (81.1%) is significantly higher ($p<0.001$) than those who were not vaccinated against COVID-19 (18.9%);

- vaccine rejection in the past: in the group of students who did not refuse a vaccine in the past, the percentage of those who have been vaccinated or agree with the vaccination against COVID-19 (86.9%) is significantly higher ($p<0.001$) than those who refuse the vaccination against COVID-19 (13.1%);

- acceptance of a vaccine despite doubts about its efficacy: in the group of those who accepted a vaccine even though they had doubts about its effectiveness, the percentage of those who were vaccinated or agreed with the vaccine against COVID-19 (93.2%) is significantly higher ($p<0.001$) compared to the percentage of those who were not vaccinated (6.8%);

- acquaintances that had severe side effects after a vaccine- the association between variables is statistically significant ($p<0.001$): in the group of those who were vaccinated, the percentage of those who know someone who had severe side effects after a vaccine (themselves/a family member/other acquaintances) (97.3%/85.7%/67.1%) is significantly higher compared to the group of those who were not vaccinated or do not agree with the vaccination against COVID-19 (2.7%/14.3%/32.9%);

- confidence in the information provided by the Romanian Government regarding the SARS-Cov-2 infection: students who agree with the vaccination against COVID-19 have a mean level of confidence in the information provided by the Government regarding the infection with the new coronavirus (3.95 points) significantly higher ($p<0.001$) than those who were not vaccinated (2.62 points);

- confidence in the measures taken by the Romanian Government to protect the population against the new coronavirus infection: students who agree with the COVID-19 vaccination have a mean level of confidence in the measures taken by the Romanian Government to protect the population against the new coronavirus infection (3.41 points) significantly higher ($p<0.001$) than those who were not vaccinated (2.40 points);

- fear of infection: students who agree with COVID-19 vaccination have a mean level of fear of

infection (2.86 points) significantly higher ($p=0.001$) than those who have not been vaccinated (2.50 points);

- fear that the vaccine will have side effects: students who agree with the COVID-19 vaccine have a significantly lower mean level of fear of side effects (2.68 points) ($p<0.001$) than those who disagree with the vaccine (3.45 points);

- confidence that vaccination will reduce the number of infected people worldwide: students who agree with the COVID-19 vaccine have a mean level of confidence that vaccination will reduce the number of infected people worldwide (4.63 points) significantly higher ($p<0.001$) compared to those who disagree with the vaccine (3.52 points).

Regarding the reasons why participants would accept the COVID-19 vaccination, the results of the chi-square test are statistically significant for the following reasons:

- to immunize myself ($p<0.001$);
- to protect those around me ($p<0.001$);
- to get rid of the obligation to wear a protective mask ($p<0.001$).

Of the five vaccination concerns, the following positively correlated with whether or not to be vaccinated:

- fear of side effects: in the group of students who do not agree to be vaccinated or are undecided, the percentage of those who fear the side effects of the vaccine (86.5%) is significantly higher ($p <0.001$) than those who are not afraid of them (13.5%);

- lack of sufficient information: in the group of the participants who do not agree to be vaccinated or are undecided, a significantly higher percentage ($p<0.001$) fears the lack of sufficient information about the vaccine (73.9%).

DISCUSSION

The present study included a number of 511 medical students and focused on their attitude towards vaccination against COVID-19. Most of the participants agree with the vaccination against COVID-19, and the predictive factors for the vaccination agreement, resulting from the statistical analysis, were: being enrolled in the Romanian study program, friends/neighbors/colleagues/relatives infected with the new coronavirus, taking care for people with COVID-19, acceptance of other vaccines, increased fear of infection, reduced fear of side effects, confidence that vaccination will reduce the number of cases worldwide, confidence in the information provided by the Romanian Government

on the SARS-CoV-2 infection and in the measures taken by the Government to protect the population. Although they are concerned about the side effects of the vaccines and the lack of information about the vaccines, most participants agree with vaccination.

The results of this study indicate that international students are more undecided and have been vaccinated in a lower percentage compared to Romanian students. The difference between foreign and national students regarding the vaccination decision was also observed in the study conducted by Sallam *et al.* [18], a study that included students from several fields (health, science, humanities), from 24 Jordanian Universities. But unlike our study, Sallam *et al.* found that foreign students are more receptive to COVID-19 vaccination compared to national, Jordanian students [18]. The more reserved attitude of foreign students, observed in our study, could be explained by the lack of information campaigns in their native languages, but also by the acceptance of certain types of vaccines in the countries of origin of these students that may not be available in Romania.

In our study, students who know relatives/colleagues/friends infected with SARS-Cov-2, reported in a significantly higher percentage that they agree with the vaccine or have already been vaccinated. Similarly, Petravic *et al.* [19] observed that 66% of participants in their study who knew someone hospitalized or who died of SARS-CoV-2 infection were more likely to get vaccinated than those who did not know such a person [19]. On the other hand, Kelekar *et al.*, in a study performed on dental and medical students in the United States, showed that those who had SARS-CoV-2 infection or knew people infected with the virus, were reluctant to be vaccinated against COVID-19 in a higher percentage than the others. Those who have hesitated believe that people get more vaccines than they need and the only reason they would receive the COVID-19 vaccine would be to make it mandatory [20].

Another factor that influenced the students' vaccination decision was related to taking care of a person with COVID-19. It turned out that those who assisted such a person agree with vaccination in a significantly higher percentage than those who did not assist such patients. A study conducted by a group of researchers from the University of Medicine and Pharmacy in Craiova, Romania, showed that of the 69% of participants who would accept the vaccine against COVID-19, most are doctors and medical students, and the fewest are pharmacists and nurses. The reason for accepting the vaccine is related to the fear of infection

and performing professional activity in hospitals for patients with COVID-19 [17]. The same attitude was observed in the study conducted by Dror *et al.* [21] in Israel, on members of the medical staff and members of the general population, the rate of receptivity to vaccination being higher among participants who assisted COVID-19 patients. On the other hand, the study by Gagneux-Brunon *et al.* in France, shows that nurses, although they have more and longer contact with infected patients, agree with vaccination against COVID-19 to a lesser extent [22].

Literature data show that one of the most important predictors of the acceptance of the COVID-19 vaccine is the acceptance of the influenza vaccination. People who agree and accepted to get vaccinated against the influenza have a lower rate of hesitancy to COVID-19 vaccination [21]. Our study indicates that those who agree with the influenza vaccine have been vaccinated or agree with the COVID-19 vaccine in a significantly higher percentage compared to those who do not agree with the flu vaccine.

Similar results were reported in another study conducted in Romania on November 3-12, 2020 among medical staff. The authors note that the acceptance of the COVID-19 vaccine correlates directly with the influenza vaccination. Of the participants who received the flu vaccine, 47.4% agreed with the COVID-19 vaccine, 19.1% disagreed, and the remaining 33.5% were undecided [23]. This attitude was also observed in the study conducted by Grochowska *et al.*, in Poland, between September 14 and November 5, 2020, which targeted doctors, nurses, medical students, pharmacists and physiotherapists. It was observed that of the 61.6% who would receive the flu vaccine in the 2020-2021 season, 83.3% said they wanted to receive the COVID-19 vaccine when it became available [24]. Petravic *et al.* [19] noted that although only 18% of participants were regularly vaccinated against influenza, 78% of them had a positive attitude toward COVID-19 vaccination compared to those who had not been vaccinated at all. However, not all people who agree with the flu vaccine also agree with the COVID-19 vaccine [21].

Our study indicates a positive attitude towards vaccination in general, with students who agree with the COVID-19 vaccine declaring a significantly higher percentage that they have not refused any vaccine in the past. They are also willing to accept the vaccine despite doubts about its effectiveness. From these results we can understand that trust in the scientific process exceeds personal opinions, being at the same time a way to show responsibility for the protection of others. In this regard,

some authors consider that students' attitudes towards vaccination are not influenced by medical knowledge, but are probably related to other motivational and psychological factors, such as personal responsibility for the health of others and the value of civic life [16]. Contrary to our findings, a study performed among medical students in Michigan showed that while the attitude toward vaccination is generally positive, the fear of significant side effects and a lack of complete trust in experts who have developed vaccines lead to their refusal to participate in clinical trials and to vaccinate against COVID-19 [15].

The level of fear of SARS-Cov-2 infection may be positively associated with a positive attitude toward vaccination, as the fear of contracting a vaccine-preventable disease is generally a key predictor of accepting vaccination [13]. In our study, students who were vaccinated or agreed to vaccination reported a significantly higher level of fear of SARS-CoV-2 infection compared to those who disagreed with vaccination. However, there are studies where the authors noted that although participants were aware that they were in high risk of contracting the disease, hesitation about vaccination was identified in 20% of them [15]. The reasons for their hesitation were related to possible side effects and lack of confidence in the information provided by public health experts [15]. These reasons are consistent with the results of our study, the fear of side effects and insufficient information about the vaccine being the main fears that were significantly associated with reluctance to vaccinate among medical students. On the other hand, there are studies to show that those who are aware that they are part of a group at high risk of infection are more willing to be vaccinated than others [25, 26].

Accurate information on the risks and benefits of vaccination must be provided by the Government and the Ministry of Health. Our study showed that those who have a higher level of confidence in the information provided by the Government and in the safety measures adopted by it are more willing to be vaccinated. The same attitude was observed in the study conducted at the School of Medicine in Southeast Michigan where students who trusted public health experts were more willing to accept vaccination [15]. Similarly, a study conducted in Croatia from March 4 to April 11, 2021 found that trust in the authorities responsible for protecting and informing the population, including the Government, is associated with a higher probability of vaccination [27]. However, there are also discrepancies between what is transmitted and what is understood

at the population level regarding vaccines in general, a possible explanation being related to the channels through which this information is transmitted [13]. An example of this is Northern Nigeria, on polio vaccination. The people of this region refused the vaccine because they thought it was contaminated with anti-fertilizers, carcinogens or HIV, all in the context of political dissent caused by the takeover of power by the democratic regime in the south of the country [28]. Similarly, Jain *et al.* [29] found that low confidence in the Government of India and public health authorities were predictors of hesitation in participating in COVID-19 vaccine testing.

The results of our study indicate that although there are concerns about the side effects of the vaccine and the information about the vaccine is insufficient, most students accept the COVID-19 vaccine. However, there are studies in the literature that associate the fear of side effects with hesitation against COVID-19 vaccination both in particular groups- such as medical students or medical staff, and in the general population. For example, a study in Japan targeting medical students at Dokkyo Medical University- School of Medicine showed that their fear of the side effects of vaccination is associated with COVID-19 vaccine hesitation similar to the general population. However, concerns about the side effects of COVID-19 vaccine were not associated with students' attitudes toward the completion of the vaccination schedule with the third dose. The authors identify as a possible explanation that the administration of the first dose of vaccine would have reduced their concern about the side effects of COVID-19 vaccine [14]. On the other hand, a study of women between the ages of 18 and 49 in Japan shows that previous experiences have made them reluctant to take the third dose of the COVID-19 vaccine [30].

The reasons that were significantly associated with the acceptance of the vaccine were the desire to immunize, the protection of others and the disappearance of the obligation to wear a protective mask. Sugawara *et al.* [14] conducted a study on the attitude of medical students towards the third dose of COVID-19 vaccine, and their results place among the reasons for its acceptance the return to the pre-pandemic social life [14]. The protective mask remains necessary for protection until the pandemic is completely stopped, despite the administration of the vaccine. And to stop the pandemic, it is necessary to vaccinate a large enough number of people so that the spread is limited.

In conclusion, the results of our study outline the portrait of the medical student willing to be vaccinated, starting from the statistically significant

factors and reasons that positively influence the acceptance of the COVID-19 vaccine by the medical students: Romanian student, who has acquaintances with COVID-19, who took care of COVID-19 patients, who generally accept vaccines, who trusts the authorities, who has a higher level of fear of infection, and who is less afraid of the vaccine's side effects.

Medical students will have a decisive role in consolidating a safer and more certain future of medicine in terms of prevention, not only for SARS-CoV-2 infection, but also for other diseases for which vaccination is available. Therefore, their training as doctors but also as supporters of the scientific data resulting from many years of study and work of medical researchers must begin during their medical studies. Knowledge of the factors that influence the vaccination decision is of high educational value, as these factors can be targeted by the strategic programs to inform future doctors about the importance of immunizing the population against infectious diseases with significant morbidity and mortality.

Conflict of interest

The authors declare that they have no conflict of interest.

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