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Knowledge, Attitudes, and Influenza Vaccination of Medical Students in Warsaw, Strasbourg, and Teheran

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Abstract
Objective: Influenza vaccinations are recommended for health professionals by the WHO and the CDC. Medical students are important health professionals not only as future physicians, but also due to their frequent contact with patients during their education. The aim of this study was to compare the knowledge, attitudes, motivations and influenza vaccinations of medicine students in three different countries: Poland, France, and Iran.
Material and methods: 1045 self-reported questionnaires were given to medical students of Warsaw Medical University (n = 502), the Faculty of Medicine of Strasbourg University (n = 371) and Teheran University of Medical Sciences (n = 172). In France, students working in a hospital can be vaccinated free of charge. In Poland and Iran students are required to pay for the vaccine and have to arrange the administration of the vaccine on their own.
Results: Vaccination of students during the year of the study time was generally infrequent: the highest was in Strasbourg 29.7%; it was lower in Warsaw 15.2%, and lowest in Teheran at 4.7%. Similarly, 60% of medical students in Strasbourg, 65% of students in Warsaw and 86% of students in Teheran have never been vaccinated. The percentage of students knowing that they belong to the group of people that have strong indications for being vaccinated was 78% in Strasbourg, 48% in Warsaw and 40% in Teheran. The main reasons for obtaining a shot, cited by students, were to protect from influenza and the fear of disease sequelae. The most important reasons for not being vaccinated were laziness, lack of time, and also lack of knowledge of the indications in favor of being vaccinated. Being vaccinated at least once in the past is the most important predictor of the vaccination in the current season.
Conclusions: Few medical students in all of the examined countries are immunized against influenza. Data indicate that providing access to free vaccinations, although very important, cannot alone solve the problem. Strengthening educational efforts seems crucial, although no immediate effects should be expected due to remarkable inertia. Influencing attitudes at an earlier stage can be more advantageous.

Key words: influenza, vaccination, medical students, health prevention

Introduction

Influenza morbidity and mortality is an important challenge for every healthcare system. The number of influenza cases is quite varied and the WHO estimates 3 to 5 million cases of influenza every year in industrialised countries [1]. During seasonal influenza epidemics from 1980 through 2001, the estimated overall number of influenza-associated hospitalizations in the United States ranged from 55000 to 431000 per annual epidemic [2]. The annual number of deaths attributed to influenza in the years 1990-1998 in the US ranged from 17000 to 51000 [3]. Recently, Thompson et al [4] presented that influenza-associated respiratory and circulatory mortality ratio amounted in the US 9.9 deaths per 100000 (95% CI 7.9-11.9). However, periodic pandemic seasons were observed and caused millions of deaths in the world. In the 20th century, three influenza pandemics occurred (in 1918–1919, 1957–1958, and 1968–1969) [5]. In Europe, depending on the severity of an influenza season, an average estimate of deaths was 25 per 100000 between 1989 and 1998 [6].

There are two ways to prevent infection which are widely used: helping the natural immune system by strictly obeying hygienic rules (inexpensive, may be applied to the entire society and in addition protects from other diseases) and augmenting the adaptive immune system response by vaccination. Due to many reasons, such as limited funds, willingness of people, the entire population cannot be vaccinated. The best option is immunizing the members of high risk groups [7]. Having them well-defined makes it easier to start the optimal prevention campaign. The effectiveness of this approach may be improved by the vaccination of people who are in frequent contact with the most vulnerable people; which is called the 'cocoon strategy' [8].

Centers for Disease Control and Prevention - Advisory Committee on Immunization Practices (CDC-ACIP) [7] and the WHO [9] recommend influenza vaccinations of health professionals and also medical students. The students are not yet full-time health professionals, but those participating in clinical training are in frequent contact with patients. Regulations regarding student influenza vaccination vary between countries. In France, students who are in contact with patients during their clinical training can be immunized free of charge in the Department of Occupational Medicine of their hospital. In Poland and Iran, students have to purchase the vaccine and have it administered on their own. However, influenza vaccination coverage depends not only on the level of institutional help, but mostly on the students' willingness to be vaccinated. This attitude is not only influenced by the students' level of knowledge, possible benefits and adverse effects, but also by cultural and socio-economic factors. Taking all these factors into consideration, one can see a full picture of the situation, which helps undertake effective actions toward the vaccination process. The aim of this study was to compare the knowledge, attitudes, motivation and actual influenza vaccination of medical students in three different countries: Poland, France and Iran.

Material and Methods

1045 self-administered, anonymous questionnaires were distributed and collected upon completion from medical students of the Medical University in Warsaw, Poland (n = 502), in the Faculty of Medicine of the University in Strasbourg, France (n = 371), and at the Teheran University of Medical Sciences (n = 172). In Warsaw, all data were obtained during the 2008/2009 influenza season. Questionnaires in Strasbourg and in Teheran were collected during two influenza seasons: 2008/2009 and 2009/2010. In Strasbourg, students from the educational years 2 to 5 were asked to fill in the questionnaires, in Warsaw they were from the years 2 to 6 and in Teheran 2 to 7. The mean length of study years amounted to 3.4 ±0.9, 3.6 ±0.9, and 4.3 ±1.5, respectively. The mean students' age was 22.1 ±1.6 in Warsaw, 21.6 ±1.8 in Strasbourg, and 22.3 ±2.0 in Teheran. Sex distribution was very similar in Warsaw and Strasbourg, with two thirds of the students being female (67% and 66%); whereas in Teheran this proportion was slightly lower, with 52% of the students being female.

Statistical Methods

Bivariant associations were quantified with exact confidence intervals for odds ratios (OR) and exact confidence intervals for binomial proportions were used to characterize populations [10]. Logistic regression was used to assess dependence of vaccination probability on several variables; final sets of predictors were selected from larger sets by stepwise procedures. Confidence coefficient was set consistently at 95%. All statistical computations were performed using the SAS System ver. 9.2 [11, 12].

Results

Influenza Immunization Rate

Vaccination during the year of this study was generally low (Fig. 1), with statistically significant differences between the countries: 15.2% in Warsaw (95% CI 12.1-18.7%), 29.7% in Strasbourg (95% CI 25.1-34.7%) and 4.7% in Teheran (95% CI 2.1-9.1%). A significant proportion of never vaccinated students were observed: 63.1% in Warsaw (95% CI 58.8-67.4%), 59.6% in Strasbourg (95% CI 54.4-64.6%) and 85.5% in Teheran (95% CI 79.3-90.4%).

Being vaccinated during the last season or the past two seasons was a positive predictive factor for continuing to act in the same manner during the year of analysis, with odds ratios of at least (lower limit of 95% CI for OR), respectively, 18.7 and 9.5 for Warsaw, 10.9 and 5.1 for Strasbourg, 4.1 and 6.0 for Teheran. On the other hand, a significant proportion of students who had been vaccinated at some point in their lives resisted undergoing vaccination in the last two seasons. This was especially observed in Warsaw and Teheran where 47.6% (95% CI 40.2-5.0%) and 48% (95% CI 27.8-68.7%) of formerly vaccinated students did not get immunize for two years in a row, whereas in Strasbourg this proportion was significantly lower: 18.7% (95% CI 12.7-25.8%).

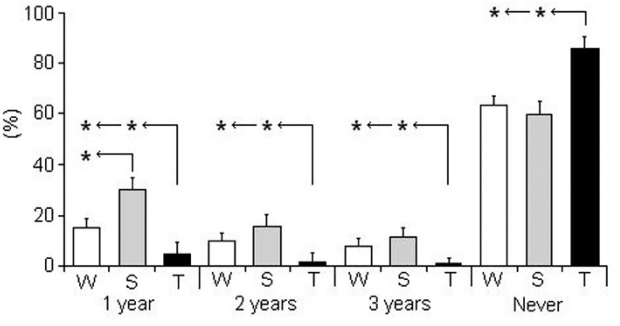

Fig. 1. Percentage of students vaccinated in the year of the examination, in last two, or three years, and never immunized against influenza. W - Warsaw, S - Strasbourg, T - Teheran. Error bars: 95% confidence intervals. *P<0.05 for differences among student groups representing each city in each year category.

Health And Vaccination Coverage

Students were asked if they were suffering from any chronic diseases. The highest proportion of positive responses was in Warsaw - 11.4% (95% CI 8.7-14.5%), with lower percentages in Strasbourg - 5% (95% CI 3.0-7.8%) and Teheran - 7.2% (95% CI 3.7-12.2%). Students who specified the disease mostly mentioned asthma and various allergies. All of these students, therefore, have an additional indication for being vaccinated, but none of them were immunized in Teheran in the year of questionnaire. Immunizations in Warsaw and Strasbourg were 36.9% (95% CI 24.5-50.7%) and 38.9% (95% CI 17.3-64.3%), respectively, with students from Warsaw being more willing to be immunized than their healthy colleagues: OR 4.1 (95% CI 2.1-7.8%).

Answers for the question about having influenza-like syndromes in the year prior to filling in the questionnaire revealed that in Strasbourg, a significantly lower number of students had such an episode (20.1%, 95% CI 16.0-24.6%) in comparison with Warsaw (41.2%, 95% CI 36.8-45.6%) and Teheran (37.1%, 95% CI 29.8-45.0%). Additionally, in Strasbourg students who were ill the year before were less likely to get vaccinated in the year of analysis: OR 0.4 (95% CI 0.2-0.8%).

Knowledge

Students were asked whether they know that they belonged to a group for whom influenza vaccination was recommended. The percentage of positive answers was significantly higher in Strasbourg – 77.9% (95% CI 73.2-82.1%) than in Warsaw – 47.7% (95% CI 43.2-52.2%) and in Teheran – 39.8% (95% CI 32.3-47.6%). In Warsaw this knowledge was associated with a higher immunization level: OR 2.9 (95% CI 1.7-5.2).

Another question aimed to ascertain which group of patients they would recommend for being vaccinated (Fig. 2). Students from Strasbourg had a significantly higher percentage of correct answers: 55.5% (95% CI 50.3-60.7%) in comparison with Warsaw – 31.8% (95% CI 27.8-36.1%) and Teheran – 38.3% (95% CI 31.1-46.1%). The frequency of students not willing to recommend vaccination was not excessive (upper limit of 95% CI) 15.3% in Teheran, 13.8% in Warsaw, and 7.9% in Strasbourg (significantly lowest). Students from Teheran were significantly least eager to vaccinate all of the mentioned groups of patients – 6.4% (95% CI 3.2-11.1%) compared with 34.7% (95% CI 30,5-39%) in Warsaw, and 29.1% (95% CI 24.5-34.0%) in Strasbourg. The students from this group in Warsaw and Strasbourg were more likely to get vaccinated OR 1.7 (95% CI 1.03-2.8) and 2.4 (95% CI 1.4-4.0) respectively.

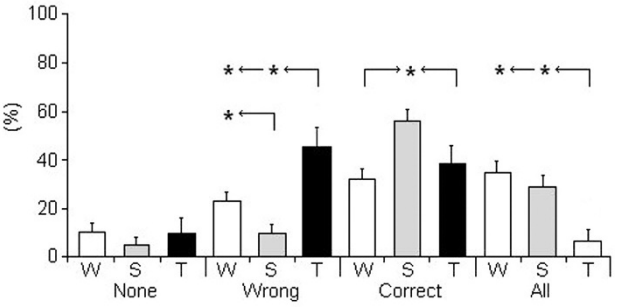

Fig. 2. Students' knowledge of vaccination determined by asking if they would recommend influenza vaccination to their patients who are: a) suffering from chronic diseases, b) older than 65 years, or c) obese. Derived categories: "all" - a, b, and c, "correct" – a and b, "none"- no answer, "wrong" any other combination. W - Warsaw, S - Strasbourg, T - Teheran. Error bars: 95% confidence intervals. *P<0.05 for the differences among student groups representing each city in a given category of answers.

Other Factors

Being in an advanced stage of their medical education studies and, therefore, belonging to a group of students with a longer contact with patients was important only in Strasbourg with OR 4.5 (95% CI 2.6-7.8) for students at a higher level than the 4th year. Students who were offered the vaccine for free were more likely to undergo vaccination with OR of at least (lower limit of 95% CI) 1.5 in Warsaw, Teheran, and 1.3 in Strasbourg, where the proposal of free vaccinations was also associated with OR of at least 1.3. About 75% of the students in Teheran (95% CI 67.3-81.2%) and 65% in Warsaw (95% CI 60.5-69.2%) were eager

Table 1. Reasons for and against influenza vaccination % (95% CI).

Reasons for being immunized	**Warsaw** (n = 75)		**Strasbourg** (n = 109)		**Teheran** (n = 8)	
Wanted to avoid disease	73%	(61-82)	75%	(66-83)	75%	(35-97)
Afraid of consequences	40%	(29-52)	13%	(7-21)	13%	(0-53)
Example of friends	1%	(0-7)	1%	(0-5)	0%	–
Expert guidelines	20%	(12-31)	7%	(3-14)	25%	(3-65)
Encouragement by university	5%	(1-13)	14%	(8-22)	0%	–
Advertising campaign	1%	(0-7)	5%	(2-10)	0%	–
Others	9%	(3-18)	19%	(12-28)	0%	–
Reasons for not being immunized	**Warsaw** (n = 427)		**Strasbourg** (n = 262)		**Teheran** (n = 164)	
Health problems	7%	(4-9)	2%	(0-4)	3%	(1-7)
Costs	11%	(8-14)	2%	(0-4)	3%	(1-7)
Lack of possibility	4%	(2-6)	6%	(4-10)	2%	(0-6)
Does not know he should	23%	(19-27)	16%	(12-22)	30%	(23-38)
Lack of time	28%	(24-32)	24%	(19-29)	12%	(7-18)
Laziness	26%	(22-30)	37%	(31-43)	32%	(25-40)
Others	25%	(21-30)	28%	(23-34)	21%	(15-28)

to be immunized if it was free of charge. Other analyzed factors such as sex, smoking, size of the city of origin, and preferences for surgical or non-surgical specialization all were found to be statistically insignificant.

Reasons for and Against

The main reasons cited by students causing them to undergo vaccination were protection from influenza and fear of the consequences of disease (Table 1). Also expert guidelines and encouragement from the university played some role. The most important reasons for not being vaccinated were laziness, lack of time but also lack of knowledge of the indications.

Joint Assessment of Factors Affecting Probability of Vaccination

Models for vaccination in the current and past seasons were established for each university separately (Table 2). Potential predictors included in the analysis were: sex, number of years of studying, preference for surgical or non-surgical specialization, history of previous vaccinations, suffering from chronic diseases, having influenza-like syndromes in a previous season, knowledge of the indications, and the proposition of payable or free of charge vaccination. Being vaccinated in previous seasons and the number of years of study were predictors present in all places (but in Teheran the latter was negatively associated with vaccination). Additionally in Warsaw, suffering from a chronic disease was a predicting factor. Previous vaccination was so important a predictor that the percentage of variation explained by models containing only on factor was comparable with the result for more complex models. Models for being immunized at least once (in current or past seasons) included the proposition of payable vaccination in Strasbourg and Teheran, and suffering from chronic disease together with the knowledge of indications in Warsaw. There were also negative predictors: male sex in Strasbourg and age in Warsaw.

Discussion

Observed medical students' vaccination coverage was lower compared with physicians in the analyzed countries: 15.2% students *vs.* 22.3% physicians in Poland [13] or 29.7% students *vs.* 54.4% physicians in France [14]. However, in the United States, as many as 69% of physicians and 63% of medical students are vaccinated [15]. There is a need for the description of this problem and possibly naming the underlying causes that can lead to finding an effective solution. Vaccination coverage levels in the general population ranged in

Table 2. Multiple logistic regression models to identify predictors of being vaccinated in current season and in any of several seasons.

Significant predictors	Max-rescaled R^2	β	OR	95% CI for OR	P-value
Model for being vaccinated in current season:					
Warsaw	0.40 (0.33*)				
Vaccination in previous years		3.06	21.4	8.6-53.1	<0.0001
Suffering from chronic disease		1.52	4.6	1.8-11.3	0.0010
Year of studies		0.51	1.7	1.1-2.5	0.0208
Strasbourg	0.36 (0.30*)				
Vaccination in previous years		2.54	12.7	5.8-28.1	<0.0001
Year of studies		0.69	2.0	1.3-3.2	0.0031
Teheran	0.54 (0.33*)				
Vaccination in previous years		4.01	55.1	4.3-708.3	0.0021
Year of studies		-1.06	0.3	0.1-0.9	0.0221
Model for being vaccinated in current or previous seasons:					
Warsaw	0.11				
Suffering from chronic disease		0.73	2.1	1.1-4.0	0.0292
Knowledge of indication		0.92	2.5	1.5-4.1	0.0003
Age		-0.35	0.7	0.6-0.9	0.0003
Strasbourg	0.07				
Male		– 0.83	0.4	0.2-0.9	0.0167
Proposition of payable vaccination		0.85	2.3	1.2-4.7	0.0167
Teheran	0.08				
Proposition of payable vaccination		1.22	3.4	1.0-11.3	0.0484

*Value for a model containing vaccination in previous years as a sole predictor.

Europe from 9.5% in Poland to 28.7% in the United Kingdom [16].

The main reasons for vaccination were protection from influenza and its consequences. This may be a good basis for an information campaign such as 'Protect Yourself and Your Patients'. A bit less impressive, but still important, were expert guidelines in Poland and in Iran and encouragement by the University in France. The latter was mentioned by 14% of the students in Strasbourg (significantly more than in Warsaw and Teheran), where the highest vaccination coverage was observed. Reasons for not being immunized were laziness, lack of time, and lack of knowledge of the indications.

This results obtained in the present study are consistent with the published data for physicians in Poland [13] and in France [14] and similar to the result for medical residents in the USA [17]. However, only 2% of the students in Teheran reported lack of the possibility of being vaccinated, which differs from data published by Askarian et al [18]. Those authors have reported that the main reason for Iranian students for not being vaccinated is the unavailability of the vaccine (35%). The cost of the vaccine was not frequently mentioned (highest level of 11% in Warsaw). On the other hand, 65% of the students in Warsaw and even 75% in Teheran would like to be immunized if it was free of charge.

Reaching those desirable levels of vaccination coverage would require some additional efforts, not only refunding the cost of the vaccine. For example, in Strasbourg where vaccination is free of charge and percentage of immunized students is fairly low, this suggests a caution with the introduction of a free vaccination program. Such a program should be accompanied by an information campaign and other actions raising students' consciousness regarding influenza vaccination indications. Students are a good target for educational campaigns as they are still in their training period and are open to changing their habits.

Students' knowledge of the indications for vaccination was highest in Strasbourg, but the number of students undergoing vaccination there was much lower than those knowing that they should. Other causes of not being vaccinated claimed by some students were that the vaccination is not effective or that they do not need to be vaccinated. Medical students can transmit influenza virus to persons at higher risk for complications from influenza. Unfortunately, only a small group of examined students know that should be vaccinated for protecting their patients against influenza [19].

Being at a higher year of studies was an important predictor in Strasbourg for students higher than the 4th year. Similarly, in the US the vaccination rates were higher for clinical students than for preclinical ones (69 *vs.* 34%) [20]. Male sex was a negative predictor in Strasbourg. In the US, there is a higher percentage of vaccinated women than men (61 *vs.* 34%) [21].

The most important predictor for immunization was a history of previous vaccination. A logistic regression model containing only this factor as a sole predictor explains about 30% of variation in vaccination decisions, with other factors adding only a bit. Previously, it has been observed that students vaccinated for the current season were more likely to be vaccinated in the next season [18]. However, in the present study we dealt not with intentions, but with real personal histories of vaccinations and their relationship with current decisions. An interesting conclusion might be made that if a person is somehow encouraged to a first vaccination, it is highly probable that it would be a start of a new habit of yearly immunizations. The situation is much more complex with a high percentage (around 48%) of formerly vaccinated students in Warsaw and Teheran who were not immunized in the last two seasons. In any case, it may be that some people show propensity to be vaccinated and others do not. If this propensity can be substantially influenced at all by educational/promotional initiatives, this should occur not in the period of their studies, but considerably earlier via the influence on their familial environments.

This effect would be more visible in the case of influenza where yearly immunization is required than in case of something such as the Hepatitis B vaccination. This hypothesis might be evaluated by using psychological tests together with questions about vaccination. The percentage of students demonstrating an eagerness to get vaccinated seems to be no higher than 40-50%. If no additional actions of encouragement are taken, reaching the level of 60% vaccinated healthcare workers, established as a goal by the Healthy People 2010 initiative [21], might be very difficult.

Vaccination of medical students is very low in all of the countries analyzed in this study, especially in Teheran, where very few medical students are frequently immunized against influenza. Data from Strasbourg indicate that providing access to free vaccinations, although very important, cannot alone solve the problem. Strengthening educational efforts seems crucial, but because of an individual's history of vaccination, this may have no immediate effects. Influencing attitudes at an earlier stage of life can be more advantageous.

Conflicts of interest: No conflicts of interest were declared by the authors in relation to this article.

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