

Assessment of the Knowledge and Opinions of Undergraduate Health Care Students Concerning Influenza Vaccination in Saudi Arabia: A Cross-Sectional Study

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Introduction: Influenza remains a significant global public health challenge, causing substantial morbidity and mortality worldwide. Despite the availability of influenza vaccines, challenges related to vaccine hesitancy and healthcare professionals' attitudes persist. Furthermore, there is a need to understand the knowledge and opinions of undergraduate healthcare students regarding influenza vaccinations. Therefore, we aimed to assess and compare the knowledge and opinions of undergraduate healthcare students about influenza vaccinations, addressing the existing knowledge gap in this area.

Methods: We employed a cross-sectional study design to assess the opinions and knowledge of undergraduate healthcare students in Saudi Arabia regarding influenza vaccination. A total of 137 healthcare programs were invited to participate via filled-out the survey online. Data analysis was performed using SPSS, with descriptive statistics for the demographic profile and Chi-Square and independent *t*-tests for examining associations and differences in opinions and knowledge, respectively.

Results: A total of 429 undergraduate students completed the survey and were included. Significant associations were found between the students' major and their beliefs regarding the effectiveness of the vaccine in preventing influenza ($p=0.017$) and the inclusion of influenza vaccines in medical practice ($p=0.016$). The majority of students agreed with seven out of nine knowledge statements, with agreement percentages ranging from 42.9% to 44.8%. When comparing knowledge scores, students majoring in medicine had a significantly higher mean knowledge score (3.91) compared to students studying other medical sciences (3.72) ($p=0.019$).

Conclusion and Recommendations: Our study suggests that a comprehensive approach involving education, awareness initiatives, and policy changes is needed to enhance knowledge about influenza vaccination among Saudi Arabian undergraduate students in Medical School allied medical sciences and medical degree programs. By implementing these strategies, we can promote a positive attitude towards flu vaccination and ultimately increase its uptake.

Keywords: influenza vaccination, allied health students, medical students, immunization, knowledge, healthcare professionals

Introduction

Influenza has remained a significant global public health challenge since the devastating 1918 Spanish flu pandemic, which claimed numerous lives.¹ Subsequent influenza pandemics, including the Asian flu in 1957, the Hong Kong flu in 1968, and the 2009 swine-origin flu, have further highlighted the seriousness of this infectious disease. The escalating morbidity and mortality associated with influenza pandemics have underscored the urgent need for the development of safe and effective vaccinations. Scientists recognize the critical importance of creating vaccines that can protect against potential life-threatening influenza pandemics.^{1,2}

Vaccination has played a pivotal role in preventing infectious diseases and has revolutionized the field of medicine. Immunization has not only reduced mortality and morbidity rates but has also altered the epidemiology of various infectious diseases, including influenza.^{3,4} Currently, influenza vaccines provide strain-specific protection against a single influenza strain due to the antigenic drift exhibited by the virus. Consequently, new vaccines must be developed each year to align with the projected circulating strains and ensure optimal protection during seasonal epidemics.⁵

Influenza poses a significant global burden, causing over half a million deaths annually worldwide.^{2,6} The economic impact of influenza is substantial, encompassing both direct and indirect healthcare costs.^{7,8} Despite the effectiveness of available influenza vaccines, challenges related to vaccine hesitancy and HCPs attitudes persist. Patient acceptance or refusal of vaccination is closely tied to the trust and influence of HCPs who provide information on vaccinations, vaccine-preventable diseases, and the benefits of.^{2,6,9-11}

In order to effectively address the challenges surrounding influenza vaccination, it is essential to acknowledge the importance of widespread vaccination efforts across healthcare settings, including Saudi Arabia, supported by available evidence. Recent studies have shown promising progress in influenza vaccine acceptance among HCPs globally in the recent years.² This is of particular importance in Saudi Arabia, where millions of pilgrims participate annually in the Hajj, necessitating heightened awareness and acceptance of vaccines among HCPs.¹²

Studies have highlighted the significance of knowledge and opinions of undergraduate healthcare students in promoting influenza vaccination within the larger community. For example, a study conducted on Saudi participants regarding their knowledge and attitude towards seasonal influenza vaccination, revealed that the participants reported that HCPs are the most reliable source of information for seasonal influenza vaccination.¹³ Another Saudi study demonstrated that the students of King Saud bin Abdulaziz University were aware of 80% of basic facts on influenza vaccines.¹⁴ However, this study's findings were from one university only which makes the results non-generalizable. Therefore, we aimed to assess and compare the knowledge and opinions of undergraduate healthcare students about influenza vaccinations.

Material and Methods

Study Design and Procedure

This study employed a cross-sectional study design that played an imperative part in the examination of the opinions and knowledge of undergraduate healthcare students on influenza vaccination in Saudi Arabia.

The [Appendix](#) shows a diagram of our recruitment and sampling process.

A total of 137 healthcare programs in Saudi Arabia were included, with undergraduate students meeting the inclusion criteria of being English-speaking and enrolled in accredited healthcare programs by the National Center for Academic Accreditation and Evaluation (NCAAA). The principal investigator (PI) contacted the respective program directors via email and requested permission to invite students to fill out the survey. The invitation email included explanation of the study and its purpose with a link to access the survey online. Participants were asked to fill out the questionnaire separately for privacy purposes. Participation was entirely voluntary, and students were asked to provide informed written consent prior to participation. A pilot trial was conducted with 15 undergraduate students from each group (allied healthcare majors and medicine majors) to estimate the sample size. The reason for having these two groups is that each program has a different number of academic years. Medical students typically undergo an extensive seven-year educational program, in contrast to allied healthcare majors who typically complete their schooling in four years. The effect size was calculated as 0.2, based on Cohen's recommendation. Using G-power software, a priori sample size estimation was performed, resulting in a total sample size of 191 students.

Ethical Considerations

The IRB committee of King Saud bin Abdulaziz University for Health Sciences approved this study (SP21J/072/03). The participants were consented and informed that their participation could potentially result in a published paper, and their

right to withdraw from the study at any time was made explicitly clear. In this study, guidelines outlined in the declaration of Helsinki were followed.

The Study Tools

The authors developed a questionnaire adapted from the current evidence in the literature.^{2,15} The reason behind this is to capture similar constructs and assess the knowledge and opinions of the target population regarding influenza vaccination. These references provided a foundation for understanding the existing literature on the topic and ensuring that our questions were relevant, valid, and aligned with previous research in the field. The study tool consisted of three parts: a) the demographic profile to determine the eligibility and nature of the participants, b) the opinion of healthcare students about vaccination, and c) the student's knowledge about the importance of vaccination. The modified Delphi technique is used to establish a consensus on the tool.¹⁶ The study by Madkor et al influenced the inclusion of questions such as "Do you routinely get vaccinated against influenza?" and "Have you changed your thoughts about vaccines because of the current pandemic?" These questions tap into the participants' vaccination behaviors and attitudes, which were explored in Madkor et al's research. A score of 80% agreement has been achieved by asking three experts in the field and developing a tool based on its 21 items. A Cronbach's alpha analysis was conducted to determine the survey's internal consistency. There was an acceptable level of reliability indicated by Cronbach's alpha coefficient of 0.676. The student's opinions about vaccination were evaluated by asking true and false questions. The knowledge was assessed using nine statements on the Likert scale, ranging from least to most agreement. We used true/false options for opinion-related questions and agreement options for knowledge-related questions based on the nature of the constructs being measured and the desired response format. Our justification is that opinion-related questions often involve subjective perspectives or beliefs, where individuals may have varying degrees of agreement or disagreement. By using true/false options, respondents can express their stance clearly without being limited to a binary agree/disagree response. On the other hand, knowledge-related questions aim to assess factual understanding or awareness of certain topics. Agreement options (eg, on a Likert scale) are commonly used to measure the extent to which respondents perceive a statement to be accurate or true. This format allows individuals to express their level of agreement with the presented knowledge statement.

Data Analysis

The data was analyzed using Statistical Package for Social Sciences (SPSS) version 23. The data were downloaded into an Excel sheet and then transferred it to SPSS. The data were then stored in a flash drive to assure data integrity. For the demographic profile, descriptive statistics were used. For the students' opinions measure as categorical data, the Chi-Square (χ^2) test was used to examine any associations or differences between different categories of opinions among the students. The test results were interpreted by comparing the calculated χ^2 value to the critical value, and the p-value was assessed to determine the statistical significance of any associations. Based on the analysis, conclusions were drawn regarding the relationships between variables and the students' opinions on vaccination.

Regarding the students' knowledge about vaccination, which was measured using a Likert scale, an independent *t*-test was used to compare two groups based on the ordinal data. The test results were interpreted by examining the calculated *t*-value, degrees of freedom, and the corresponding p-value. The significance of any observed differences in knowledge scores between the two groups was evaluated, leading to conclusions about variations in knowledge levels among the student cohorts.

Overall, the interpretation of the data involved assessing statistical significance, considering effect sizes, and drawing conclusions based on the findings. The results of both the Chi-Square test and the independent *t*-test provided insights into the students' opinions and knowledge about vaccination, which were then used to inform the broader conclusions of the study.

Results

Participant Characteristics

A total of 444 enrolled college students responded to the online survey, of which 429 (96.6%) completed the questions and were included in the study ([Appendix](#)). The socio-demographic characteristics of the 429 participants are shown in

Table 1. More than half of the students were male (56.0%, n=240). Almost two third of the participants were found under the age group 21–23. Only one student (0.2%) was non-Saudi. The participants came from thirteen different universities, but the majority were studying at King Saud Bin Abdulaziz University for Health and Science (74%, n=321). Additionally, 33.1% (n=142) were studying medicine as a major, while more than 66% (n=287) were studying a major in medical sciences other than medicine (**Table 1**).

Participant's Opinions Toward the Influenza Vaccine

Overall, more than half of the students (60.9%, n=261) do not get routinely vaccinated against influenza (**Table 2**). The most reported reason for not taking the influenza vaccine (for those who do not regularly get vaccinated) was that the influenza is not serious, and they have had it before (37.5%, n=98), the second most reported reason was that the participants does not know where to get the influenza vaccine (14.0%, n=37). Other reasons include the beliefs that the vaccine will make them sick, and the vaccine is not important if you are young or have good personal hygiene.

Table 2 shows the opinions toward influenza vaccines. Most students (73.4%, n=315) believe the influenza vaccine is effective in preventing the flu, and 64.4% (n=276) believe that it should be administered annually. In addition, 63.0% of the students (n=270) believe that administering the influenza vaccine should be included in their medical practice. When asked about their health educational program regarding influenza vaccine, 25.6% (n=110) reported that their program encourages and offers influenza vaccine, 8.6% (n=37) encourage but do not offer the vaccine and 12.6% (n=54) require and offer the vaccine, whereas 12.6% of them (n=54) indicated that none of these statements applied to their health education program. 89.6% (n=385) of students had not participated in any training or continuing education related to the influenza vaccine in the past 12 months. However, the majority (72%, n=309) were interested in participating in such

Table 1 Demographic Characteristics of Participants (N = 429)

Characteristic	Frequency	Percent (%)
Gender		
Male	240	56
Female	189	44
Age		
18–20	116	27
21–23	263	61.3
24–26	42	9.8
Above	8	1.9
Nationality		
Saudi	428	98
Non-Saudi	1	0.2
University		
Jazan University	5	1.2
King Abdulaziz University	67	15.6
King Saud Bin Abdulaziz University for Health and Science	321	74.8
King Saud University	10	2.3
Taif University	1	0.2
Umm Al Qura University	18	4.2
University of Jeddah	1	0.2
Others ^a	6	1.4
Major		
Medicine	142	33.1
Other medical sciences subjects ^b	287	66.9

Notes: ^aOthers: Imam Abdulrahman bin Faisal University, and University of Tabuk. ^bOther medical sciences subjects: Respiratory Therapy, Nursing, Anaesthesia technology, Emergency Medical Services, Occupational Therapy, Dentistry, Pharmacy, Clinical Nutrition, radiological Sciences, Physical Therapy, Health services and hospital administrative, Healthcare Management, Audiology, and Clinical laboratory, and Echo cardiovascular Technology.

Table 2 Opinions Toward Flu Vaccine

Statement	Response	N (%)
Do you routinely get vaccinated Against influenza?	Yes	168 (39.1)
	No	261 (60.9)
Do you think the influenza vaccine is effective in preventing the flu?	Yes	315 (73.4)
	No	114 (26.6)
Do you believe that Saudi scientific committee for influenza and pneumococcal vaccination (SCIPV) recommends vaccination?	Yes	150 (35)
	No	50 (11.7)
	I do not know	229 (53.3)
How often do you think the flu vaccine should be administered? Choose one	Every 5 years	94 (22)
	Every 6 months	20 (4.6)
	Every year	276 (64.4)
	Once in lifetime	39 (9)
Have you changed your thoughts about vaccines because of the current pandemic?	Yes	227 (53)
	No	202 (47)
Do you think administering the influenza vaccine should be part of your medical practice?	Yes	270 (63)
	No	159 (37)
Which statement applies to your health educational program regarding influenza vaccine:	They encourage and offer influenza vaccine	110 (25.6)
	They encourage, but do not offer the influenza vaccine	37 (8.6)
	They require and offer the influenza vaccine	54 (12.6)
	None of the above	228 (53.2)
Have you participated in any training or continuing education related to the influenza vaccine in the past 12 months	Yes	44 (10.4)
	No	385 (89.6)
Would you be interested in participating in training related to the influenza vaccine?	Yes	309 (72)
	No	120 (28)
Does your health institute offer the influenza vaccine to your patients?	Yes	96 (22.3)
	No	68 (15.9)
	I do not know	265 (61.8)
Are you aware of the published guidelines of the advisory committee on immunization practices (ACIP) Saudi scientific committee for influenza and pneumococcal vaccination (SCIPV) or CDC for influenza immunization?	Yes	90 (21)
	No	339 (79)

a program in the future. Interestingly, 79.0% (n=339) of the students do not know the published guidelines of ACIP (advisory committee on immunization practices), SCIPV (Saudi scientific committee for Influenza and pneumococcal vaccination) or CDC (centers for disease control and Prevention) for influenza vaccination, where more than half of the students (53.3%, n=229) do not know if the SCIPV recommends influenza vaccination.

Factors Associated with Opinions Toward Influenza Vaccination

Gender and major of the students were displayed in contingency tables with the students' opinions toward the flu vaccine in Table 3. The results revealed a significant association between major and the belief that the influenza vaccine is effective in preventing influenza ($P=0.017$), as well as a significant association between major and the belief that influenza vaccines should be used in medical practice ($P=0.016$). However, no significant relationship was found between gender and students' opinions toward the flu vaccine (Table 3).

Knowledge of Study Participants About Influenza and Influenza Vaccination

Among the students, the majority agreed with seven out of the nine knowledge statements, with a median value of 4 for all statements. The two statements related to influenza symptoms ("Coughing and sneezing are the most common ways

Table 3 The Relationship Between Categorical Groups (Gender and Major), and the Opinions Statements

Factor		Gender		P-value	Major		P-value
		Male N=240	Female N=189		Medicine N=142	Other Medical Sciences N=287	
Do you routinely get vaccinated against influenza?	Yes	97	71	0.548	51	117	0.333
	No	143	118		91	170	
Do you think the influenza vaccine is effective in preventing the flu?	Yes	117	138	0.864	94	221	0.017
	No	63	51		48	66	
Have you changed your thoughts about vaccines because of the current pandemic?	Yes	118	109	0.080	64	163	0.022
	No	122	80		78	124	
Do you think administering the influenza vaccine should be part of your medical practice?	Yes	145	125	0.223	78	192	0.016
	No	95	64		64	95	
Would you be interested in participating in training related to the influenza vaccine?	Yes	166	143	0.137	98	211	0.328
	No	74	46		44	76	
Do you believe that Saudi scientific committee for influenza and pneumococcal vaccination (SCIPV) recommends vaccination?	Yes	88	62	0.231	41	109	0.166
	No	32	18		17	33	
	I do not know	120	109		84	145	

for influenza to spread” and “Fever, headache, sore throat, cough, nasal congestion, aches, and pain are all signs and symptoms of influenza”) received the highest agreement percentage, with 44.5% and 44.8% strongly agreeing, and 42.9% and 43.8% agreeing, respectively. Conversely, most students disagreed with the statement “Healthcare workers are less vulnerable to influenza outbreaks than the general public”, with 27.7% strongly disagreeing and 24.5% disagreeing.

Table 4 Knowledge Differences Between Independent Groups (Male-Female, Medicine-Other Medical Sciences, Vaccinated - Unvaccinated)

	Knowledge Mean	P-value
Gender		
Male (N=240)	3.73	0.114
Female (N=189)	3.85	
Major		
Medicine (N=142)	3.91	0.019
Other medical sciences (N=287)	3.72	
Routine vaccination		
Vaccinated (N=168)	3.91	0.010
Non vaccinated (N=216)	3.71	

Regarding the statement “Only after symptoms arise do people with influenza have the ability to spread the infection”, 33.1% of the responses were neutral.

Factors Associated with Knowledge

Table 4 illustrates the knowledge differences between independent groups.

The average knowledge score among students in the medicine field was found to be significantly higher than those studying other medical sciences, with mean values of 3.91 and 3.72, respectively (p -value = 0.019). Additionally, students who reported being vaccinated against influenza had a significantly higher mean knowledge score compared to unvaccinated students, with mean values of 3.91 and 3.71, respectively (p -value = 0.010). However, there was no significant difference in knowledge between male and female students, as indicated by a p -value of 0.114 (Table 4).

Discussion

Influenza is linked to major clinical, humanistic, and financial cost worldwide. The ability to manage the influenza virus with vaccines is crucial, but despite recommendations from regulatory public-health authorities, vaccination coverage rates throughout the world continue to vary widely.^{13,14,17} The study sought to assess and compare the knowledge and opinion of undergraduate healthcare students about influenza vaccination in Saudi Arabia. The undergraduate healthcare students (33.1% studying medicine and 66.9% studying other medical were recruited from universities across Saudi Arabia. Most of the students disagreed with the statement “Healthcare workers are less vulnerable to influenza outbreaks than the general public”. However, only 37.8% of the students were vaccinated with the influenza vaccination. This can be attributed to the scarce knowledge of flu vaccines, such as the frequency of vaccination, efficacy, and protection, coupled with the fact that this vaccine is paid for and non-mandatory.¹⁷ Thus, a low vaccination uptake is expected. However, the cohort of undergraduates that were recruited were healthcare university students which have mandatory modules on microbiology and immunology, infectious disease, community medicine, public health, and epidemiology, all of which inform the students on immune-prophylaxis against infectious disease and prepare on health promotion including primary prevention by vaccination, which should have resulted in a higher vaccination uptake.^{15,18,19}

The low vaccination uptake among healthcare-related students is relatively low when compared to similar studies.^{20–24} In this study, an overall 39.1% of the students have been vaccinated. The remaining unvaccinated students report reasons such as the unknown location of vaccine availability, the flu shot will make them sick, and the vaccine is not important if you have good hygiene. Previous studies students’ have linked low flu vaccination rates to students’ strong sense of health and positive perception of themselves,^{20,22,24} as they do not frequently get sick, they do not feel that the flu vaccine is necessary for them. A study by Kalucka et al indicated that some students of nursing, midwifery, and pharmacy considered young age and good health contraindications to vaccinations.²⁵ According to this survey, there are serious gaps in knowledge about vaccination among healthcare students, suggesting that students are susceptible to media allegations and rumours. Using these findings, targeted interventions could be developed to bridge such gaps in their knowledge, such as programs to provide continuous medical education related to influenza vaccines.²⁵

Healthcare professionals, such as medical doctors and scientists in other medical fields, are responsible for disseminating accurate information about the influenza vaccine in society in order to maintain a high standard of medical care and prevent vaccine-preventable diseases like influenza.^{20,23,26–28} It is therefore concerning that 24.9% of the students strongly agree, and 34.5% strongly agree, that “the flu shot contains live viruses that may cause influenza in some people”. Similar findings were found in other studies as well.^{15,20,25,26} Additionally, a total of 79% of the surveyed students did not know about the published guidelines of ACIP, SCIPV, and CDC for influenza immunization which would negatively affect the public as proper health education and awareness of primary prevention would be significantly lacking because the future healthcare professional is unaware of the current guidelines and updates.^{27,29–31}

It was also observed that medical students were significantly more likely to have good knowledge compared to allied healthcare students. In fact, medical students studied detailed pathogenesis and an immunological response would result in graduates with the knowledge and skills necessary to increase vaccination coverage and acceptance among the

public.^{26,27,29,30,32} The detailed understanding of the pathogenesis of the types of vaccines, immune response to vaccines, and the benefits of the vaccines among this group are heavily concentrated on the medical degree compared to allied healthcare sciences which may contribute to the lack of knowledge and positive beliefs on the benefits of the influenza vaccination.^{22,25,33–37} Medical students' knowledge and opinions regarding influenza vaccine uptake correlated significantly with the study year in a recent study conducted in Saudi Arabia.¹⁴ Students in the second, third, and fourth years scored significantly lower in both domains than students in the fifth and sixth years. Perhaps this was due to a lack of exposure to vaccination in earlier years; the study participants did not receive formal vaccination education until their first exposure to pediatric clinical care in their fifth year.¹⁴

Study Limitations

Study limitations include the small sample size which attempts to represent healthcare-related university students in Saudi Arabia, which should be taken into consideration when interpreting the results. There is a large study population drawn from the enrolment of students at a single institution in Saudi Arabia and the use of a self-administered instrument delivered via email. Despite the various limitations of this study, its findings have a great deal of potential for encouraging further research in order to examine and improve university students' knowledge and opinions regarding the influenza vaccine around the country.

Conclusion

Our study found that Saudi Arabian undergraduate students in Saudi Arabia, specifically those enrolled in Medical School allied medical sciences degrees and medical degrees, have a positive opinion about influenza vaccination. Considering knowledge gaps found in this study and the statistically significant association between knowledge and opinions towards the uptake of influenza vaccination, it is suggested that enhancing knowledge about flu vaccination can be achieved through a combination of education, awareness initiatives, and policy.

To address this, a comprehensive educational program on vaccinology should be introduced at the undergraduate level, with a particular focus on students studying allied medical sciences subjects. This program would aim to increase understanding and awareness of the importance of influenza vaccination. Additionally, annual awareness initiatives should be conducted by the Ministry of Health and Ministry of Education, specifically targeting the surveyed universities. These initiatives should emphasize the significance of vaccination, provide evidence-based information about vaccine safety and efficacy, highlight vaccine availability, address vaccine side effects, and promote the guidelines published by the ACIP and SCIPV.

Regarding policy, medical universities can implement requirements for all faculty members, students, and staff to undergo training and education on the importance and efficacy of vaccination. This policy would ensure that everyone within the university community is knowledgeable about influenza vaccination and can effectively communicate its benefits.

Abbreviations

HCPs, Health care professionals; PI, Principal investigator; NCAAA, National Center for Academic Accreditation and Evaluation; SPSS, Statistical Package for Social Sciences; ACIP, Advisory committee on immunization practices; SCIPV, Saudi scientific committee for influenza and pneumococcal vaccination; CDC, Centers for disease control and prevention.

Disclosure

The authors report no conflicts of interest in this work.

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