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.

Objective: This study aims to evaluate influenza vaccine hesitancy and assess knowledge about influenza vaccination among medical students.

Methods: A cross-sectional survey was conducted between November 1st and 15th, 2023, involving both pre-clinical 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 pre-medical 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%), non-smokers (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 towards receiving the influenza vaccine. Additionally, 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 (OR: 4.501, $p < 0.001$, CI: 2.541 to 5.386), pre-clinical student status (OR: 3.565, $p < 0.001$, CI: 2.226 to 4.040), non-smoking status (OR: 2.721, $p = 0.010$, CI: 1.605 to 3.601), and lack of prior influenza vaccination (OR: 2.107, $p = 0.003$, CI: 1.903 to 3.466). These variables collectively explained 49.7% of the variance in vaccine hesitancy.

Conclusions: Vaccine hesitancy was notably higher among pre-clinical 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: Influenza Vaccine, Hesitancy, Knowledge, Pre-Medical Students, Clinical Students, Iraq.

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. Annually, influenza viruses undergo mutations and evolutionary shifts, culminating in seasonal epidemics that cast a wide net, ensnaring millions of individuals worldwide. These seasonal outbreaks, ranging from mild to severe in symptomatology, carry a substantial risk, particularly for vulnerable populations such as the elderly, young children, and individuals with underlying health conditions. Beyond the individual health toll, influenza places a formidable burden on healthcare systems, straining resources and triggering surges in hospitalizations during peak flu seasons [1,2].

One of the most potent public health interventions to combat the pervasive threat of influenza is the seasonal influenza vaccine. Engineered to impart immunity against the most prevalent influenza virus strains for a given season, the influenza vaccine emerges as a pivotal tool in curbing virus transmission, mitigating severe illness, and ultimately safeguarding lives. This introduction sets out to underscore the paramount significance of influenza vaccination, unravel the multifaceted factors impacting its uptake, and illuminate the pivotal role healthcare professionals, including pharmacists, play in advocating for vaccine coverage [3,4,5].

Influenza casts a vast, overarching shadow as a global health challenge that spares no age group or demographic. Each year, seasonal epidemics leave a sobering trail in their wake, inflicting an estimated one billion cases of influenza and contributing to a staggering 290,000 to 650,000 respiratory-related deaths worldwide [6]. These figures underscore the immense burden that influenza imposes on societies and healthcare systems alike. The virus's potential to induce severe complications, including pneumonia and acute respiratory distress syndrome, looms particularly large over high-risk segments of the population, such as the elderly, young children, pregnant women, and individuals with chronic medical conditions [7].

In addition to the annual recurrence of seasonal epidemics, influenza harbors the latent potential to trigger pandemics when novel virus strains emerge. The 1918 Spanish flu pandemic, etched in history as one of the most infamous influenza outbreaks, stands as a stark reminder of the virus's pandemic potential, claiming an estimated 50 million lives worldwide [8]. The ever-present specter of influenza pandemics serves as a poignant reminder of the imperative need for robust surveillance systems, vigilant preparedness measures, and proactive vaccination campaigns to preemptively blunt the impact of future outbreaks.

At the forefront of influenza prevention and control strategies stands the seasonal influenza vaccination, a stalwart shield against the virus's relentless assault. The vaccine operates by harnessing the immune system's capabilities, spurring the production of antibodies tailored to combat influenza viruses. While the vaccine's effectiveness can fluctuate from season to season due to viral variations, it consistently ranks as the most efficacious method for curtailing the risk of influenza infection and its accompanying complications [9].

The benefits of influenza vaccination transcend individual protection, permeating entire communities. Achieving high vaccination coverage rates within populations engenders the phenomenon of herd immunity, effectively diminishing the virus's capacity for transmission. This collective immunity, indispensable for those unable to receive the vaccine due to medical contraindications or compromised immune systems, serves as a bulwark guarding vulnerable

demographics, including infants and the elderly, against influenza-related hospitalizations and fatalities [10].

Despite the well-documented advantages of influenza vaccination, vaccination coverage rates remain imperfect in many nations, subject to a complex interplay of determinants. Understanding these multifaceted factors is essential for designing effective vaccination strategies and tailored public health campaigns [11].

Perceptions of Vaccine Safety and Efficacy: Public perceptions surrounding vaccine safety and efficacy exert a pivotal influence on vaccination uptake. Apprehensions regarding vaccine side effects, reservations regarding vaccine efficacy, and misunderstandings concerning influenza's severity can collectively discourage individuals from pursuing vaccination [12]. Addressing these concerns hinges on clear and precise communication strategies that convey accurate information.

Access to Vaccination Services: The accessibility of vaccination services, including the convenience of vaccination sites, the affordability of vaccines, and the ready availability of vaccines, significantly shapes vaccine uptake rates [13,14]. Broadening the accessibility of vaccines by involving diverse healthcare providers, including pharmacists, stands as a potent avenue for enhancing coverage rates [15].

Healthcare Provider Recommendations: The influence of healthcare professionals, comprising physicians, nurses, and pharmacists, emerges as a decisive factor in driving vaccination adoption. Compelling evidence demonstrates that robust recommendations from healthcare providers constitute a primary motivator compelling individuals to embrace influenza vaccination [13].

Knowledge and Awareness: A deficit in knowledge or awareness regarding the pivotal importance of influenza vaccination can precipitate low uptake rates [16]. Fostering public health campaigns and educational initiatives proves indispensable in elevating awareness levels and imparting an understanding of the vaccine's substantial benefits.

Social and Cultural Factors: Cultural beliefs, entrenched social norms, and peer influences hold the potential to sway vaccine decisions. Confronting cultural and social barriers to vaccination proves imperative in steering towards higher coverage rates [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] and

colleagues 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, individuals over the age of 65, pregnant women, and individuals with certain underlying health conditions [21,22,23,24].

A study conducted in neighboring Jordan highlighted the importance of healthcare provider recommendations in influencing vaccine uptake [23]. In Saudi Arabia, a study found that knowledge and awareness about influenza vaccination were significantly associated with higher vaccination rates among healthcare workers [24]. This underscores the importance of educational campaigns to improve vaccine uptake. In Iraq, where healthcare infrastructure has faced challenges, especially in conflict-affected areas, efforts to improve influenza vaccination coverage should consider the unique circumstances of the country. Collaboration between healthcare providers, public health authorities, and international organizations is essential to enhance vaccination programs and reduce the burden of influenza in Iraq. This study aimed to assess the understanding of influenza vaccine, the factors contributing to hesitancy, and the influential elements among medical students enrolled at Diyala University in Iraq

Methods

Study population

In the first two weeks of September 2023, a prospective cross-sectional study was conducted, focusing on medical students enrolled at the College of Medicine, University of Diyala in Iraq. To facilitate data collection, a self-administered questionnaire was transformed into a URL link using Google Forms. These questionnaires were then disseminated among the student body via WhatsApp, with each class's batch leader responsible for distribution

Inclusion and exclusion criteria

The research aims to assess and compare knowledge levels and vaccine hesitancy between preclinical and clinical medical students. To achieve this, the investigators designated the second class as the preclinical group and the fifth class as the clinical group, both of whom expressed willingness to participate during the data collection phase. 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. This calculation was based on a margin of error set 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 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, 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 Social Science (SPSS) software version 16.0. 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.

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. The average age of the students was 20.7 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.

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

No.	Items	Categories	n (%)

1	Age; Mean ± (SD)	21.5 ± (7.3)	
2	Gender	Male	61 (38.6)
		Female	97 (61.4)
3	Class	2nd class	83 (52.5)
		5th 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)

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 (as presented in 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 5th year group compared to 2nd year group, with percentages of 86.7% vs. 65.1% (p=0.002), 78.7% vs. 51.8% (p<0.001), and 85.3% vs. 62.7% (p=0.020), respectively. However, no significant differences were noted between the two groups for the remaining statements.

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	2ND year (n: 83)	5th 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**

Responses on influenza vaccine hesitation scale

The findings of the study revealed noteworthy insights into the attitudes and perspectives of the respondents 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. Additionally, 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 one-year immunity duration. Additionally, 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 (as outlined in Table 3).

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 one 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

Factors associated with influenza vaccine hesitation in multiple logistic regression

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 2nd 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. Additionally, non-smoking 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.

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	S.E.	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							
2^{ND} year	51 (61.4)	32 (38,6)	2.102	0.412	0.000	3.565	2.226-4.040
5^{th} 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.

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 healthcare worker hesitancy was notably lower at 17.0% [29]. Consistent with findings from numerous previous studies [27-29], the primary driving force behind influenza vaccine acceptance among the medical students under examination was the desire to safeguard both themselves (49.2%) and their families (43.1%). Furthermore, a significant majority (55.4%) expressed their willingness to heed the recommendations of healthcare professionals regarding vaccines. These motivations align closely with outcomes observed in research conducted in Saudi Arabia [30]. In a broader Middle Eastern context, a survey encompassing three countries [31] found that healthcare workers (HCWs) across the United Arab Emirates (56.6%), Kuwait (54.5%), and Oman (64.7%) were primarily motivated by the desire to protect themselves when making vaccine decisions. Similarly, a separate study conducted in Oman identified the top reasons for vaccine acceptance among HCWs as personal protection and community wellbeing [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%). Comparatively, studies conducted in different regions have highlighted a range of barriers to influenza vaccine uptake. Notably, research conducted in Egypt [28] reported that the most frequent barriers included concerns about vaccine side effects (42.9%) and doubts regarding vaccine effectiveness (24.5%). Meanwhile, a study carried out in Saudi Arabia [29] identified barriers such as skepticism regarding vaccine effectiveness (21.0%), a sense of personal health (17.0%), and concerns about vaccine side effects (13.0%). These variations in vaccine hesitancy rates across different regions underscore the importance of considering regional and cultural factors in understanding and addressing this issue. Factors such as healthcare systems, public health policies, and cultural beliefs can significantly influence individuals' attitudes towards vaccination.

In the present study, a noteworthy disparity emerged when assessing the knowledge levels pertaining to the influenza vaccine between preclinical (2nd year) and clinical (5th year) students. It was evident that correct responses to specific statements, such as "Vaccination provides lifelong protection," "Vaccination reduces productivity loss," and "Individuals with chronic illnesses should receive the flu vaccine," exhibited statistically significant superiority among the 5th-year students compared to their 2nd-year counterparts.

This finding resonates with the outcomes of a study by Chen et al. [33], which detailed the outcomes of an influenza vaccine education program implemented at Stony Brook University School of Medicine in the USA. 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 post-survey phase. Specific aspects that witnessed notable enhancement post-education included the ability to explain the potential benefits and risks of flu vaccines to patients, as well as addressing common misconceptions about these vaccines.

Additionally, 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% post-seminar.

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 post-test assessments of knowledge and attitudes toward vaccinations. The results of the post-test 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 regression in this study unveiled several predictive factors for vaccine hesitancy, including gender, academic year (2nd year), non-smoking 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 pre-clinical 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. Additionally, 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 Kalucka 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].

Several limitations should be acknowledged when interpreting the findings of this study. Firstly, the study's small sample size, which comprises medical students from a single university in Iraq, may limit the generalizability of the results to a broader population. Additionally, the study relies on a sample drawn from voluntary enrollment, and data collection is facilitated through a self-administered online instrument. Furthermore, it's important to note that the cross-sectional observational study design employed in this research may not establish causation between the studied variables. Despite these inherent limitations, this study presents valuable insights into influenza vaccine hesitancy among medical college students. Its findings serve as a potential catalyst for future research endeavors aimed at gaining a more comprehensive understanding of vaccine hesitancy trends among medical students across the country. Furthermore, this study underscores the importance of enhancing knowledge about influenza vaccines among medical college students, an area where further exploration and intervention may yield significant public health benefits.

Conclusion

In conclusion, a significant proportion of the participants, approximately 53.2%, exhibited

hesitancy towards receiving the influenza vaccine. The results from the multiple logistic regression analysis identified several predictive factors for vaccine hesitancy, including gender (females), being in the 2nd year of medical studies, non-smoking status, and lack of previous influenza vaccination. Furthermore, this study highlighted substantial knowledge gaps and negative attitudes towards influenza vaccination among pre-clinical medical students (2nd year) when compared to their clinical counterparts (5th year). These findings underscore the importance of early education on influenza and vaccination within medical training programs. Efforts should be directed towards imparting a comprehensive understanding of influenza vaccination, ultimately fostering more favorable attitudes and increasing vaccine acceptance among future healthcare professionals.