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The issue of vaccine refusal: the study of a risky behavior

Purpose: Influenza is the most common seasonal infectious disease that causes permanent social, economic, and medical problems worldwide. Therefore, the most effective way to prevent influenza is through vaccines. The aim of this study is to identify the influence of factors that determine the refusal of influenza vaccine among three subjects groups.

Materials and Methods: A survey was conducted amongst the three high-risk groups in 2018–2019 (Moscow, Russia). The survey involved 1,620 parents and pregnant women (group 1), 324 doctors (group 2), and 433 students (group 3). Poor vaccine uptake was observed among respondents in all three groups.

Results: According to the survey results, only 22.2% of children and 13.8% of adults were vaccinated against influenza. Group 2 showed increased rates with 36.7% of vaccinated adults and 58.7% of children. The lowest adherence to annual vaccinations was recorded in group 3 (only 17.3%). There is also a negative correlation between adherence to vaccination and smoking (-0.66), unhealthy diet (-0.73), poor oral hygiene (-0.61), and insufficient awareness of the need for influenza vaccine as well (-0.81).

Conclusion: Thus, a general lack of vaccination awareness has a fundamental role in forming a negative attitude toward influenza vaccine. It is necessary to conduct research to promote vaccination against influenza to improve vaccine uptake among high-risk groups, particularly students.

Keywords: Influenza, Vaccines, Smoking, Vaccination awareness, Prevention & control

Introduction

Influenza is the most widespread infectious disease in the world, which dominates over infections [1]. According to the World Health Organization, another feature of influenza is that it occurs as an annual epidemic [2]. The spread of influenza is difficult to maintain since this virus is characterized by a high antigenic diversity [3]. In addition, influenza is described as highly pathogenic in the viral transmission environment. Influenza is also characterized by a poor vaccination effect. People of working age, from 18 to 40 years are of the most susceptible groups [4]. Influenza is hazardous since complications arising from it tend to be of various severity. Pneumonia is the main complication that occurs in up to 65% of cases. Various forms of bronchitis occur as well, but with lower frequency (from 4% to 8%) [5,6]. According to medical research, vaccination has the greatest justification in the prevention of influenza [7-9]. The high-risk groups are the most in need of vaccination as they have higher chances of complications.



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These groups include children, seniors, and people suffering any chronic diseases. The consequences of complications may even be fatal [10]. The positive point of vaccination is that its implementation can provide protection against other forms of severe acute respiratory syndrome (SARS). Despite the long-term practice of vaccination, there is an ambiguous attitude towards influenza vaccines in society [11].

The most common reasons for vaccine refusal are either distrust of the medical system (for religious and other reasons) or lack of awareness of vaccine implementation [12]. Due to the fact that influenza and SARS occupy about 90% of all types of infectious pathologies, the influenza virus has a large genetic diversity, so the spectrum of pathologies is also quite wide. The consequences of influenza can vary from mild respiratory disease to respiratory failure or acute respiratory distress syndrome [13]. High-risk groups of the population have a higher chance of a severe course of influenza. Immunosuppression is one of the causes that determine the severity of influenza. The risk of a high-severity outcome and death is 4–5 times greater compared to the population groups not included in the high-risk list [14]. For instance, recent studies have shown that the mortality rate among pregnant women could reach 20% in such countries as China, Mexico, New Zealand, and Canada. The studies were conducted during the pandemic caused by A(H1N1) influenza virus [8,11,13,15]. For the other two countries (the United States and Australia), the mortality rate was at a lower level, from 1% to 16% [16]. Therefore, prompt vaccination can reduce the risk of severe complications.

The influenza epidemic is seasonal, so each epidemic causes serious damage to public health annually. Hence, mortality may also seasonally increase worldwide. Complications are mainly determined by influenza viruses of types A(H1N1), A(H3N2), and B [11]. Other population groups with influenza complications include pregnant women, children under 5, and people with weakened immunity. Moreover, this group also includes medical workers. They are more likely to be infected through either interacting with a patient or visiting people in high-risk groups [4]. According to the results of numerous studies, vaccination reduces the morbidity rates of influenza [5–9,13]. Besides high-risk groups, vaccination is also important for people who interact or live with individuals of high-risk groups. Some studies show that vaccination during a season or several years can cover up to 40% of the population. However, there are population groups with a high level of vaccination refusal [17]. This is facilitated not only by religious or personal beliefs but also

because of the propaganda of total vaccine refusal [18]. This statement refers to influenza and other respiratory diseases, for example, there is a significant protest movement against coronavirus disease 2019 vaccination. As a result, the number of vaccine refusals increases significantly. This includes the influenza vaccine as well [5]. The influenza vaccine is a planned annual practice. According to World Health Organization (WHO) recommendations, annual vaccination should primarily be provided among high-risk groups, which include pregnant women, children aged 6 months to 5 years, elderly people over 65 years, doctors, and people with chronic diseases [2]. The current tendency of vaccination refusal has not been sufficiently investigated, and it is necessary to specify factors that can influence the decision to refuse. Risky behavior as characteristic of some groups of the population can be the reason for vaccine refusal [3]. Existing studies usually cover only one group of the population, mostly without taking into account the features of any other group [4,6]. The mentioned problem has determined the relevance of this study.

The aim of this study is to identify and evaluate the factors determining vaccination refusal among three groups of respondents (doctors, students, and parents). The objectives of the study included: (1) to assess the awareness of the issues of influenza prophylaxis through vaccination; (2) to study the factors contributing to vaccination refusal; and (3) to suggest approaches that can increase adherence to influenza vaccination. The authors state that negative factors may be associated with poor awareness of the vaccination mechanisms and bad habits such as smoking, poor oral hygiene, and unhealthy diet.

Materials and Methods

The sample

The study was conducted from November 2018–January 2019 in Moscow (Russia). According to its aim, a survey was done among three groups of people. The first group consisted of parents of children who regularly visited a pediatrician or had in-patient care. Besides, this group included pregnant women who were in their third trimester and under the care of an antenatal clinic. The number of people interviewed amounted to 1,620. The second group included doctors of different medical specialties. The number of respondents in the second group amounted to 324. Lastly, the third group consisted of medical university students, the number of which reached 433. The students were of three different medical majors; however, in order to maintain anonymity, the names of their

majors were omitted. Therefore, the division is as follows: 119 students of the first medical major in their 4th and 6th years of study, 153 students of the second one in their 4th and 5th years and 161 students of the last major in the 1st, 5th, and 6th years of study.

Ethical statement

This study was conducted in accordance with international standards of ethics and morality (Helsinki Declaration). All participants were guaranteed anonymity and confidentiality of the information received. Names, work, or place and year of study are not disclosed. This was stipulated in the contract with each of the participants. The study was approved at a meeting of the Ethics Committee of M. V. Lomonosov Moscow State University (protocol no., 4591).

Research design

The preselected groups of respondents are in some manner related to risk groups. Both doctors and pregnant women constitute risk groups directly, whereas parents can also be attributed there since their children often get SARS and other infectious diseases in kindergartens and then infect parents or other family members. Medical students may become doctors in the future which also means entering the risk group. The study did not include people with chronic diseases, as well as those who refused to sign a contract. The agreement guaranteed the anonymity of the data obtained, and thoroughly informed respondents about the nature of the study. A comparison of three groups of respondents may indicate the difference in the effect of various negative factors occurring within these groups. The respondents were selected randomly.

Research methods

Surveys were used as a method of gathering data. Respondents were inquired to fill out questionnaires distributed in the form of office documents in the public domain. A questionnaire for parents and pregnant women included 15 questions. All questionnaires were developed by the authors of this study. The questions for the first group of respondents included: (1) questions about demography (age); (2) questions about social status (education, marital status); (3) the awareness degree of the need for annual prevention against influenza; (4) questions about the respondents' level of commitment to vaccination, in general, and particularly to vaccination against influenza. An offered questionnaire for the doctors from the second one consisted of 12 questions. In addition to

demographic and social data, and awareness of vaccinations, these included professional opinion questions about the need for immunoprophylaxis for patients. The questions were also aimed to find out how committed doctors are to influenza vaccination and whether doctors and their children are vaccinated against influenza. The 12 questions offered to the respondents of the third group set out to examine the students' awareness of the need to vaccinate against influenza. The two possible options for the response were offered: all survey participants were inquired to either choose one of the answers or leave their own. In order to maintain the representativeness of the third group's sample, only 10%–30% of the number of students of different majors was included. Only fully filled-out questionnaires with correctly displayed answers were taken into account for the analysis. There was an additional block of questions, which included questions about the regime, nutrition, smoking, and the frequency of oral hygiene.

Statistical analysis

All the answers received were entered into the Excel 2016 database (Microsoft Corp., Redmond, WA, USA). Further analyses were performed using the Statistica ver. 10.0 program (StatSoft Inc., Tulsa, OK, USA). The data given in the article are absolute and relative values. The minimum significance level is $p \leq 0.05$, i.e., with a confidence interval of 95%. In order to estimate the statistical significance between different groups, the criterion χ^2 was used. Correlations were used to evaluate the relationship between the fact of vaccination refusal and the presence of any factor (smoking, unhealthy diet, insufficient awareness of the need for vaccination, low level of oral hygiene).

Results

Group 1: It was found that a significant part of the group is represented by the age from 21 to 40 years, which is 84.3% (or 1,367 parents). The main number of respondents are female (1,145 people or 70.6%). The respondents with higher education (928 people or 57.2%) mostly participated in the survey, followed by respondents with secondary professional education (479 people or 29.5%). Almost all parents (98% or 1,590 respondents) vaccinated their children. Most of the children receive a full vaccination program, according to the vaccination schedule (1,479 people or 93%). The majority of respondents indicate that pediatricians determine the quality of information about the prevention of influenza by vaccination. It

was also found that parents who vaccinate children against influenza have a higher motivation to increase their awareness of vaccinations (72%, $p < 0.001$). Responses to the issue of influenza vaccine were received in 94.5% of cases (1,532 respondents). Of them, 22.2% of respondents (309 people) vaccinate children (and no other family members), and a slightly larger number of respondents (512 people or 33.4%) vaccinate all family members. The least number of respondents (212 people or 13.8%) vaccinate only adult family members. Finally, 499 people (or 32.5%) are not vaccinated against influenza.

Group 2: Almost half of the doctors surveyed (49% or 159 doctors) consisted of pediatricians. And 77.5% of all doctors (251 people) were between the ages of 21 and 50. More than half (53% or 171 people) worked in polyclinics. 60% of doctors (191 people) not only supported vaccinations included in the vaccination schedule but also considered vaccination against other common epidemiological diseases as compulsory. This was typical of the majority of pediatricians (70% or 108 out of 159 people), as well as doctors of such medical specialty as neonatologists (26 out of 41 or 63%). The lowest rate was recorded among therapists, only 16% (two people out of 12). Doctors' opinions about the level of knowledge about the preventive value of vaccination were divided approximately in half, which means 51% (or 165 people) stated that their knowledge was low, and another 49% (159 people) claimed that their awareness was at an adequate level. At the same time, sufficient knowledge was significantly more common among pediatricians (89 people out of 159 doctors, or 56%, $\chi^2 = 5.98$, $p < 0.05$), as well as neurologists (19 people out of 27 specialists, or 70%, $\chi^2 = 4.52$, $p < 0.05$). It is interesting to note that there were also tendencies to admit an insufficient level of knowledge among doctors of certain professions. The statistics is as follows: 67% of gynecologists (28 people out of 42, $\chi^2 = 4.81$, $p \leq 0.05$), 100% of resuscitators (18 doctors, $\chi^2 = 18.46$, $p \leq 0.001$). A third of doctors do vaccinations set out in the vaccination schedule, including the influenza vaccine (119 people or 37%). Taking into account doctors of all medical specialties, it was revealed that more than a third of pediatricians showed their adherence to regular vaccinations (59 out of 159 or 37%), approximately the same number of gynecologists (16 out of 42 doctors or 38%), and a slightly larger number of anesthesiologists (19 out of 41 or 46%). There were not any statistically significant differences found in relation to medical specialties. The majority of doctors (80% or 262 people) had children in their families. Of them, 64% (or 167 people) vaccinated their children according to the vaccination schedule. The respons-

es for the influenza vaccine were received from these 167 people. It was found that 58% of the doctors (98 people) give flu shots to their children. This number consists of 44% of pediatricians, 36% of gynecologists, and 65% of anesthesiologists. The majority of doctors (212 people or 62%) tried to convince parents that vaccination was necessary, including influenza. Moreover, they informed parents about possible consequences: vaccination, influenza itself, and its complications.

Group 3: Most of the students indicated that vaccination against influenza is necessary (300 people or 69%), 30 people or 7% of students did not give a definite answer, and another 101 students (or 23%) believed that vaccination against influenza is not necessary. The results are displayed in Fig. 1 and Table 1.

It was determined that students from faculties 1 and 3 have statistically significant differences in responses, these students were more likely to consider influenza vaccinations compulsory (128 people or 79% from faculty 1 and 78 people or 65% from faculty 3). Accordingly, for the faculty 1 $\chi^2 = 12.44$ (at $p \leq 0.001$), whereas for the faculty 3 $\chi^2 = 5.82$, at $p \leq 0.05$. 14% of students receive a flu shot annually. At the same time, the number of vaccinated students from faculty 1 is to a larger extent (33%, $\chi^2 = 8.68$, $p \leq 0.01$). A negative response was received from 294 students, 32% (96 people) of those were afraid of possible complications, vaccination refusal due to uselessness was recorded among 29% or 86 people, 23% (68 people) did not trust any vaccine available and the reason for refusal for another 15% was insufficient knowledge about the need for vaccination (44 students). For the majority (298 people or 69%) of group 3 respondents, there was no negative attitude to influenza vaccinations. The refusal was a result of the influence of several factors: (1) bad personal experience (52 people or 12%), (2) negative opinion of relatives and friends (another 9% or 42 people), (3) conclusions based on the information received from doctors (23 people or 5%), and (4) media influence (18 people or 4%). The absolute majority of respondents from group 3 indicated that influenza vaccination is effective (340 people or 78%), and 21% or 93 people stated that vaccination in general is not effective against influenza. The majority of respondents (276 people or 63%) claimed that they were well-versed in the issue of influenza prevention through vaccination, 75 people or 17% believed that they were insufficiently informed (Table 1). Most of the students did not find a clear answer to the question about the need for vaccination of pregnant women (189 people or 43%), 93 people (21%) answered "yes", another 151 people (34%) answered "no". There was also

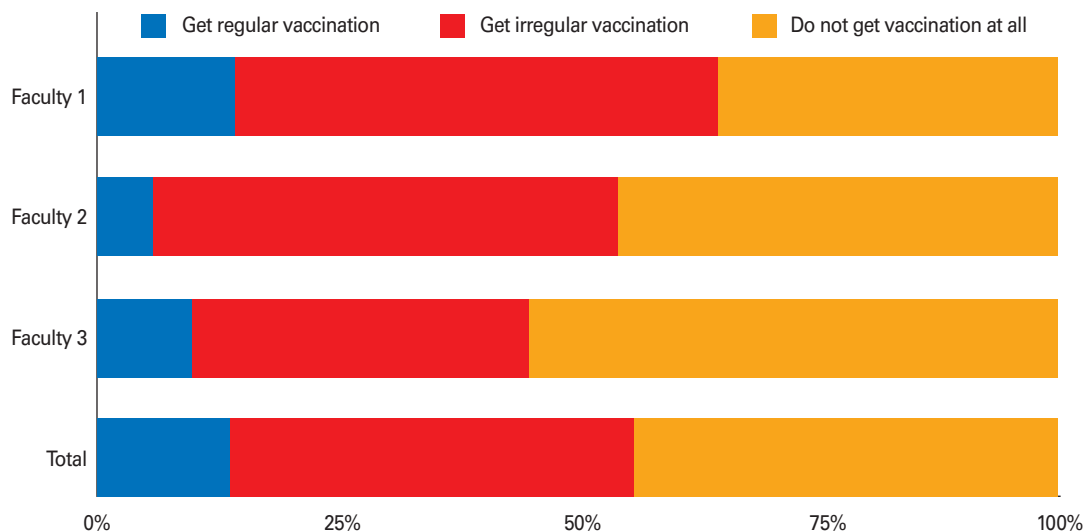


Fig. 1. The results of the survey conducted among the respondents of group 3 (students).

Table 1. Results of the survey conducted among 433 respondents of group 3 (total=433)

The questions and answers options	Total		Faculty 1		Faculty 2		Faculty 3	
	No.	OR (95% CI)	No.	OR (95% CI)	No.	OR (95% CI)	No.	OR (95% CI)
What is the reason for your refusal of annual vaccination?								
It is useless	86	29 (24–34)	21	27 (22–32)	35	29 (23–37)	30	30 (21–40)
Lack of confidence in vaccination	68	23 (18–27)	14	18 (10–26)	28	23 (16–30)	26	26 (18–35)
Possible complications	96	32 (27–38)	34	44 (38–50)	39	50 (42–59)	23	23 (15–31)
Poor awareness of vaccine	44	15 (9–20)	8	10 (4–17)	17	14 (8–20)	19	19 (15–23)
How aware are you about influenza prevention through vaccines?								
Fully aware	276	64 (59–68)	105	65 (61–70)	90	59 (51–66)	81	68 (64–72)
Not aware	75	17 (14–21)	26	16 (11–21)	30	19 (13–25)	19	16 (12–18)
It's hard to answer	82	19 (15–22)	30	18 (13–24)	33	21 (15–28)	19	16 (12–18)

CI, confidence interval.

a correlation between the regularity of annual vaccinations found on the one hand and the presence of some bad habits on the other. This is due to smoking (-0.66), unhealthy diet (-0.73), insufficient oral hygiene (-0.61), as well as poor awareness of the need for influenza vaccine (-0.81). The obtained results suggest that participation in annual vaccination against influenza is mainly determined by the awareness of respondents and slightly less by the presence of bad habits.

Discussion

Some studies show that parents are highly adherent to vaccination and follow the age recommendations of the vaccination schedule [19-21]. The share of such parents ranges from

98% to 93% in developed countries such as China, the European Union, and the United States [22]. The data obtained for group 1 (parents and pregnant women) has a significantly lower percentage: only 33% of respondents vaccinate all family members, another 22% stated that they vaccinate only children, and about a third of respondents believe that there is no need for vaccination against influenza. This suggests that adherence to vaccination in some countries may be very low. It is possible to improve these rates only by increasing public confidence in the issue. It is well known that doctors are one of the risk groups in the influenza epidemic [23]. In this regard, the majority of respondents from group 2 (60% of all doctors who participated in vaccination) believe that it is compulsory to do both scheduled vaccination and vaccinations not included in

the list. About 51% of doctors admitted that their knowledge was insufficient. The results in group 2 show that 58% of children of the respondents are vaccinated against influenza; however, there are only 36% of respondents reported that they are vaccinated themselves. This proves the fact shown in other studies that doctors are poorly motivated for personal vaccination [24,25]. According to data published, it is known that their refusal is mainly due to distrust of vaccines, doctors do not believe in their full safety [26]. In addition, they note that the social effect of vaccination against influenza is quite low and that occasionally their knowledge about influenza is insufficient [22]. The studies conducted by a number of scientists show that about 10% of doctors do not regard the vaccination of healthcare workers as obligatory, which could have an impact on the epidemic rates [27]. Furthermore, it may influence public vaccination rates. According to the recommendations formulated by WHO, at least 75% of the population should be vaccinated against influenza [2]. The risk groups also include students of medical universities since they come into contact with patients during their internship, especially when it takes place in a polyclinic environment. This is a reason to include students from medical universities to the risk groups [28]. Thus, it turns out to be a controversial situation as all medical students must be vaccinated without exception, but this may cause a negative attitude towards the influenza vaccine in the future. That was confirmed by the following data collected: there is a low adherence to influenza vaccination amongst medical students. A major part of the students participating in the survey were undergraduates (5th–6th year of study), and 69% of them consider vaccination obligatory, although only 17% follow this rule. The statistics of vaccination adherence vary on different faculties, making up from 16% to 33%. These students are future doctors who are responsible for increasing adherence to vaccination among parents. Moreover, according to the results of some studies, parents believe that pediatricians have a decisive influence on their choice [29,30]. The prevailing reasons for the refusal of vaccines, particularly influenza vaccine, are as follows: (1) concerns about possible complications, (2) lack of confidence in vaccines, and (3) insufficient knowledge of vaccination methods. These opinions are the results of the poor knowledge about vaccines and non-vaccination tendency in social networks and media influences as well. Besides, only a fifth of the students (21%) responded positively about mandatory influenza vaccination for pregnant women. Health care workers are responsible for the complications occurred because of their incompetence in

the matter of vaccination. It is known that some possible complications during embryonic development can lead to its death. However, according to the results of some studies, up to 73% of doctors showed low awareness of possible complications of influenza during pregnancy [22]. In addition, about a third of doctors (33%) believed that influenza vaccine was dangerous, and 13% of doctors were not aware of influenza vaccine for pregnant women [27]. In accordance with WHO recommendations, complications from influenza during pregnancy can be prevented if vaccination is given in a timely manner [2]. Therefore, the study shows that the vaccine promotion should be done for medical students, as their opinion may possibly influence patients' adherence to vaccination against influenza. At the same time, the encouragement of a healthy lifestyle (smoking cessation, proper diet, regular oral hygiene procedures) can also have a positive impact on increasing the public motivation to vaccinate against influenza.

In conclusion, the majority of the respondents of group 1 (parents, 1,590 people) regularly vaccinated their children, 93% of them (1,479 respondents) stated that their children are fully vaccinated according to the vaccination schedule. All parents admitted that their opinion about the need for vaccinations is determined by the influence of the local pediatricians. Parents of vaccinated children have a higher motivation level to increase their knowledge of vaccination mechanisms (72%, $p < 0.001$). It was also found that the level of vaccine awareness among doctors (group 2) depends on their particular medical specialty. For example, 56% of pediatricians ($\chi^2 = 5.98$, $p \leq 0.05$) and 70% of neurologists ($\chi^2 = 4.52$, $p \leq 0.05$) had a high level of knowledge. The insufficient level of vaccination knowledge was recorded for the majority of the gynecologists ($\chi^2 = 4.81$, $p \leq 0.05$) and for all resuscitators ($\chi^2 = 18.46$, $p \leq 0.001$). As for the students, a clear correlation was noticed between the reasons for vaccination refusal and the faculty they studied in. Thus, students from faculties 1 and 3 (79%, $\chi^2 = 12.44$ (at $p \leq 0.001$) and 65%, $\chi^2 = 5.82$, at $p \leq 0.05$, respectively) admitted the need for influenza vaccination. At the same time, only 14% of students received regular flu shots, while 32% of students considered flu shots dangerous and therefore refused them. Additionally, 29% believed that vaccinations do not provide any benefits. Furthermore, 23% of the respondents lacked confidence in vaccines. Lastly, 15% claimed that insufficient knowledge about vaccinations was the reason for their refusal. Negative correlations were found between adherence to vaccinations and factors such as smoking (-0.66), an improperly balanced diet (-0.73), poor compliance with

oral hygiene (-0.61), and a low level of vaccination awareness as well (-0.81).

In order to increase adherence to regular influenza vaccination, it is mandatory to promote a positive attitude towards the issue among students during their studies since they will directly influence patients' level of vaccination awareness in future. In addition, promoting a healthy lifestyle can help increase adherence to influenza vaccination. In the future, it is necessary to conduct research on identifying ways to increase adherence to vaccination amongst health care workers. The main limitation of this study is that the number of survey participants did not comprise all existing risk groups, further studies should cover a wider list, including people with chronic diseases and the elderly.

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