Original Article

Exploring Influenza Vaccine Knowledge, Hesitancy, and Influential Factors among Medical Students at Diyala University, Iraq

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Abstract

Background: Influenza continues to be a significant factor contributing to disease and mortality. Despite the availability of influenza vaccines, the persistently high levels of vaccine hesitancy remain a cause for concern. **Objectives:** This study aims to evaluate influenza vaccine hesitancy and assess knowledge about influenza vaccination among medical students. **Materials and Methods:** A cross-sectional survey was conducted between September 1, 2023 and September 15, 2023, involving both preclinical and clinical medical students at Diyala University's College of Medicine in Iraq. Data collection utilized an online, self-administered questionnaire, and data analysis was performed using SPSS version 16. Statistical significance was determined at a threshold of $P < 0.05$. **Results:** The study included a total of 158 participants, consisting of 83 premedical students (52.5%) and 75 clinical students (47.5%). The mean age of the participants was 21.5 years (±7.3). The majority of respondents were female (61.4%), nonsmokers (89.2%), had received the COVID-19 vaccine (91.8%), and had not received the influenza vaccine (86.7%). Alarmingly, more than half of the participants (53.2%) expressed hesitancy toward receiving the influenza vaccine. In addition, the study revealed that clinical students had a better understanding of influenza vaccine-related information. The multiple logistic regression analysis identified several predictor variables associated with vaccine hesitancy, including female gender (odds ratio [OR]: 4.501, $P < 0.001$, confidence interval [CI]: 2.541–5.386), preclinical student status (OR: 3.565, $P < 0.001$, CI: 2.226–4.040), nonsmoking status (OR: 2.721, $P = 0.010$, CI: 1.605–3.601), and lack of prior influenza vaccination (OR: 2.107, $P = 0.003$, CI: 1.903–3.466). These variables collectively explained 49.7% of the variance in vaccine hesitancy. **Conclusions:** Vaccine hesitancy was notably higher among preclinical medical students. Identifying the reasons for vaccine acceptance and refusal can inform strategies to enhance vaccination uptake among healthcare providers and the general population.

Keywords: Clinical students, hesitancy, influenza vaccine, Iraq, knowledge, premedical students

INTRODUCTION

Influenza, commonly known as the flu, stands as a persistent and formidable public health threat caused by influenza viruses. With its capacity to incite widespread outbreaks, induce severe morbidity, and trigger significant mortality rates, influenza consistently commands attention as an ongoing concern in the realm of public health. Influenza viruses subject to annual mutations and evolutionary transformations leading to seasonal epidemics with millions of incidences in various regions of the world. The influenza is a global health challenge that affects all age and demographic groups annually. The estimated annual influenza cases exceed 1 billion, which contributes to nearly a 700,000 of respiratory related deaths.[1] Elderly people, children, pregnant women, and

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chronically ill people are often a target of these seasonal outbreaks. Severe complications, including pneumonia and severe respiratory syndrome induced by influenza put a huge burden on individuals and healthcare systems due to the high costs of health resource consumption during peak seasons.[2-5]

The vaccination is one of the most prominent tools for combating seasonal influenza. Influenza vaccine is specially designed to transport immunity against the most prevalent influenza virus for a specific season. Influenza vaccine appears as an effective technique in curbing the transmission of viruses, relieving severe disease, and protecting life.[6-8] However, the effectiveness of the vaccine can fluctuate from one season to another due to viral differences.[9]

The benefits of influenza vaccination include protecting individuals and societies by achieving high coverage rates for vaccination and reaching herd immunity, which effectively reduces the ability of the virus to transmit infection. This collective immunity is very important, especially for those who cannot receive the vaccine due to the contraindications of the medical or immune system at risk and the weak population group, including infants and the elderly.[10]

Despite the well-known benefits of influenza vaccination, vaccination coverage rates are still weak in many countries, so understanding the determinant reasons is necessary to find strategies for effective vaccination.[11] Several determinants can affect differently on the uptake of influenza vaccine including the perceptions of general population toward the vaccine safety and efficacy, accessibility of vaccination services, recommendation of healthcare providers, public knowledge and awareness, and cultural standards.[12-17]

In Iraq, routine childhood immunization programs typically focus on vaccines against diseases such as polio, measles, mumps, rubella, diphtheria, pertussis, tetanus, and hepatitis B, among others. Influenza vaccination was not consistently included as part of a nationwide immunization program in Iraq. The inclusion of vaccines in national immunization programs can vary from country to country, and it often depends on several factors, including the prevalence of the disease, available resources, and public health priorities.[18]

Despite the benefits of influenza vaccination, its uptake in Iraq, as in some other Middle Eastern countries, has faced challenges related to awareness, access, and healthcare infrastructure. There is limited specific literature on influenza vaccination in Iraq. In 2012, Saod and Alkhudhair[19] conducted a study with the objective of assessing the knowledge of healthcare personnel regarding the utilization of vaccines in preventive initiatives. More recently, Al Mosawi *et al.*[20] carried out an investigation to explore the potential association between influenza vaccination and the occurrence of COVID-19 infections as well as the severity of illness. However, their findings suggested the absence of a positive correlation in this context. In most of neighboring countries, influenza vaccination has been recommended primarily for high-risk groups, including healthcare workers (HCWS), individuals over the age of 65, pregnant women, and individuals with certain underlying health conditions.[21-24] The recommendations of healthcare providers significantly influenced the rate of vaccines uptake in Jordan.[23] Knowledge and awareness also about the vaccination of influenza emerged as an effective factor in high vaccination rates among healthcare workers in the Kingdom of Saudi Arabia.[24] Indeed, the cooperation between different sectors and taking into account the overall challenges that Iraq faced are the essential factors to design influenza vaccination improvements programs. This study aimed to explore the knowledge about influenza vaccine and the vaccine hesitancy-related variables among medical students enrolled at Diyala University in Iraq.

MATERIALS AND METHODS

Study population
In the first half of September 2023, a prospective cross-sectional study was designed to survey medical students registered at the College of Medicine, Diyala University, Iraq.

Inclusion and exclusion criteria
The study aims to evaluate and compare knowledge and vaccine hesitancy between medical students in preclinical and clinical levels. To achieve this, the researchers designated that the students in the second class as the preclinical group and those in the fifth class as the clinical group, both of whom showed willingness to participate during the phase of data collection. Students who declined to participate or provided incomplete data were excluded from the study.

Sample size
The sample size determination resulted in a total of 158 participants. Basically, the calculation employed margin of error at ± 7%, a confidence level of 90%, and a response distribution of 50%. A non-response correction factor of 10% was also incorporated into the calculation. Therefore, the final sample size consisted of 158 individuals. Throughout the data collection process, rigorous supervision was maintained at every stage to ensure data quality.

Questionnaire
The data were collected using universal sampling technique and a self-administered questionnaire. The questionnaire items have been converted into a URL link using Google Document Form. Then the questionnaire was distributed

through the WhatsApp-related student groups. The questionnaire encompasses three distinct sections. In the initial section, sociodemographic variables such as age, gender, marital status, medical class, comorbidities, tobacco smoking, COVID-19 vaccination, influenza vaccination, and immunization schedule were collected. To facilitate statistical analysis, certain independent variables were grouped into two categories as required.

In the second section of the questionnaire, we employed a well-established semi-structured scale comprising nine items, which had been previously utilized in a study by Ayhan *et al.*[25] This scale was employed to assess the knowledge levels of medical students concerning the influenza vaccine. Respondents provided responses in the form of "true" or "false." Each accurate response was assigned a score of 1, while an incorrect response received a score of zero.

In the third section of the questionnaire, we incorporated a 10-item instrument related to COVID-19 vaccine hesitancy, originally developed by Hrin *et al.*[26] To adapt it for assessing influenza vaccine hesitancy, necessary adjustments were made. Each item in the scale was rated on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Notably, four items (7, 8, 9, and 10) were reverse-keyed for negatively phrased statements. It's important to note that higher scores on this scale indicate lower levels of hesitancy. To establish a benchmark for non-hesitancy, a score of ≥ 34 on the 10-item scale (with a maximum score of 50) was determined as the ideal threshold.

Statistical analysis

Normality tests were conducted, and it was determined that all quantitative data exhibited a normal distribution. The data collected were subjected to analysis using the Statistical Package for the Social Science (SPSS) software version 26.0 (SPSS Inc., Chicago, IL, USA). To examine dichotomized characteristics of the respondents and their vaccine hesitancy, cross-tabulation (Chi-square test) was employed. Furthermore, multiple logistic regression analyses were carried out to identify and elucidate significant factors contributing to vaccine hesitancy within the scope of this study.

Ethical Approval

This study has been approved by the ethical committee of the College of Medicine, University of Diyala, Diyala, Iraq [reference number 245 on June 15, 2023].

RESULTS

Sociodemographic and clinical characteristics

Table 1 provides an overview of the sociodemographic and clinical characteristics of the study participants. A total of 158 medical students were included in the final analysis.

Table 1: Sociodemographic and clinical features of respondents (n = 158)

No.	Items	Categories	No. (%)
1	Age; mean ± (SD)	21.5 ± (7.3)	
2	Gender	Male	61 (38.6)
		Female	97 (61.4)
3	Class	Second class	83 (52.5)
		Fifth class	75 (47.5)
4	Marital status	Married	37 (23.4)
		Single	126 (76.6)
5	Comorbidities	Yes	17 (10.8)
		No	141 (89.2)
6	Smoking	Yes	44 (27.8)
		No	114 (72.2)
7	COVID-19	Vaccinated	145 (91.8)
		Unvaccinated	13 (8.2)
8	Influenza	Vaccinated	21 (13.3)
		Unvaccinated	137 (86.7)
9	Immunization Schedule	Completed	123 (77.8)
		Uncompleted	35 (22.2)

The average age of the students was 21.5 ± (7.3) years, with a standard deviation of 1.61 years. The majority of the participants were female (97 students, constituting 61.4% of the sample), unmarried (76.6%), and enrolled in the second year of their medical program (52.5%). Approximately 11% of the students reported having comorbidities, and 27.8% indicated a history of some form of smoking. In terms of vaccination, a substantial proportion (91.8%) had received the COVID-19 vaccine, while only 13.3% had received the influenza vaccine. Furthermore, 77.8% of the students had completed their childhood immunization schedule.

Knowledge level among the preclinical and clinical students

The assessment of knowledge levels regarding the influenza vaccine involved posing a series of true/false questions, with a subsequent comparison between the groups [Table 2]. It was observed that the correct responses to specific statements, such as "Once you get vaccinated, it protects for a lifetime," "Vaccine reduces labor loss," and "People with chronic illnesses should have a flu vaccine," were statistically higher among the fifth year group compared to second year group, with percentages of 86.7% versus 65.1% (*P* = 0.002), 78.7% versus 51.8% (*P* < 0.001), and 85.3% versus 62.7% (*P* = 0.020), respectively. However, no significant differences were noted between the two groups for the remaining statements.

Responses on influenza vaccine hesitation scale

The findings of the study revealed noteworthy insights into the attitudes and perspectives of the respondents

Table 2. Accurate responses to specific statements regarding the influenza vaccine when comparing the second and fifth medical classes (*n* = 158)

No.	Items	Actual right answer	Second year (*n* = 83)	Fifth year (*n* = 75)	Total (*n* = 158)	*P*-value	
1.	Vaccine provides partial protection	True	65 (78.3)	68 (90.7)	133 (84.2)	0.071	133-25
2.	People who are vaccinated have less flu	True	78 (94.0)	71 (94.7)	149 (94.3)	0.218	148-10
3.	Vaccine reduces hospitalization	True	61 (73.5)	67 (89.3)	128 (81.0)	0.153	128-30
4.	Once you get vaccinated, it protects lifetime	False	54 (65.1)	65 (86.7)	119 (75.3)	0.002	119-39
5.	Vaccine causes flu	False	60 (72.3)	63 (84.0)	123 (77.8)	0.066	123-35
6.	Influenza vaccination should be done in the fall annually	True	69 (83.1)	66 (88.0)	135 (85.4)	0.112	135-23
7.	Vaccine reduces labor loss	True	43 (51.8)	59 (78.7)	102 (64.6)	0.000	102-56
8.	Vaccine has a lot of side effect	False	64 (77.1)	62 (82.7)	126 (79.7)	0.311	126-32
9.	People with chronic illness should have a flu vaccine	True	52 (62.7)	64 (85.3)	116 (73.4)	0.010	116-42

Table 3: Responses on influenza vaccine hesitation scale (in %)

No.	Items	Strongly disagree	Disagree	NA	Agree	Strongly agree
1.	Vaccines are important for my health	23.4	22.8	18.4	12.0	10.1
2.	Vaccines are effective	28.5	10.1	27.4	12.9	21.1
3.	Being vaccinated is important for the health of others in my community	15.3	27.6	14.0	25.8	17.3
4.	The information I receive about vaccines from the vaccine program is reliable and trustworthy	17.0	18.3	27.7	16.4	20.6
5.	Getting vaccines is a good way to protect myself from disease	14.5	24.1	23.2	21.3	17.8
6.	Generally, I do what my doctor or health care provider recommends about vaccines	15.4	12.5	16.6	28.5	26.9 55.4
7.*	I question the safety and effectiveness of the influenza vaccine.	17.6	20.4	16.3	19.3	26.4
8.*	I am reluctant to get the influenza vaccine, because it offers only 1 year of immunity.	10.7	13.2	14.5	31.5	30.2
9.*	I prefer to wait to get the influenza vaccine, because there might be unknown risks associated with it.	11.2	12.2	13.3	32.3	31.0
10.*	I would not get the influenza vaccine if I knew I would experience even mild side effects.	12.2	8.0	15.2	28.1	36.5

*Negatively phrased item; responses were reverse-keyed

concerning influenza vaccination. A substantial portion of the participants, comprising 53.2%, expressed hesitancy toward receiving the influenza vaccine. Only 22.1% believed that vaccines held importance for their personal health, and a modest 34.0% held the view that the influenza vaccine was effective. Approximately 43.1% acknowledged the significance of vaccination for the health of others within their community. When assessing the reliability and trustworthiness of information received about vaccines from vaccination programs, about 37.0% of the respondents considered it reliable. In addition, 39.1% believed that vaccines were an effective means of self-protection against diseases. Interestingly,

55.4% of the participants reported adhering to the recommendations of their healthcare providers regarding vaccines. However, a substantial 45.7% expressed concerns regarding the safety and effectiveness of the influenza vaccine. Furthermore, a significant proportion of medical students exhibited reluctance toward influenza vaccination for various reasons. For instance, 61.7% were disinclined to receive the vaccine due to its limited 1-year immunity duration. In addition, 63.3% preferred to postpone vaccination, citing concerns about potential unknown risks associated with it. Moreover, 64.6% stated they would forgo the influenza vaccine if they anticipated even mild side effects [Table 3].

Table 4 The relationship between sociodemographic and clinical factors with hesitancy to influenza vaccine ($n = 158$)

Variables	Hesitant 84 (53.2)	Non-Hesitant 74 (46.8)	*B*	SE	*P*-value**	Exp(B) [POR]*	95.0% C.I for EXP(B) Lower-upper
	N (%)	N (%)					
Gender							
Female	63 (64.9)	34 (35.1)	2.233	0.423	0.000	4.501	2.541-5.386
Male	21 (34.4)	40 (65.6)	Reference				
Education level							
Second year	51 (61.4)	32 (38.6)	2.102	0.412	0.000	3.565	2.226-4.040
Fifth year	33 (44.0)	42 (56.0)	Reference				
Smoking							
No	67 (58.8)	47 (41.2)	1.105	0.389	0.010	2.721	1.605-3.601
Yes	17 (38.6)	27 (61.4)	Reference				
Influenza vaccinated							
Unvaccinated	75 (54.7)	62 (45.3)	1.552	0.310	0.003	2.107	1.903-3.466
Vaccinated	9 (42.9)	12 (57.1)	Reference				

*POR: Prevalence odd ratio,

** *P*-value significant at < 0.05.

Factors associated with influenza vaccine hesitation in multiple logistic regressions

Table 4 presents the final model derived from the multivariable logistic regressions, shedding light on the factors associated with a heightened level of influenza vaccine hesitancy. The results indicate that several demographic and health-related variables are significantly correlated with an increased likelihood of influenza vaccine hesitancy. Female medical students exhibited a substantial association with vaccine hesitancy, with an odds ratio (OR) of 4.501 and a 95% confidence interval (CI) ranging from 2.541 to 5.386. Similarly, students in their second year of medical studies displayed a heightened propensity for vaccine hesitancy, with an OR of 3.565 and a 95% CI spanning from 2.226 to 4.040. In addition, nonsmoking individuals exhibited a notable association with vaccine hesitancy, featuring an OR of 2.721 and a 95% CI ranging from 1.605 to 3.601. Unvaccinated status against the influenza virus also emerged as a significant factor contributing to vaccine hesitancy, with an OR of 2.107 and a 95% CI extending from 1.903 to 3.466. The statistical assessment of the model's goodness-of-fit through the Hosmer and Lemeshow test yielded a favorable result, signifying a good fit ($P = 0.301$). Furthermore, the overall model achieved statistical significance ($P = 0.001$) and accounted for a substantial proportion of the variance, elucidated by a Nagelkerke *R*-square value of 0.497, which corresponds to 49.7% of the variance being explained by the model.

DISCUSSION

In this research, an investigation was conducted to assess influenza vaccine hesitancy and the factors influencing it among medical students enrolled at the University of Diyala in Iraq. The study employed a 10-item instrument adapted from a tool related to COVID-19 vaccine hesitancy. The findings of this survey revealed a notable vaccine hesitancy rate of 53.2% among the participating medical students. This observed hesitancy rate stands in contrast to the results of prior studies in different regions. For instance, a study conducted among university students in China reported a lower hesitancy rate of 44.7%.[27] In Egypt, research by Hussein *et al*.[28] documented a hesitancy rate of 46.8% among healthcare providers. Furthermore, data from Saudi Arabia indicated that HCWS hesitancy was notably lower at 17.0%.[29]

The results of this study are compatible with the findings of many previous studies,[27-29] the desire to protect themselves (49.2%) and their families (43.1%) was the primary driving force behind the acceptance of the influenza vaccine among medical students. Moreover, the majority of students (55.4%) showed their willingness to respond to healthcare professionals' recommendations about the flu vaccines. These motives are closely consistent with the results observed in the study conducted in the Kingdom of Saudi Arabia.[30]

Furthermore, a survey of three Middle Eastern countries[31] found that HCWS in the United Arab Emirates (56.6%), Kuwait (54.5%), and Oman (64.7%) are primarily driven by the desire to protect themselves when making vaccine uptake decisions. Likewise, separate research conducted in Oman indicated that the main reasons for accepting the vaccine among HCWs were personal protection and well-being of society.[32]

The most prevalent barriers identified included concerns about potential side effects (64.6%), apprehensions regarding unknown risks (63.3%), and the perception that the vaccine provides immunity for only a single year (61.7%).

Potential side effects (64.6%), unknown risks (63.3%), and the belief that the flu vaccine provides only 1 year immunity (61.7%) were the most prevalent vaccine uptake barriers.

Likewise, study conducted in Egypt[28] stated that the most common barriers included concerns about the side effects of the vaccine (42.9%) and suspicions related to the effectiveness of the vaccine (24.5%). Meanwhile, a study conducted in the Kingdom of Saudi Arabia[29] set barriers such as doubts regarding the effectiveness of the vaccine (21.0%), a personal health feeling (17.0%), and concerns about the side effects of the vaccine (13.0%).

These differences in vaccine hesitancy rates across various regions emphasize the importance of considering regional and cultural factors when addressing these issues. Healthcare system, health policies and cultural norms can significantly motivate public attitude toward vaccination.

In this study, a noteworthy variation appeared when assessing the levels of knowledge related to the influenza vaccine between preclinical students (the second year) and clinical students (the fifth year). It was clear that the correct responses to specific questions, such as vaccination provides lifelong protection, "vaccination reduces productivity loss," "individuals with chronic diseases," and "should get the influenza vaccine," expressed statistically significant superiority among fifth year students compared to their counterparts in the second year.

This result is compatible with the findings of a study conducted by Chen *et al.*,[33] who detailed the outcomes of the education program about influenza vaccine implemented at the Stony Brook University in the United States of America.

The program resulted in significant enhancements in the knowledge base of first-year students concerning the flu virus and vaccine. Subsequent self-assessments of knowledge and clinical skills also demonstrated improvement in the postsurvey phase. Specific aspects that witnessed notable enhancement posteducation included the ability to explain the potential benefits and risks of flu vaccines to patients, as well as addressing common misconceptions about these vaccines.

In addition, Bechini *et al.*[34] conducted a seminar that notably improved students' understanding of vaccine indications, with a strong positive impact observed in the number of students who would recommend influenza vaccination during pregnancy, witnessing a significant increase of 19.0% postseminar.

Further reinforcing the impact of educational interventions, Marotta *et al.*[35] reported on the responses of students from medicine and biology schools at Palermo University. Their study involved pre- and posttest assessments of knowledge and attitudes toward vaccinations. The results of the posttest revealed significant improvements across nearly all administered questions, with an overall percentage of correct answers surging from 38.8% to 77.6% ($P < 0.001$).

The outcomes of multiple logistic regressions in this study unveiled several predictive factors for vaccine hesitancy, including gender, academic year (second year), nonsmoking status, and lack of prior vaccination among medical students.

In alignment with our findings, Fayed *et al.*[36] discovered that older participants and males exhibited greater willingness to be vaccinated compared to younger adults and females. Nonetheless, adjusted regression analysis pinpointed high perceived risk, vaccine hesitancy, and former smoking as the sole factors significantly associated with the inclination to receive seasonal influenza vaccination.

Similarly, Abalkhail *et al.*[37] identified second-year medical students as having the lowest vaccination rates, potentially attributed to limited exposure to clinical settings. These results strongly imply suboptimal compliance not only among preclinical students but also within the clinical cohort.

Comparatively, the vaccination uptake among healthcare-related students in this study, at 13.3%, appears notably lower when juxtaposed with analogous research.[38-42] This divergence can be ascribed to the limited knowledge concerning flu vaccines, including aspects such as vaccination frequency, efficacy, and protective attributes. In addition, the fact that influenza vaccination is neither mandatory nor free in Iraq likely contributes to the lower uptake.

Al Nufaiei *et al.*[43] reported a vaccination rate of only 37.8% among healthcare students in Saudi Arabia, with unvaccinated students citing reasons such as uncertainty about vaccine availability, concerns about vaccine-induced illness, and a perception that vaccination is unnecessary for individuals practicing good hygiene.

Prior investigations have linked low flu vaccination rates among students to their strong perception of good health and infrequency of illness, leading them to believe that flu vaccination is unnecessary.[21,24] They often view young age and overall good health as contraindications to vaccination, a trend identified in a study by Kałucka *et al.*[44] involving nursing, midwifery, and pharmacy students. Collectively, the current study and previous surveys underscore the existence of significant knowledge gaps regarding vaccination among healthcare students, emphasizing the pressing need for comprehensive educational interventions in this demographic.[45]

There are several limitations that must be mentioned when discussing the results of this study. First, the generalization of the results to wide population is limited by relatively

small sample size, which includes medical students from one university in Iraq.

In addition, the collection of samples depends on voluntary enrollment through an online self-administered tool. Moreover, the cross-sectional design of the study may not prove causation between the studied variables.

Despite these known limitations, this study provides valuable visions on the influenza vaccine hesitancy among students of the college of medicine. Its results are a potential incentive for future research endeavors that aim to obtain a more comprehensive understanding of vaccine hesitancy trends among medical students throughout the country. Moreover, this study emphasizes the importance of improving knowledge about flu vaccines among students of the college of medicine, a field in which more exploration and intervention may lead to great general health benefits.

CONCLUSION

In conclusion, a large percentage of the participants showed hesitancy in receiving the influenza vaccine. The results of the multiple logistic regression analysis have indicated many of the predictive factors, including gender (females), being in the second year of medical studies, the state of smoking (nonsmoking), and lack of previous flu vaccination. Moreover, this study found a significant gap in knowledge and negative attitudes toward influenza vaccination between preclinical medical students (second year) compared to their clinical counterparts (the fifth year).

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Conflicts of interest
There are no conflicts of interest.

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