Original Article

Access this article online
Quick Response Code:

Website: www.jehp.net
DOI: 10.4103/jehp.jehp_722_22

Knowledge, attitude, and practice toward seasonal influenza vaccine during the COVID-19 pandemic among students at King Saud bin Abdulaziz University for Health Sciences-Jeddah, Saudi Arabia

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Received: 24-05-2022
Accepted: 15-09-2022
Published: 31-01-2023

Abstract:

BACKGROUND: Annual influenza vaccine is recommended among health professionals especially, health science undergraduates; although, studies suggest that there is a low level of vaccine coverage among health care undergraduates. Thus, the study aimed to investigate students' knowledge, attitudes, and practices regarding the seasonal influenza vaccine at King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) in Jeddah, Saudi Arabia.

METHODS: A cross-sectional, unicentral study was carried out during the period of April to November 2021. A total of 341 validated questionnaires that included four sections were distributed in all four different colleges of KSAU-HS. Data management and analyses were carried out using Statistical Software for Social Sciences (SPSS) version 25.

RESULTS: Out of 341 respondents, 336 participants completed the full survey (98.53% completion rate). The majority of participants were males (67.6% and the most participants were from the college of medicine (60.4%). The mean knowledge score of students was found to be (11.3 ± 2.0) out of 14 points. The most common barrier to vaccination among healthcare students was not having enough time to take the vaccine (23.8%), while the second one was the COVID-19 pandemic (22.32%). The vaccination rate in 2020 was 103 (30.7%), while 235 (80.4%) students stated that they have received the vaccine previously. School/work requirements and the student's awareness of the vaccine's importance were the most common reasons for taking the influenza vaccine.

CONCLUSION: Even though students showed a high level of knowledge and a positive attitude towards the influenza vaccine, they generally had a low level of vaccine uptake. To enhance immunization rates, we encourage vaccine campaigns in all healthcare colleges. Further studies are needed to identify influences on students' attitudes and practices regarding influenza vaccination.

Keywords:

Attitude, KAP, knowledge, KSAU-HS, practice, seasonal influenza, vaccine

Introduction

Seasonal influenza is one of the most contagious diseases which affects the respiratory tract, and sometimes it is highly associated with an increased rate of morbidity and mortality, especially in some

How to cite this article: Abushouk A, Ahmed ME, Althagafi Z, Almehmadi A, Alasmari S, Alenezi F, *et al*. Knowledge, attitude, and practice toward seasonal influenza vaccine during the COVID-19 pandemic among students at King Saud bin Abdulaziz University for Health Sciences-Jeddah, Saudi Arabia. J Edu Health Promot 2023;12:17.

individuals such as infants, elderly people, pregnant women, and immune-compromised patients.[1,2] Fortunately, seasonal influenza can be prevented by taking the influenza vaccine annually.[2] Health practitioners including health sciences undergraduates are among the most exposed people to the influenza virus.[2] By taking the vaccine, they can protect themselves and the patients with whom they interact.[3]

The following statistics demonstrate the massive strain the disease has caused on public health systems worldwide. According to the World Health Organization (WHO), around 3 to 5 million incidences of severe sickness occur each year, with 290,000 to 650,000 cases of influenza resulting in respiratory mortality worldwide.[4] Also, the Centers for Disease Control and Prevention (CDC) estimate that around 400,000 hospitalizations occurred due to influenza in 2019–2020.[5] That's an increase of 138% from their estimates for 2010–2011.[6] In Saudi Arabia, in 2019, 15,850 cases of influenza A were detected.[7] In addition, Saudi Arabia is considered in a unique position because millions of Muslims travel to its holy cities every year for Hajj and Umra, thus increasing the susceptibility of transmission in the country.[8] In a study done on 421 medical students at King Saud University, Saudi Arabia, only 57% of the medical students had the seasonal influenza vaccine.[9] Another study was done at King Saud bin Abdulaziz University for health sciences (KSAU-HS) Riyadh, Saudi Arabia, which surveyed 241 nursing students. The percentage of students who did not have the vaccine in the last 12 months was 33.2%. Both studies indicate a low level of vaccination against seasonal influenza among public health undergraduates in Saudi Arabia.[10]

As public health undergraduates constitute a large group of healthcare future workers, increasing vaccination coverage among them should be a priority as they may be a significant educational resource for health information, including the importance of vaccinations; therefore, identifying the factors preventing or encouraging individuals of the society to take the vaccine shall enhance the understanding; in addition, underlining not only vaccine knowledge but also their social responsibility to protect patients. Influenza vaccination is an infection control strategy over and above an ethical and professional responsibility.

Since KSAU-HS includes undergraduates in health sciences, their attitudes and practices are key indicators of the future of public health practices. This study aimed at examining the knowledge, attitude, and practices toward seasonal influenza vaccine among the students of King Saud bin Abdulaziz University for Health Sciences-Jeddah.

Materials and Methods

Study design and setting

This cross-sectional and unicentral study was carried out from April to November 2021. We collected the data using a Google® survey webpage which was distributed via WhatsApp®. This type of design was performed to obtain information regarding the knowledge, attitude, and practices toward the seasonal influenza vaccine among students of KSAU-HS Jeddah, Saudi Arabia. The university encompasses 4 colleges: College of Medicine (COM), College of Nursing (CON), College of Applied Medical Sciences (CAMS), and College of Science and Health Professions (COSHP).

Study participants and sampling

The total number of students in all four colleges was 2487. All students were considered eligible for the study. The convenience sampling method was used to represent the University's four different colleges. By using Raosoft® software, the minimal sample size was determined to be 333 students; in which, the confidence level was estimated at 95%, and the margin of error (± 5%).

Data collection tool and technique

The questionnaire contained 23 items within four different sections and each section corresponding to a specific area of study. The first section of the study aimed to collect demographical information from participants, which included six items: gender (male/female), age, year of study, area of study, and health status, and were living with high-risk individuals. The second section of the questionnaire included seven items that measured the basic knowledge of the students regarding the influenza vaccine and the influenza virus by using a 3-points Likert scale (Yes/No/Not sure) and multiple-choice questions. The correct answer was given two points, the incorrect answer was given zero points, and if not sure was chosen one point was given. The third section included seven items that examined the participants' barriers and difficulties in taking the influenza vaccine. It included a 5-points Likert scale in which responders specified their level of agreement with statements about their attitudes towards the seasonal influenza virus and vaccination. The responses were: Strongly disagree, Disagree, Neutral, Agree, and Strongly agree. The fourth section assessed the participants' practices for influenza vaccination and their reasons for acceptance or denial of the influenza vaccine. It was made of four multiple-choice questions. The questionnaire was validated using content and construct validity by qualified medical and research experts. A pilot study of 40 participants was conducted to test the reliability of the responses. Cronbach alpha coefficient for internal consistency was calculated for the items of attitudes section. The value of the coefficient was calculated at 0.753 indicating a sufficient level

of internal consistency of responses. The Statistical Software for Social Sciences (SPSS) version 25 was used to analyze the data. The data were presented as mean and standard deviation (SD) for scale variables. Frequency and percentages were used to describe categorical variables. T-test and ANOVA were used to analyze the differences between knowledge and vaccine uptake by demographical variables. Also, a *P* value of <0.05 was considered statistically significant, and the confidence level was estimated at 95% with a margin of error (±5%).

Ethical considerations

The study was approved by the Institutional Review Board (IRB) of King Abdullah International Medical Research Center (KAIMRC). The study ensured complete confidentiality and privacy, the purpose of the study was explained to all participants, and informed consent was obtained from all subjects involved in the study.

Results

Out of 341 respondents, 336 participants completed the survey (98.53% completion rate). Most of the participants were males 227 (67.6%). The majority of respondents 203 (60.4%) were from the College of Medicine. Fourth-year students were the largest proportion of sample 118 (35.1%). Most of the respondents 293 (87.2%) reported they were healthy. Moreover, 200 (59.5%) reported they were living with high-risk individuals who could develop serious complications from the influenza virus. The general characteristics of the subjects are shown in Table 1.

Table 2 represented the knowledge characteristics of participants. The mean knowledge score was found to be (11.3 ± 2.0), where the highest attainable score was 14. In a detailed inspection of the knowledge section, the table illustrates that 321 (95.5%) of the students selected the correct response regarding the route of transmitting the virus, and 255 (75.9%) knew that the vaccine is given freely in every primary healthcare facility in Saudi Arabia. However, more than half of the students 177 (52.7%) did not know that the vaccine contains inactive viruses. Interestingly, the majority of the participants 235 (69.9%) understood that the vaccine does not weaken the immune system, thus it does not increase the chance of opportunistic infections.

Table 3 depicted the participants' attitudes toward the influenza vaccine. It showed that 281 (83.6%) of participants agreed that the influenza vaccine is effective, and 235 (69.9%) disagreed that the influenza vaccine may have dangerous side effects. However, 75 (22.3%) did not prefer to get the vaccine due to the COVID-19 pandemic. Other aspects of the students' knowledge were presented in Table 3.

Table 1: Demographic characteristics of students (*n*=336)

Demographic Variables	Frequency *n* (*n*=336)	Percentage
Gender		
Male	227	67.6
Female	109	32.4
College		
COM	203	60.4
CON	25	7.4
CAMS	24	7.1
COSHP	84	25.0
Academic year		
1st	77	22.9
2nd	60	17.9
3rd	65	19.3
4th	118	35.1
5th	6	1.8
6th	10	3.0
Health status		
Healthy	293	87.2
Chronic controlled disease	34	10.1
Chronic uncontrolled disease	6	1.8
Immunocompromised	3	0.9
Living with people who have a high risk of developing serious complications from the influenza virus		
Yes	200	59.5
No	136	40.5

Tables 4–5 demonstrated the practice characteristics of students. In 2020, only 103 (30.7%) of students received the vaccine, while 270 (80.4%) had received the vaccine previously. In addition, 35 (10.4%) of students stated that they take the vaccine every year, while 66 (19.4%) had never been vaccinated. The most common reason for taking the vaccine was due to school or work requirements (N = 116). Other details were presented in Table 4.

Table 6 showed knowledge score differences by the basic characteristics of students using the independent T-test and ANOVA. A significant difference in knowledge score was identified by college and academic year (*P* value < 0.05). Students of CAMS scored the highest mean (11.8). Sixth-year students had the highest level of knowledge (mean score 12.8), while 1st-year students had the lowest level of knowledge (mean score 10.4).

Tables 7–8 demonstrated the difference in vaccine uptake by the basic characteristics of students using an independent T-test and ANOVA. A significant difference in vaccine uptake was identified by gender and academic year (*P* value < 0.05). Female students had a higher level of vaccine uptake both in 2020 and annually. Also, 5th and 6th-year students had the highest rates of vaccination.

Table 2: Knowledge characteristics of students (*n*=336)

Item	Frequency (*n*=336)	Percentage
Are coughing and sneezing among the most common route of transmitting influenza virus?		
Yes	321	95.5
No	5	1.5
Not sure	10	3.0
Is the seasonal influenza vaccine provided freely healthcare facility?		
Yes	255	75.9
No	6	1.8
Not sure	75	22.3
Does the influenza vaccine contain an active virus that causes infection?		
Yes	75	22.3
No	159	47.3
Not sure	102	30.4
Does the influenza vaccine weaken the immune system, and increase the chance of developing infections?		
Yes	33	9.8
No	235	69.9
Not sure	68	20.2
Are fever, muscle and joint pains, headache, fatigue, and loss of appetite adverse effects of the influenza vaccine?		
Yes	212	63.1
No	31	9.2
Not sure	93	27.7
Vaccine administration		
Every 6 months	31	9.2
Every year	237	70.5
Every 5 years	31	3.9
Once in a lifetime	14	4.2
I don't know	41	12.2
Vaccine time		
Months before flu	265	78.9
Throughout the year	17	5.1
Peak season	25	7.4
I don't know	29	8.6

Table 3: attitude characteristics of students (*n*=336)

Item	Frequency (*n*=336)	Percentage
I believe the influenza vaccine is NOT effective.		
Agree to strongly agree	23	6.9
Disagree to strongly disagree	381	83.6
Neutral	32	9.5
I believe that the influenza vaccine may have dangerous side		
Agree to strongly agree	29	8.7
Disagree to strongly disagree	235	69.9
Neutral	72	21.4
I am not at risk of contracting the flu virus; thus, I do NOT have to get the influenza vaccine	61	18.1
Agree to strongly agree	220	65.4
Disagree to strongly disagree	55	16.4
Neutral		
Influenza is NOT a serious condition therefore NOT worth vaccinating against.	47	14
Agree to strongly agree	231	68.8
Disagree to strongly disagree	58	17.3
Neutral		
I do NOT have the time to get the Influenza vaccine.		
Agree to strongly agree	80	23.8
Disagree to strongly disagree	186	55.4
Neutral	70	20.8
Due to needle fear, I do NOT like to get the Influenza vaccine.		
Agree to strongly agree	24	7.1
Disagree to strongly disagree	296	88.1
Neutral	16	4.8
Due to the current situation (COVID-19 pandemic), I don't prefer to get the influenza vaccine.	75	22.3
Agree to strongly agree	205	61
Disagree to strongly disagree	56	16.7
Neutral		

Female students and 5th and 6th-year students showed more willingness in taking the vaccine in the future.

Discussion

Seasonal influenza outbreaks in Saudi Arabia can cause a significant strain on the public health system, especially among pilgrims during the hajj season.[11] However, multiple studies have demonstrated that influenza vaccination rates among healthcare workers and students in Saudi Arabia are generally low.[9,12,13] As influenza vaccination reduces the rate of transmission of the influenza virus, it is important to increase the vaccination rate in groups exposed to the influenza virus such as healthcare students.[14,15] This study aimed at examining the knowledge, attitude, and practices toward the seasonal influenza vaccine among the students of KSAU-HS.

The knowledge section included 7 questions where the correct answer was given 2 points. The mean score of students was (11.3 ± 2), indicating that the students were aware of 80% of basic facts. This showed that the students had adequate knowledge regarding the influenza vaccine in comparison with other local studies.[9,10] We believe that the COVID-19 pandemic might have increased public knowledge about vaccines in general, which may explain why students in this study had better knowledge than students in other local studies, even though

Table 4: practice characteristics of students (*n*=336)

Practice Variables	Frequency (*n*=336)	Percentage
Previous receive vaccine		
Yes 2020	52	15.5
Before 2020	167	49.7
Every year	35	10.4
Never	66	19.6
In and before 2020	16	4.8
Plan take vaccine in future		
Yes	162	48.2
No	35	10.4
Maybe	139	41.4

Table 5: practice characteristics (more than one answer can be chosen)

Practice Variables	Frequency	Percentage
The reason of been vaccinated		
Recommended by health care providers	78	19.0
Recommended by family/friend	86	20.9
Awareness of the vaccine's importance	112	27.3
Hajj requirement	19	4.6
School/work requirement	116	28.2
Family member been vaccinated		
Yes, my parents.	184	41.1
Yes, my children.	10	2.2
Yes, another family member.	177	7.0
No	77	17.2

Table 6: Knowledge score by basic characteristics of students

Variable	Mean Score	*P*
Gender		
Male	11.3	0.899
Female	11.2	
College		
COM	11.6	0.001
CON	9.9	
CAMS	11.8	
COSHP	10.6	
Academic year		
1st	10.4	0.001
2nd	10.8	
3rd	11.5	
4th	11.8	
5th	11.2	
6th	12.8	
Health status		
Health	11.3	0.221
Chronic controlled disease	10.9	
Chronic uncontrolled disease	10.3	
Immunocompromised	9.7	

comparing knowledge across different studies was impractical without uniformity of knowledge questions. Knowledge generally increased with the academic year, which implied that a college education improves influenza awareness. Only (47.3%) of students knew that the vaccine does not cause influenza. The belief that the vaccine may cause influenza is a common misconception and was found in the literature among both healthcare students and healthcare workers.[16,17] The fact that the vaccine's side effects resemble influenza symptoms might explain why this misconception is widespread.

The most common barrier to vaccination among healthcare students was not having enough time to take the vaccine (23.8%). This was consistent with other studies done on healthcare students and healthcare workers in Saudi Arabia.[18,19] Providing easier access to the vaccine at the hospital or university might greatly increase vaccination rates among students. The second most common barrier to vaccination was the COVID-19 pandemic (22.32%). Lockdown measures that were implemented in 2020 have made it harder for students to get the influenza vaccine. Another barrier to vaccination was the students' false perception that they are not at risk of contracting influenza (18%). Multiple studies have shown that this belief is common among healthcare students.[9,19] Regarding the effectiveness of the influenza vaccine, 83.6% of participants disagreed that the influenza vaccine is not effective. This was substantially different from another local study performed on healthcare workers in which only (51%) of respondents believed that the vaccine was not effective in preventing disease.[20] Side effects of the vaccine were another subject where our data differed from the literature. Only 8.7% of participants thought that the influenza vaccine may have dangerous side effects. While in the literature we've found higher percentages in local studies, reaching up to 58% in a study done by Alshammari *et al*.,[18] on healthcare workers.

Regarding vaccination status in 2020, only (30.7%) of students were vaccinated against influenza. Other studies were done on healthcare students in Saudi Arabia before 2020 showed similarly a low level of vaccine uptake.[9,10] However, our study was the only one conducted during the height of the COVID-19 pandemic, and the lockdown measures during the pandemic have made access to the vaccine harder in 2020. Since KSAU-HS implements an annual influenza vaccine campaign for students on its campus, we expected that the vaccination rate would have been higher compared to other local studies, but there were no vaccination campaigns in 2020 because of the COVID-19 pandemic.

Limitation and recommendation

One limitation of the study was the use of convenience sampling which means that students who participated in the study may have been more likely to be interested in vaccination compared to those who did not participate. This could have resulted in an overestimation of vaccination coverage and knowledge in participants compared to non-participants. Since this study samples students from

Table 7: Previous vaccine receiving by basic characteristics of students (*n*=336)

Variable	2020	Before 2020	Every year	Never	In and before 2020	*P*
Gender						
Male	14.1	53.7	7.1	20.3	4.8	0.027*
Female	18.4	41.3	17.4	18.4	4.6	
College						
COM	21.8	52.7	10.3	19.2	4.9	0.354
CON	28.0	36.0	16.0	16.0	4.0	
CAMS	29.2	41.7	12.5	8.3	8.3	
COSHP	14.3	48.8	8.3	25.0	3.6	
Academic year						
1st	18.2	44.2	10.4	25.9	1.3	0.001*
2nd	15.0	45.0	8.3	26.7	5.0	
3rd	6.2	67.7	10.8	12.3	3.1	
4th	17.8	50.9	7.6	17.8	5.9	
5th	0	16.7	33.3	0	50.0	
6th	40.0	10.0	40.0	10.0	0	
Health status						
Health	15.4	49.8	10.9	19.5	4.4	0.159
Chronic controlled disease	8.8	58.8	8.8	14.7	8.8	
Chronic uncontrolled disease	50.0	16.7	0	33.3	0	
Immunocompromised	33.3	0	0	66.7	0	

Table 8: Plan take vaccine in future by basic characteristics of students (*n*=336)

Variable	Yes	No	Maybe	*P*
Gender				
Male	42.3	10.6	47.1	0.004*
Female	60.5	10.1	29.4	
College				
COM	50.7	8.9	40.4	0.646
CON	50.0	12.0	36.0	
CAMS	37.5	8.3	54.2	
COSHP	44.0	14.3	41.7	
Academic year				
1st	40.3	14.3	45.4	0.005*
2nd	36.7	11.7	51.6	
3rd	43.1	4.6	52.3	
4th	56.8	11.0	32.2	
5th	83.3	0	16.7	
6th	90.0	10.0	0	
Health status				
Health	47.1	10.9	42.0	0.464
Chronic controlled disease	55.9	2.9	41.2	
Chronic uncontrolled disease	66.7	16.7	16.6	
Immunocompromised	33.3	33.3	33.4	

one university, the results cannot be generalized to all Saudi universities. Another potential limitation was the use of self-reported data, which may have introduced recall bias to this study. Finally, students from the 5th and 6th academic years had low representation in this study.

Conclusion

Our study demonstrated that KSAU-Hs students' knowledge regarding the vaccine was generally adequate. Students showed a positive attitude towards the influenza vaccine. On the other hand, the vaccination rate among students was low in 2020. The COVID-19 pandemic precautions restricted the students' ability to access the influenza vaccine in 2020. We recommend vaccine campaigns at all healthcare colleges to increase the vaccination rate. In addition, knowledge about the vaccine can be increased by educational campaigns that emphasize the importance of annual vaccination among future healthcare workers. Further studies that include all healthcare colleges in Saudi Arabia are needed to assess the vaccination rate and knowledge level among healthcare students in the country.

Acknowledgements

This study was conducted in accordance with the ethical principles stated in the Declaration of Helsinki. Appreciation and gratitude to the students whom accepted to participate in the study. The researchers also valued the study's reviewers for their constructive remarks which made the article substantial.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Grohskopf L, Sokolow L, Broder K, Olsen S, Karron R, Jernigan D, *et al*. Control of seasonal influenza with vaccines recommendations of the advisory committee on prevention and immunization practices — United States, 2016–17 influenza season. 2020.
2. Grohskopf L, Alyanak E, Broder K, Blanton L, Fry A, Jernigan D, *et al*. Prevention and Control of Seasonal Influenza with Vaccines: Recommendations of the Advisory Committee on Immunization Practices — United States, 2020–21 Influenza Season. 2020.
3. Paules CI, Sullivan SG, Subbarao K, Fauci AS. Chasing seasonal influenza — The need for a universal influenza vaccine. N Engl J Med 2018;378:7–9.
4. Who.int. 2021. Influenza (Seasonal). Available from: https://www.who.int/news-room/fact-sheets/detail/influenza-(seasonal). [Last accessed 2021 Sep 02].
5. Estimated influenza illnesses, medical visits, hospitalizations, and deaths in the United States-2019–2020 influenza season. Centers for Disease Control and Prevention. Centers for Disease Control and Prevention; 2021. Available from: https://www.cdc.gov/flu/about/burden/2019-2020.html. [Last accessed on 2021 Sep 02].
6. Burden estimates for the 2010-2011 influenza season. Centers for Disease Control and Prevention. Centers for Disease Control and Prevention; 2018. Available from: https://www.cdc.gov/flu/about/burden/2010-2011.html. [Last accessed on 2021 Sep 02].
7. Alhawsawi M, Alghamdi A, Alzayed B, Binmugren H, Alshehri R, Abusalih H. Knowledge, barriers and uptake of influenza vaccine among non-health college students at Princess Nourah Bint Abdulrahman University, Riyadh, Saudi Arabia. J Public Health Res 2020;9:1856.
8. Al-Daghri N, Al-Attas O, Alokail M, Alkharfy K, Yousef M, Sabico S, *et al*. Diabetes mellitus type 2 and other chronic non-communicable diseases in the central region, Saudi Arabia (riyadh cohort 2): A decade of an epidemic. BMC Med 2011;9:76.
9. Abalkhail M, Alzahrany M, Alghamdi K, Alsoliman M, Alzahrani M, Almosned B, *et al*. Uptake of influenza vaccination, awareness and its associated barriers among medical students of a University Hospital in Central Saudi Arabia. J Infect Public Health 2017;10:644-8.
10. Salem S, Miligi E, Alanazi HH, Alanazi NA, Alanazi AA. Knowledge and limitations associated with the uptake of seasonal influenza vaccine among nursing students. Novel Res Healthcare Nurs 2019;6:471-9.
11. He D, Chiu APY, Lin Q, Cowling BJ. Differences in the seasonality of Middle East respiratory syndrome coronavirus and influenza in the Middle East. Int J Infect Dis 2015;40:15–6.
12. Alshammari TM, AlFehaid LS, AlFraih JK, Aljadhey HS. Health Care Professionals' awareness of, knowledge about and attitude to influenza vaccination. Vaccine 2014;32:5957–61.
13. Awadalla NJ, Al-Musa HM, Al-Musa KM, Asiri AM, Albariqi AA, Majrashi HM, *et al*. Seasonal influenza vaccination among primary health care workers in southwestern Saudi Arabia. Hum Vaccin Immunother 2019;16:321–6.
14. Lambert LC, Fauci AS. Influenza vaccines for the future. New England Journal of Medicine 2010;363:2036-44.
15. JJ; NKLT. Vaccines for seasonal and pandemic influenza [Internet]. The Journal of infectious diseases. U.S. National Library of Medicine. Available from: https://pubmed.ncbi.nlm.nih.gov/17163383/. [Last accessed on 2021 Dec 23].
16. Walker L, Newall A, Heywood AE. Knowledge, attitudes and practices of Australian medical students towards influenza vaccination. Vaccine 2016;34:6193–9.
17. Haridi HK, Salman KA, Basaif EA, Al-Skaibi DK. Influenza vaccine uptake, determinants, motivators, and barriers of the vaccine receipt among healthcare workers in a tertiary care hospital in Saudi Arabia. J Hosp Infect 2017;96:268–75.
18. Alshammari TM, Yusuff KB, Aziz MM, Subaie GM. Healthcare professionals' knowledge, attitude and acceptance of influenza vaccination in Saudi Arabia: A multicenter cross-sectional study. BMC Health Serv Res 2019;19:229.
19. Rogers CJ, Bahr KO, Benjamin SM. Attitudes and barriers associated with seasonal influenza vaccination uptake among public health students; A cross-sectional study. BMC Public Health 2018;18:1131.
20. Rehmani R, Memon JI. Knowledge, attitudes and beliefs regarding influenza vaccination among healthcare workers in a Saudi hospital. Vaccine 2010;28:4283–7.