

Vaccination against Influenza among Health Care Workers in Al Mashaer during Hajj 2019 (1440 H); Uptake and Barriers

Faris Maeed Alqahtani (1)

Shady A. Kamel (2)

Sami Almudarra (3)

Alaa A. Mathkour (4)

(1) Public Health Physician, Communicable Diseases Department, General Directorate of Health Affairs, Aseer Region, Saudi Arabia

(2) Preventive Medicine Consultant, Ministry of Health, Field Epidemiology Training Program, Riyadh, Saudi Arabia

(3) Public Health and Epidemiology Consultant, Gulf Center for Disease Prevention and Control, Gulf Health Council

(4) Epidemiologist. Communicable Diseases Department, General Directorate of Health Affairs, Aseer Region, Saudi Arabia

Corresponding Author

Dr. Faris Maeed Alqahtani

Public Health Physician, Communicable Diseases Department,
General Directorate of Health Affairs, Aseer Region,
Saudi Arabia

Email: dr.faris.jubran@gmail.com

Received: June 2022 Accepted: July 2022; Published: August 1, 2022.

Citation: Faris Maeed Alqahtani et al. Vaccination against Influenza among Health Care Workers in Al Mashaer during Hajj 2019 (1440 H); Uptake and Barriers. World Family Medicine. 2022; 20(8): 112-130 DOI: 10.5742/MEWFM.2022.9525128

Abstract

Background: Hajj (i.e., pilgrimage) is one of the largest mass gatherings in the globe. It brings people from around the world into small confined areas, which facilitates the transmission of droplet infections, like influenza. Saudi Arabia requires all healthcare workers (HCWs) receive the influenza vaccine since they can transmit influenza among infected patients to un-infected patients, including high-risk groups. We sought to assess the commitment of the HCWs toward vaccination as well as the reasons for vaccine refusal.

Methodology: A cross-sectional study was performed during Hajj season 2019 among HCWs in Al Mashaer, Makkah, Saudi Arabia. Anonymous, self-administered questionnaires were distributed to collect the information on demographic characteristics, vaccine uptake, and their attitudes and concerns towards receiving the vaccine.

Results: A total of 760 completed questionnaires were received, with a response rate of 95%. Males represented (58%), and the average age (Mean±SD) was 36.7±7.65 years. More than half of participants (56%) were working in the primary Health Centers (PHCs), while (44%) were working in the hospitals.

(93%) of the participants have received the vaccine before in their life. For the 2019 Hajj season, (76%) of them received the vaccine. Following the authority's recommendation (74%) was the main reason for vaccination, 24% were not vaccinated before attending this Hajj, and 25% did not intend to take the vaccine in the future. Concerns about the vaccine side effects (46%) and misconceptions regarding its efficacy (44%) were the main barriers for vaccination refusal. Logistic regression analysis showed that the other health cadres, pharmacists, and working in hospitals were independently associated with vaccine avoidance in the 2019 Hajj. While for the future intention to take the vaccine, working in the hospitals, HCWs from the northern region, other health cadres, nurses, and pharmacists were independently associated with vaccine rejection.

Conclusion: Despite the good uptake of the vaccine, there are still misconceptions about the efficacy of the vaccine and concerns about its side effects. Awareness programs are required to address those concerns, especially for younger staff, pharmacists, and other cadres. Higher vaccine uptake among healthcare workers will impact the vaccination of the general population.

Key Words: Pilgrimage, Seasonal influenza vaccine, healthcare workers, Saudi Arabia.

Introduction

Seasonal influenza is a contagious respiratory infection caused by negative-stranded RNA viruses of the Orthomyxoviridae family that circulate worldwide (1-2). Influenza viruses are classified into four different types (A, B, C, and D). Influenza A and B viruses spread and lead to seasonal epidemics of illness. Type A viruses are also categorized into subtypes based on the proteins located on the surfaces of the viruses called hemagglutinin (HA) and the neuraminidase (NA). Currently, the subtypes of influenza A viruses that circulate in human beings are A(H1N1) and A(H3N2). Influenza B viruses are classified into two lineages, identified as B/Yamagata and B/Victoria. Influenza C viruses usually cause mild illness and do not lead to human epidemics, while influenza D viruses mainly affect cattle and are not known to cause disease in humans (1).

Influenza viruses are constantly mutating. The strains can change in two different ways, Antigenic drift and Antigenic shift. Antigenic drift is minor changes in the influenza viruses' genes that also can lead to changes in the surface proteins (HA) and (NA) of the viruses. The HA and NA surface proteins are antigens, triggering the immune response of the body's immune system to produce the antibodies that can fight the infection. The mutations associated with antigenic drift constantly occur as the virus replicates. Therefore, a person becomes vulnerable to influenza illness again. Antigenic drift is the most important reason why people can get influenza more than one time, and it is also a crucial reason why the influenza vaccine structure needs to be evaluated and updated annually. Antigenic shift is a huge, significant change in an influenza A virus, resulting in new HA and/or new HA and NA proteins in influenza viruses that infect humans. The shift can result in a new influenza A subtype in humans, such as in Spring 2009, when an H1N1 virus with genes from North American swine, Eurasian swine, humans, and birds emerged to infect people and rapidly spread, resulting in a pandemic (2-3).

Persons infected with the influenza virus mostly show symptoms such as fever, fatigue, headache, chills, muscle pain, coughing, and rhinitis. Furthermore, the infection may lead to more serious complications like bronchitis, pneumonia, secondary bacterial infections, respiratory distress, and cardiovascular problems, which all may lead to death if left untreated (2). Both the common cold and influenza are respiratory illnesses with symptoms similar to each other, but they are caused by different viruses. It can be challenging to differentiate between them based on symptoms only. Generally, influenza is worse than the common cold and more severe and results in significant health problems (3).

People at any age can be affected, but some groups are more at risk than others, including children aged under five years (especially younger than two years), adults aged more than 65 years, pregnant and post-

delivery women, people with chronic medical morbidities, immunocompromised people, severely obese people, and residents of nursing homes. Among the high-risk groups, immunocompromised individuals are considered to be at a very high risk of complications from influenza (4). Health care workers also are at high risk of getting an influenza infection because of the exposure to the patients, as well as enhancing the spread of the disease to vulnerable individuals (1).

People infected with the influenza virus can spread it to others up to about one meter away, commonly by droplet mode when people with the influenza cough, sneeze, or talk (3). Also, it can be spread by hands contaminated with the influenza virus, through touching a surface or item that has the virus on it and then touching their mouth, nose, or maybe their eyes. The period from when an individual is exposed and infected with influenza to when symptoms begin (incubation period) is around two days, ranging from one to four days (1). Infected persons with influenza are most contagious in the first three or four days after their illness. Some otherwise healthy adults can infect others one day before the development of symptoms and up to one week after becoming sick. Others, especially young children and immunocompromised individuals, may possibly be able to infect others for an even more extended period (3).

The diagnosis of influenza is usually based on clinical symptoms. However, in a low activity period, the diagnosis should be considered in individuals with acute febrile respiratory symptoms who have lately spent time in settings related to an influenza outbreak. These may include organized tour groups, any mass gatherings, summer camps, cruise, and military ships, as well as their contacts (4). Laboratory tests used to confirm the presence of the influenza virus are antigen detection test, virus isolation, or detection of influenza-specific RNA by reverse transcriptase-polymerase chain reaction (RT-PCR) (1).

Rapid influenza diagnostic tests (RIDTs) can detect influenza A and B viral nucleoprotein antigens in respiratory samples and quickly (less than 15 minutes) provide results, and are mostly suitable for bedside and office use. RIDTs are significantly less sensitive compared to other types of tests like RT-PCR (false-negative results are not uncommon) (4).

The best available and effective preventive measure for influenza viruses is the vaccine, especially for the high-risk groups, and due to the changes and mutations of the antigen of the virus (Antigenic drift), it is necessary to update the vaccine on an annual basis (5). Besides that, personal protective measures and good health behaviors like hand hygiene, respiratory hygiene by wearing the mask and covering the mouth and nose when coughing and sneezing, and avoiding close contact with ill individuals can stop the spread of the viruses and prevent the influenza disease (1).

Acute respiratory tract infection is a significant health challenge during the annual Hajj season. The Saudi Arabian government has successfully controlled the spread of other diseases like meningitis and cholera during Hajj (6). Approximately 5% to 15% of the global population contract influenza and cause an average of 650,000 respiratory deaths a year (8). Influenza virus rapidly spreads in seasonal epidemics and creates a considerable economic burden associated with high health care costs and lost productivity.

More than two million Muslims from different countries gather in Makkah for Hajj each year, and according to WHO, mass gatherings expose a large number of people to infectious diseases (6-9). Al-Tawfiq et al. (10) indicate that the intense crowding that is created by limited space facilitates the transmission of airborne infections. Therefore, the Hajj, which is the largest gathering of humans in a limited area, increases vulnerability to infectious diseases and creates an optimal environment for the spread of the influenza virus (6). Literature suggests that there is a high incidence of influenza infections during the annual Muslim Hajj pilgrimage in Mecca (6-7); approximately 4-15% of pilgrims contract seasonal influenza during Hajj (11).

Therefore, the Saudi government mandates the meningococcal vaccine for all visitors during Hajj to prevent the spread of infectious diseases (12). Also, the authority strongly recommends other vaccines, including yellow fever, tetanus, diphtheria, measles, and influenza vaccines (13). In contrast, many pilgrims lack awareness about the importance of the influenza vaccine, which exposes health care workers at a higher risk for acquiring the virus from their patients during Hajj. However, there are misconceptions about the benefits of the influenza vaccine among health workers in Saudi Arabia, which acts as a barrier for fear of side effects and vaccine costs (14).

Health care workers are at high risk for contracting influenza compared to adults working in non-health settings. They acquire influenza from patients because the virus spreads through close contact with the ill person (15-16). Therefore, influenza vaccination reduces the spread of the virus and decreases absenteeism in health care settings (17).

Health care workers may also transmit influenza viruses and other respiratory infections to their patients (18). Thus, influenza vaccination for health workers improves indirect protection for patients. Also, the influenza vaccine among health care workers reduces the transmission of the virus to their family members (19). The rate of vaccination acceptance among the medical personnel is low despite the interventions that have been put in place, and has remained low at 42%. The non-acceptance of the influenza vaccines by medical personnel is due to a wide range of misconceptions and lack of knowledge about influenza infection and its risks for patients, and about the vaccine's effectiveness and safety. The non-recipients may not know their risk of getting influenza (20).

Besides, according to Alshammari et al. (21), there are cases in which some medical personnel believe that vaccines increase the chances of a person getting influenza. The lower awareness about the importance of immunization is responsible for the poor uptake rates of vaccines among healthcare workers.

Petek et al. (22) explain that the primary motivators for vaccination coverage were: awareness of the high risk of infection at the workplace, self-protection, and protection of family members and co-workers. Notably, a definite link was found between the vaccination, advanced age, and belief in the effectiveness of influenza, while a negative association was found between the nurses' profession and vaccination.

Lee et al. (23) noted that achieving a high vaccine uptake in the early stages of a medical career might, therefore, improve subsequent influenza vaccine uptake. Alenazi et al. (18) indicate that medical personnel reject vaccines because they are wary of the adverse effects of the vaccine. However, the medical personnel who accept to be immunized do so to enhance their protection and that of patients.

According to Kuster et al. (15), the rates of infection are low among medical practitioners who have been vaccinated. The prevention of influenza among healthcare workers can only happen if they follow the guidelines that govern the immunization process. Sočan et al. agreed with Alenazi, that providing education on the efficacy and safety of vaccines should be one of the priority public health measures taken to improve knowledge and eliminate misconceptions and attitudinal barriers regarding immunization in health care workers (18-19).

Influenza vaccine hesitancy among health care workers increases the prevalence of seasonal flu during the Hajj. Anti-vaccine campaigns, and lack of motivation to receive the vaccine hinder the uptake of the influenza vaccine (23-24). Many health workers during Hajj do not have correct information concerning the influenza vaccines. According to Badahdah et al. (7), the lack of awareness limits the knowledge that people have towards the immunization program. Also, the shortage of vaccines or non-availability is one of the reasons for poor uptake among health professionals (25).

This study was conducted during the Hajj season in 2019 / 1440 H in Al Mashaer, Holy Makkah, Saudi Arabia, aiming to assess the uptake rates of influenza vaccine among healthcare workers, their commitment toward the vaccine before attending the Hajj, and to determine the barriers behind not receiving the vaccine.

Methodology

This is a cross-sectional study that was carried out during the period between August 1st and 15th, 2019, among HCWs in Al Mashaer, Makkah, Saudi Arabia. The study was conducted in all primary health centers of Mena and Arafat, as well as all hospitals of Al Mashaer (4 in Mena and 4 in Arafat).

The eligible participants were HCWs (including all physicians, nurses, pharmacists, and other staff who served pilgrims) who were employed in Saudi Arabia and working in Al Mashaer during the Hajj 2019 and who agreed to participate and provide information.

We constructed and used an anonymous self-administered questionnaire in both Arabic and English languages based on thorough review of relevant literature and previous research findings (7, 18, 20, 21, 26). The questionnaire included participants' demographics (age, gender, nationality, region, profession, chronic comorbidities if any, working experience, and Hajj participating times), knowledge about the frequency of vaccination and the perceived effectiveness, whether the participants received the influenza vaccine in the past and also for this Hajj season particularly, motivations for getting vaccinated and the barriers behind not getting the vaccine, and willingness to take the vaccine in the future.

The questionnaire was pilot-tested on a convenience sample of HCWs with research experience to ensure clarity and simplicity of administration. The main investigator and well-trained team were in charge of distributing the questionnaires throughout visits to the participating hospitals and PHCs.

The Institutional Review Board (IRB) of King Fahad Medical City reviewed and approved the study protocol and the questionnaire, with approval number 19-358E.

Data entry and analysis was performed using Statistical Package for Social Sciences (IBM, SPSS, version 23) and Microsoft Excel 360. Descriptive statistics were performed using counts and percentages for categorical variables and using mean \pm standard deviation for continuous variable. Chi-square test or Fisher's exact test were applied to compare categorical variables, and a binary logistic regression was used to examine associations between vaccination practice and other independent variables. A p-value of ≤ 0.05 was considered statistically significant.

Results

Out of 800 questionnaires that were distributed, 760 were returned for a response rate of 95%. Males represented 57.7% (n = 432), and the average age of the included participants was 36.7 ± 7.65 years, ranging from 22 to 67 (median 35) years. Participants were categorized based on age into five main groups: under 25 (2.91%), 26 – 35 (49.4%), 36 – 45 (33.7%), 46 – 55 (11.5%) and 56 years

or higher (2.51%). 55.8% (n=424) of the participants were working in the PHCs while the remaining 44.2% (n=336) were working in the hospitals. Participants from Central and Western regions of Saudi Arabia represented 30.9% and 34.1%, respectively. Participants from the Southern region represented 6.33%. Approximately three quarters of the included participants were Saudis (73.8%). Nurses represented 48.6% while physicians and pharmacists represented 29.8% and 12.5%, respectively. Half of the participants had more than 10 years of experience (53.6%). Results showed that 63.2% of the included HCWs previously worked as HCWs during the Hajj. Hajj participating times were categorized into four main groups: less than 5 times (66.5%), 6 - 10 (24.3%), 11 – 15 (6.7%), more than 15 times (2.5%) (Table 1).

Only 6.22% of the included HCW had medical conditions that required treatment. Medical conditions included diabetes (2.77%), asthma (0.66%), hypertension (3.3%) and heart problems (0.13%) (Table 2).

Most of the included HCWs received influenza vaccine at least one time before (93.3%). Being a physician and non-Saudi HCW, are significantly increased in vaccination compliance ($P < 0.001$, $P = 0.006$) respectively. There was no significant difference in vaccination rate among age groups. Then, the age regrouped into Two main groups: less than 35 years (52.3%) and older than 35 years (47.3%). With respect to those groups, vaccination compliance was more in the participants older than 35 years ($P = 0.034$).

Three quarters (76%) of the included HCW were vaccinated for this specific Hajj season. Older than 35 years, being a physician and Non-Saudi HCWs, are significantly increased in vaccination compliance ($P = 0.008$, $P < 0.001$, $P < 0.001$) respectively. On the other hand, 31.5% of the participants who were working in the hospitals did not receive the vaccine for this Hajj season ($P < 0.001$) (Table 3).

The majority of the included HCWs strongly agreed (35.9%) or agreed (45%) that influenza vaccine is effective. However, 23.7% of the participants aged less than 35 years, 22.9% of the Saudi participants, and 30.4% of the other HCWs were either unsure or disagreed ($P < 0.001$). In addition, 95.5% of the physicians ($P < 0.001$), 94.9% of the Non-Saudi HCWs ($P < 0.001$), 87.8% of the participants aged older than 35 ($P = 0.001$) and 89.4% of the HCWs who have chronic morbidities ($P < 0.001$) significantly agreed or strongly agreed that all HCWs should get influenza vaccine. 75.3% of the participants responded with "Yes" when asked whether they would have an influenza vaccine in the future. (Table 4).

The most common reason for ever receiving influenza vaccine was the recommendations of Saudi MOH (73.9%). Other reasons included self-protection (64.6%) and avoiding sickness during Hajj (60.7%). The least common reason was to avoid taking sick leave (22.3%) (Figure 1).

The most common reason for not receiving influenza vaccine was the concerns regarding side effects (46.2%). Other reasons included wrong perception regarding the effectiveness of the vaccine (44.2%) and the risk of getting flu through the vaccine (32.7%) (Figure 2).

Regarding the frequency of influenza vaccine, the correct answer (every year) was selected by 75% (n = 546) of the HCWs who participated in the study. Physicians comprised the highest percentage (85.9%) followed by nurses and pharmacists (74.3% and 73.3%, respectively). On the other hand, 55% of other HCWs did not answer this question correctly (P <0.001). Furthermore, one-third of the participants from the hospitals answered incorrectly (P <0.001).

The correct effective duration for the vaccine (one year) was chosen by 77.1% (n = 549) of the participating HCWs. Female gender (82.7% P = 0.017), Non-Saudi HCWs (91.5% P <0.001) and physician (90.2% P <0.001) represent the highest percentage among all participants (Table 5).

Table 6 shows the results of the predicted probability of the binary logistic regression analysis for those who did not receive the vaccine. Refuse to take the vaccine at all was significantly higher among the pharmacists compared to other HCWs (OR=11.07; 95%CI: 2.47- 49.4; P= 0.002). Regarding the vaccination status for the current Hajj season, working in a hospital (OR=1.9;95%CI:1.3-2.8, P=0.001) was a significant factor for not taking the vaccine. Furthermore, other HCWs (OR=4.3;95%CI:1.9-9.4, P<0.001), Pharmacists (OR=2.7;95%CI:1.3-5.8, P=0.008) were more likely not to take the vaccine for this Hajj compared to other HCWs (physician and nurses). On the other hand, Non-Saudi participants (OR=0.48;95%CI:0.24-0.96, P=0.038) were significantly more compliant to receive the vaccine for the current Hajj season. For the future intention to take the vaccine, the participants who were working in the hospitals (OR=1.5;95%CI:1.09-2.3, P=0.015) and the HCWs from the northern region (OR=1.8;95%CI:1.2-3.4;P=0.042) significantly rejected the thought of taking the vaccine in the future. Among the professions, other HCWs (OR=4.9;95%CI:2.1-11, P<0.001), pharmacists (OR=2.7;95%CI:1.2-6;P=0.011) and nurses (OR=2.4;95%CI:1.2-4.6;P=0.010) were also more likely to refuse the vaccine in the future compared to the physicians.

Table 1: Demographic and occupational characteristics of the included participants during Hajj season 2019 (1440 H), Makkah, Saudi Arabia.

Characteristics	No. (%)
Working place	
• PHC	424 (55.8)
• Hospital	336 (44.2)
Gender:	
• Male	432 (57.1)
• Female	325 (42.9)
Age Groups:	
• Under 25	22 (2.91)
• 26 – 35	374 (49.4)
• 36 – 45	255 (33.7)
• 46 – 55	87 (11.5)
• 56 and older	19 (2.51)
• Mean±SD	36.7±7.65
Nationality:	
• Saudi	558 (73.8)
• Non-Saudi	198 (26.2)
Region:	
• Central	225 (30.9)
• Northern	96 (13.2)
• Southern	46 (6.33)
• Eastern	112 (15.4)
• Western	248 (34.1)
Profession:	
• Physician	226 (29.8)
• Nurse	369 (48.6)
• Pharmacist	95 (12.5)
• Others	69 (9.09)
Experience:	
• < 10 years	350 (46.4)
• ≥ 10 years	405 (53.6)
First time working as a health care worker during Hajj	
• Yes	279 (36.8)
• No	480 (63.2)
Number of times (categorical)	
• Less than 5 times	298 (66.5)
• 6 - 10 times	109 (24.3)
• 11 - 15 times	30 (6.70)
• More than 15 times	11 (2.46)

Table 2: Medical comorbidities reported by the included HCW during Hajj season 2019 (1440 H), Makkah, Saudi Arabia

Characteristics	No. (%)
Ongoing medical condition that requires treatment	
• Yes	47 (6.22)
• No	709 (93.8)
Associated comorbidity	21 (2.77)
• Diabetes	21 (2.77)
• Asthma	5 (0.66)
• Hypertension	25 (3.30)
• Heart problems	1 (0.13)

Table 3a: Vaccination status among the participants according to their demographic characteristics during Hajj season 2019 (1440 H), Makkah, Saudi Arabia.

		Have you ever had influenza vaccine?					Are you vaccinated for this specific Hajj season?				
		Yes		No		P Value	Yes		No		P Value
		No.	%	No.	%		No.	%	No.	%	
Age group (years)	≤35	362	91.4	34	8.6	0.034*	286	72.2	110	27.8	0.008*
	>35	343	95.3	17	4.7		288	80.4	70	19.6	
Gender	Male	402	93.3	29	6.7	0.980	329	76.3	102	23.7	0.800
	Female	303	93.2	22	6.8		244	75.5	79	24.5	
Chronic diseases	Yes	46	97.9	1	2.1	0.200	36	76.6	11	23.4	0.930
	No	659	93.1	49	6.9		537	76.1	169	23.9	
Nationality	Saudi	512	91.8	46	8.2	0.006*	396	71.1	161	28.9	<0.001*
	Non-Saudi	192	97.5	5	2.5		176	89.8	20	10.2	
Region	Central	212	94.2	13	5.8	0.940	178	79.1	47	20.9	0.190
	Northern	87	91.6	8	8.4		75	78.1	21	21.9	
	Southern	43	93.5	3	6.5		30	68.2	14	31.8	
	Eastern	105	93.8	7	6.3		90	81.1	21	18.9	
	Western	232	93.5	16	6.5		180	72.6	68	27.4	

* Statistically Significant

Table 3b: Vaccination status among the participants according to their occupational characteristics during Hajj season 2019 (1440 H), Makkah, Saudi Arabia

	Have you ever had influenza vaccine?						Are you vaccinated for this specific Hajj season?				
	Yes		No		P value	Yes		No		P value	
	No.	%	No.	%		No.	%	No.	%		
Working place	PHCs	396	93.6	27	6.4	0.67	345	81.9	76	18.1	<0.001*
	Hospitals	312	92.9	24	7.1		230	68.5	106	31.5	
Profession	Physician	219	97.3	6	2.7	<0.001*	196	87.5	28	12.5	<0.001*
	Nurse	344	93.2	25	6.8		281	76.4	87	23.6	
	Pharmacist	80	84.2	15	15.8		63	66.3	32	33.7	
	Others	64	92.8	5	7.2		34	49.3	35	50.7	
Experience (years)	<10	323	92.3	27	7.7	0.20	265	75.7	85	24.3	0.83
	>10	382	94.6	22	5.4		307	76.4	95	23.6	
First time in Hajj	Yes	259	92.8	20	7.2	0.71	210	75.3	69	24.7	0.69
	No	448	93.5	31	6.5		365	76.5	112	23.5	

* Statistically Significant

Table 4a: Attitudes of health care workers towards influenza vaccination according to their demographic characteristics during Hajj season 2019 Makkah, Saudi Arabia

		The influenza vaccine is effective										P value
		Strongly Agree		Agree		Unsure		Disagree		Strongly Disagree		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Age groups (years)	≤35	118	29.8	184	46.5	69	17.4	17	4.3	8	2.0	<0.001*
	>35	153	42.4	157	43.5	38	10.5	12	3.3	1	0.3	
Chronic morbidities	Yes	24	51.1	16	34.0	3	6.4	3	6.4	1	2.1	0.09
	No	247	34.8	325	45.8	103	14.5	26	3.7	8	1.1	
Gender	Male	174	40.3	176	40.7	61	14.1	16	3.7	5	1.2	0.055
	Female	98	30.2	164	50.5	46	14.2	13	4.0	4	1.2	
Nationality	Saudi	176	31.5	254	45.5	96	17.2	23	4.1	9	1.6	<0.001*
	Non-Saudi	96	48.5	87	43.9	9	4.5	6	3.0	0	0.0	
Region	Central	83	36.9	104	46.2	31	13.8	5	2.2	2	0.9	0.43
	Northern	32	33.3	44	45.8	18	18.8	2	2.1	0	0.0	
	Southern	23	50.0	14	30.4	5	10.9	3	6.5	1	2.2	
	Eastern	37	33.0	49	43.8	22	19.6	3	2.7	1	0.9	
	Western	89	35.9	112	45.2	31	12.5	12	4.8	4	1.6	

Table 4a: Attitudes of health care workers towards influenza vaccination according to their demographic characteristics during Hajj season 2019 Makkah, Saudi Arabia (continued)

		All health care workers should get influenza vaccine:										P value
		Strongly Agree		Agree		Unsure		Disagree		Strongly Disagree		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Age Groups (years)	≤35	145	36.6	182	46.0	46	11.6	15	3.8	8	2.0	0.001*
	>35	177	49.0	140	38.8	29	8.0	15	4.2	0	0.0	
Gender	Male	200	46.3	171	39.6	38	8.8	19	4.4	4	0.9	0.120
	Female	122	37.5	151	46.5	37	11.4	11	3.4	4	1.2	
Chronic morbidities	Yes	29	61.7	13	27.7	2	4.3	3	6.4	0	0.0	0.040*
	No	292	41.2	310	43.7	72	10.2	27	3.8	8	1.1	
Nationality	Saudi	200	35.8	255	45.7	70	12.5	25	4.5	8	1.4	<0.001*
	Non-Saudi	122	61.6	66	33.3	5	2.5	5	2.5	0	0.0	
Region	Central	100	44.4	92	40.9	24	10.7	7	3.1	2	0.9	0.070
	Northern	42	43.8	35	36.5	18	18.8	1	1.0	0	0.0	
	Southern	23	50.0	16	34.8	4	8.7	3	6.5	0	0.0	
	Eastern	46	41.1	48	42.9	13	11.6	4	3.6	1	0.9	
	Western	101	40.7	117	47.2	13	5.2	12	4.8	5	2.0	

* Statistically Significant

Table 4a: Attitudes of health care workers towards influenza vaccination according to their demographic characteristics during Hajj season 2019 Makkah, Saudi Arabia (continued)

		Would you have an influenza vaccine in the future?				P value
		Yes		No		
		No.	%	No.	%	
Working place	PHCs	335	79.0%	89	21.0%	0.007*
	Hospitals	237	70.5%	99	29.5%	
Profession	Physician	201	88.9%	25	11.1%	<0.001*
	Nurse	264	71.5%	105	28.5%	
	Pharmacist	68	71.6%	27	28.4%	
	Others	38	55.1%	31	44.9%	
Experience (years)	< 10	251	71.7%	99	28.3%	0.025*
	> 10	319	78.8%	86	21.2%	
First time in Hajj	Yes	208	74.6%	71	25.4%	0.740
	No	363	75.6%	117	24.4%	

* Statistically Significant

Table 4b: Attitudes of health care workers towards influenza vaccination according to their occupational characteristics during Hajj season 2019, Makkah, Saudi Arabia

		The influenza vaccine is effective										P value
		Strongly Agree		Agree		Unsure		Disagree		Strongly Disagree		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Working place	PHCs	177	41.7	176	41.5	48	11.3	16	3.8	7	1.7	0.001*
	Hospitals	96	28.6	166	49.4	59	17.6	13	3.9	2	0.6	
Profession	Physician	118	52.2	93	41.2	9	4.0	5	2.2	1	0.4	<0.001*
	Nurse	107	29.0	175	47.4	65	17.6	16	4.3	6	1.6	
	Pharmacist	30	31.6	43	45.3	19	20.0	2	2.1	1	1.1	
	Others	17	24.6	31	44.9	14	20.3	6	8.7	1	1.4	
Experience (years)	≤10	120	34.3	159	45.4	51	14.6	14	4.0	6	1.7	0.72
	>10	150	37.0	182	44.9	55	13.6	15	3.7	3	0.7	
First time in Hajj	Yes	99	35.5	135	48.4	35	12.5	7	2.5	3	1.1	0.40
	No	174	36.3	206	42.9	72	15.0	22	4.6	6	1.3	

* Statistically Significant

Table 4b continued

		All health care workers should get influenza vaccine:										P value
		Strongly Agree		Agree		Unsure		Disagree		Strongly Disagree		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Working place	PHCs	213	50.2	161	38.0	26	6.1	19	4.5	5	1.2	<0.001*
	Hospitals	110	32.7	163	48.5	49	14.6	11	3.3	3	0.9	
Profession	Physician	149	65.9	67	29.6	5	2.2	5	2.2	0	0.0	<0.001*
	Nurse	117	31.7	183	49.6	47	12.7	17	4.6	5	1.4	
	Pharmacist	38	40.0	41	43.2	13	13.7	2	2.1	1	1.1	
	Others	18	26.1	33	47.8	10	14.5	6	8.7	2	2.9	
Experience (years)	≤10	143	40.9	150	42.9	38	10.9	14	4.0	5	1.4	0.75
	>10	176	43.5	174	43.0	36	8.9	16	4.0	3	0.7	
First time in Hajj	Yes	124	44.4	112	40.1	33	11.8	8	2.9	2	0.7	0.31
	No	199	41.5	212	44.2	41	8.5	22	4.6	6	1.3	

* Statistically Significant

Table 4b continued

		Would you have an influenza vaccine in the future?					P value
		Yes		No			
		No.	%	No.	%		
Working place	PHCs	335	79.0%	89	21.0%	0.007*	
	Hospitals	237	70.5%	99	29.5%		
Profession	Physician	201	88.9%	25	11.1%	<0.001*	
	Nurse	264	71.5%	105	28.5%		
	Pharmacist	68	71.6%	27	28.4%		
	Others	38	55.1%	31	44.9%		
Experience (years)	<10	251	71.7%	99	28.3%	0.025*	
	>10	319	78.8%	86	21.2%		
First time in Hajj	Yes	208	74.6%	71	25.4%	0.740	
	No	363	75.6%	117	24.4%		

* Statistically Significant

Table 5a: Knowledge of participants regarding the Influenza vaccine according to their demographic characteristics during Hajj season 2019 (1440 H), Makkah, Saudi Arabia.

		How often do you think you need a flu vaccine?								P value
		Every six months		Every year		Once in a lifetime		When it is mandatory		
		No.	%	No.	%	No.	%	No.	%	
Age Groups (years)	<35	22	5.9	273	73.0	10	2.7	69	18.4	0.170
	>35	27	7.7	271	77.2	7	2.0	46	13.1	
Gender	Male	35	8.4	303	73.0	12	2.9	65	15.7	0.160
	Female	15	4.8	240	77.4	5	1.6	50	16.1	
Chronic morbidities	Yes	1	2.2	39	84.8	1	2.2	5	10.9	0.410
	No	47	6.9	506	74.5	16	2.4	110	16.2	
Nationality	Saudi	37	7.0	376	70.9	15	2.8	102	19.2	<0.001*
	Non-Saudi	12	6.2	168	86.6	2	1.0	12	6.2	
Region	Central	16	7.3	164	75.2	5	2.3	33	15.1	0.830
	Northern	6	6.6	70	76.9	1	1.1	14	15.4	
	Southern	1	2.3	30	69.8	1	2.3	11	25.6	
	Eastern	9	8.5	78	73.6	1	0.9	18	17.0	
	Western	16	6.7	178	74.8	8	3.4	36	15.1	

* Statistically Significant

Table (5b): Knowledge of participants regarding the Influenza vaccine according to their occupational characteristics during Hajj season 2019 (1440 H), Makkah, Saudi Arabia

		How long do you think the vaccine is effective?								P value
		For life		For 1 year		For 2 years		For 5 years		
		No.	%	No.	%	No.	%	No.	%	
Age Groups (years)	<35	21	5.8	267	73.8	54	14.9	20	5.5	0.170
	>35	16	4.6	279	80.4	41	11.8	11	3.2	
Gender	Male	24	6.0	293	72.7	66	16.4	20	5.0	0.010*
	Female	13	4.2	253	82.7	29	9.5	11	3.6	
Chronic morbidities	Yes	4	9.1	36	81.8	4	9.1	0	0.0	0.250
	No	33	5.0	512	77.0	91	13.7	29	4.4	
Nationality	Saudi	34	6.6	375	72.3	82	15.8	28	5.4	<0.001*
	Non-Saudi	2	1.1	173	91.5	12	6.3	2	1.1	
Region	Central	8	3.8	173	81.2	25	11.7	7	3.3	0.070
	Northern	6	6.7	66	73.3	14	15.6	4	4.4	
	Southern	2	4.8	27	64.3	8	19.0	5	11.9	
	Eastern	7	6.7	73	70.2	22	21.2	2	1.9	
	Western	13	5.6	185	79.4	24	10.3	11	4.7	

* Statistically Significant

Table 5b: Knowledge of participants regarding the Influenza vaccine according to their occupational characteristics during Hajj season 2019 (1440 H), Makkah, Saudi Arabia

		How often do you think you need a flu vaccine?								
		Every six months		Every year		Once in a lifetime		When it is mandatory		P value
		No.	%	No.	%	No.	%	No.	%	
Working place	PHCs	26	6.4	332	81.4	10	2.5	40	9.8	<0.001*
	Hospitals	24	7.5	214	66.9	7	2.2	75	23.4	
Profession	Physician	17	7.7	189	85.9	0	0.0	14	6.4	<0.001*
	Nurse	20	5.7	260	74.3	11	3.1	59	16.9	
	Pharmacist	6	6.7	66	73.3	1	1.1	17	18.9	
	Others	7	10.4	30	44.8	5	7.5	25	37.3	
Experience (years)	≤ 10	23	6.9	241	72.6	8	2.4	60	18.1	0.51
	> 10	27	6.9	301	76.8	9	2.3	55	14.0	
First time in Hajj	Yes	22	8.4	199	75.7	6	2.3	36	13.7	0.49
	No	28	6.0	347	74.8	11	2.4	78	16.8	

* Statistically Significant

Table 5b continued

		How long do you think the vaccine is effective?								P value
		For life		For a year		For 2 years		For 5 years		
		No.	%	No.	%	No.	%	No.	%	
Working place	PHCs	16	4.0	318	79.7	54	13.5	11	2.8	0.030*
	Hospitals	21	6.7	231	73.8	41	13.1	20	6.4	
Profession	Physician	3	1.4	194	90.2	16	7.4	2	0.9	<0.001*
	Nurse	14	4.0	268	77.5	50	14.5	14	4.0	
	Pharmacist	10	11.5	57	65.5	14	16.1	6	6.9	
	Others	10	15.9	29	46.0	15	23.8	9	14.3	
Experience (years)	≤ 10	18	5.5	252	77.1	44	13.5	13	4.0	0.950
	> 10	19	5.0	293	76.9	51	13.4	18	4.7	
First time in Hajj	Yes	14	5.4	204	78.8	35	13.5	6	2.3	0.240
	No	22	4.9	345	76.3	60	13.3	25	5.5	

* Statistically Significant

Table 6a: Logistic regression analysis for the participants who did not receive the vaccine according to their demographic characteristics during Hajj season 2019 (1440 H), Makkah, Saudi Arabia.

Variable	Vaccinated before		Vaccinated for this Hajj		Future intention to get the vaccine	
	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value
Age Groups						
≤35 years	Ref	0.58	Ref	0.46	Ref	0.73
>35 years	0.81(0.38-1.7)		0.84(0.53-1.3)		0.92 (0.59-1.4)	
Gender		0.81		0.37		0.62
Male	Ref		Ref		Ref	
Female	0.916(0.44-1.8)		1.2(0.79-1.8)		1.1(0.73-1.6)	
Chronic morbidities		0.48		0.51		0.88
Yes	Ref		Ref		Ref	
No	2.09(0.26-16.6)		0.75(0.32-1.7)		1.07(0.43-2.6)	
Nationality		0.77		0.038*		0.16
Saudi	Ref		Ref		Ref	
Non-Saudi	1.20(0.33-4.4)		0.48 (0.24-0.96)*		0.61(0.30-1.2)	
Region		0.71		0.16		0.042*
Central	Ref		Ref		Ref	
Northern	1.84(0.70-4.8)		1.3(0.70-2.4)		1.8(1.02-3.4)*	
Southern	1.4(0.27-3.9)		1.8(0.84-3.8)		1.2(0.85-2.8)	
Eastern	0.85(0.30-2.3)		0.72(0.38-1.3)		1.01(0.56-1.8)	
Western	1.05(0.47-2.3)		1.3(0.84-2.1)		1.1(0.70-1.7)	

OR, Odd ratio; 95%CI, Confidence interval; *Significant P-value.

Table 6b: Logistic regression analysis for the participants who did not receive the vaccine according to their occupational characteristics during Hajj season 2019 (1440 H), Makkah, Saudi Arabia

Variable	Vaccinated before		Vaccinated for this Hajj		Future intention to get the vaccine	
	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value
Work Place PHCs Hospitals	Ref 1.33(0.69-2.5)	0.38	Ref 1.94(1.3-2.8)*	0.001*	Ref 1.5(1.09-2.3)*	0.015*
Profession Physician Nurses Pharmacist Others	Ref 3.85(0.94-15.8) 11.07(2.47-49.4)* 3.6(0.64-20.4)	0.002*	Ref 1.5(0.79-2.8) 2.7(1.3-5.8)* 4.3(1.9-9.4)*	0.008* <0.001*	Ref 2.4(1.2-4.6)* 2.7(1.2-6)* 4.9(2.1-11)*	0.010* 0.011* <0.001*
Experience ≤ 10 years > 10 years	Ref 0.85(0.41-1.7)	0.66	Ref 1.08(0.71-1.6)	0.69	Ref 0.77(0.51-1.7)	0.23
First Hajj Yes No	Ref 0.82(0.41-1.6)	0.57	Ref 0.96(0.46-1.6)	0.88	Ref 1.2(0.80-1.8)	0.37

OR, Odd ratio; 95%CI, Confidence interval; *Significant P-value.

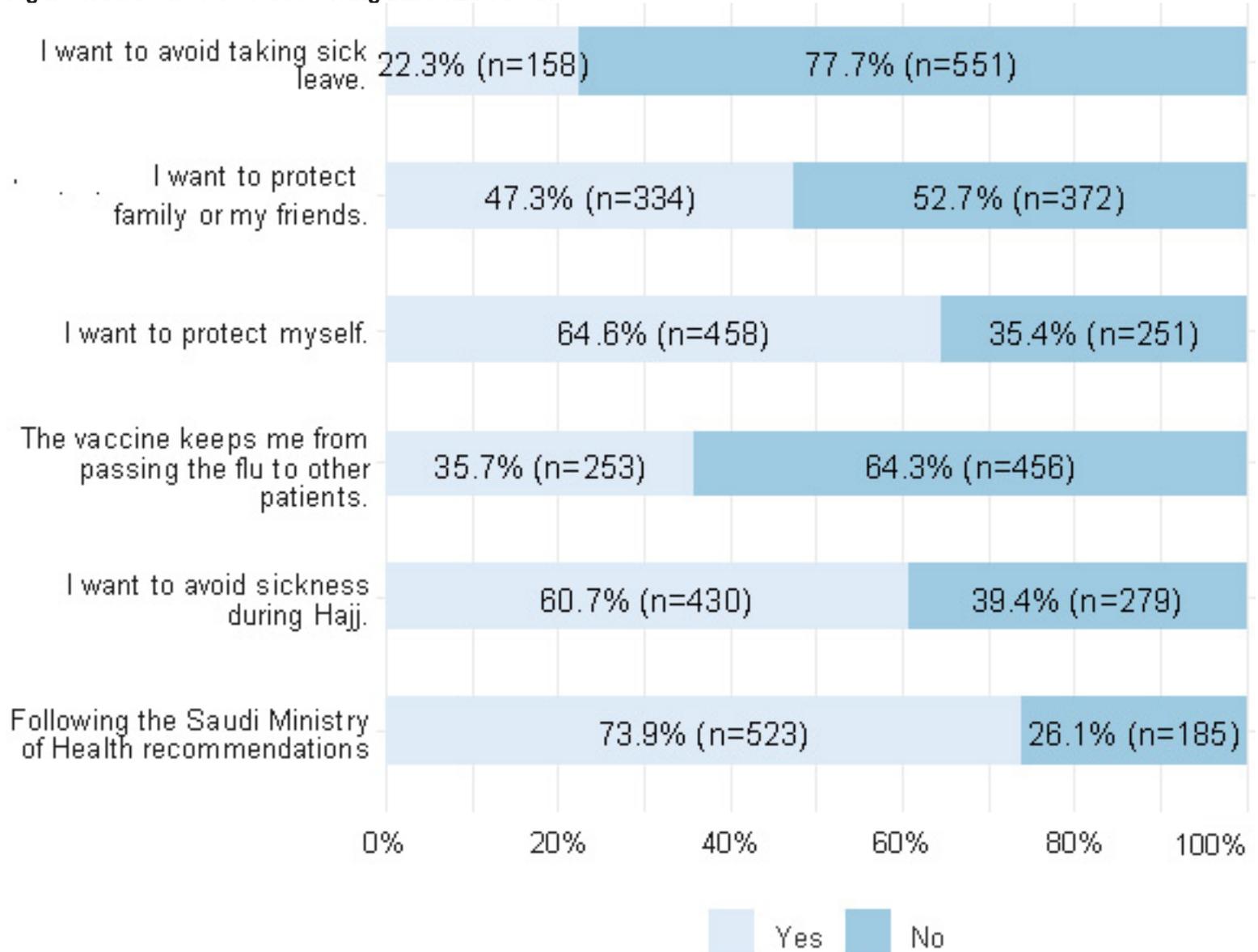
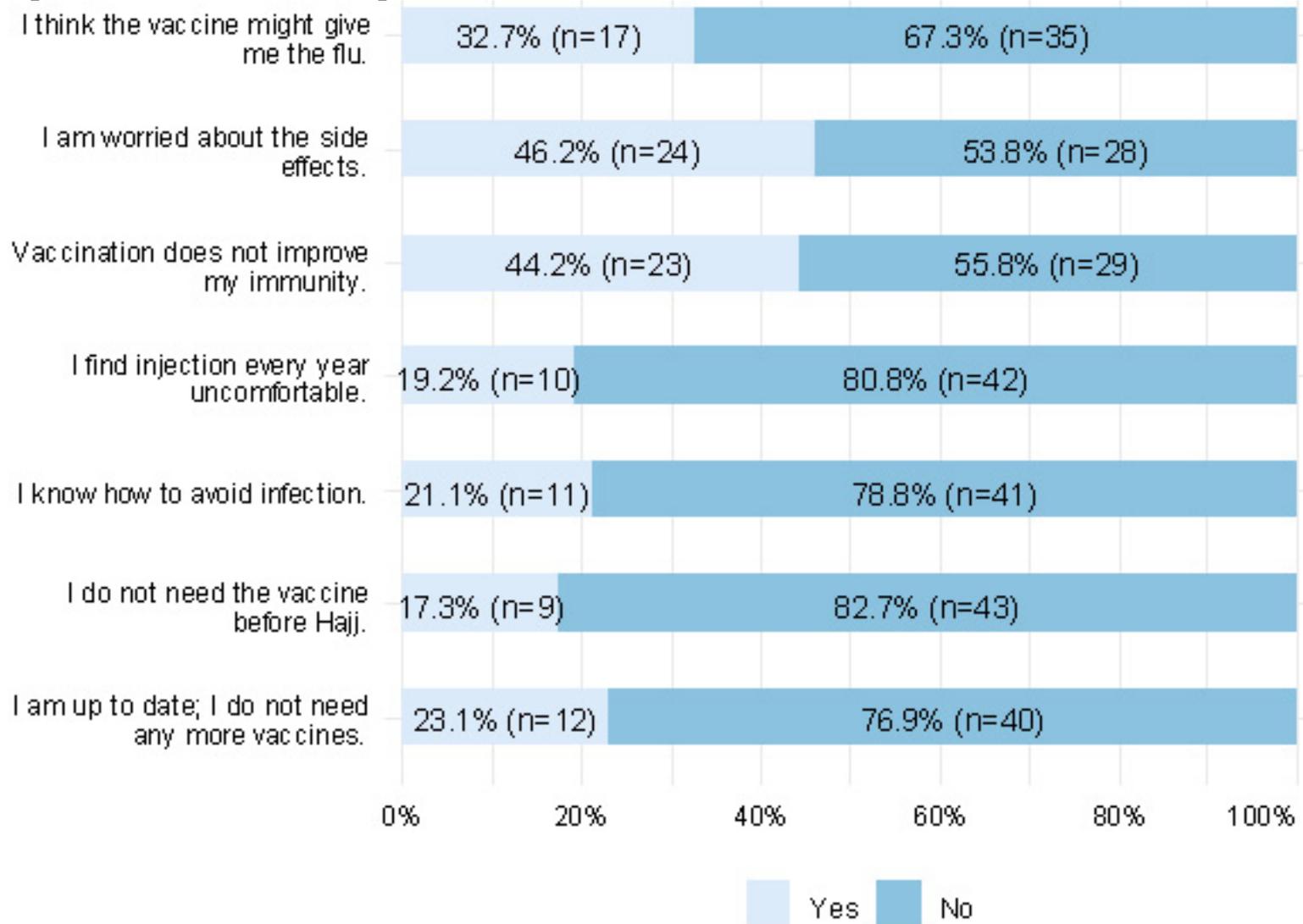
Figure 1: Reasons for ever receiving influenza vaccine

Figure 2: Reasons for not receiving influenza vaccine

Discussion

This study was conducted among the healthcare workers in Almashaer Primary Health Centers and Hospitals in Holy Makkah, Saudi Arabia, during the Hajj season 2019, which holds the biggest annual mass gatherings of people around the globe.

Our study shows that three-quarters of the participants have received the vaccine for this Hajj season. This vaccination rate is a little higher than the previous study (69%), which was conducted by Badadah et al. in Hajj season 2017 (7). In particular, the physicians represented the highest vaccination rate at 87.5% among the HCW. Furthermore, physicians were more committed to the vaccine; we found that 97.5% of them were vaccinated before in their life. In contrast to other study results conducted by Heradi et al. among the healthcare workers in a tertiary care hospital in Saudi Arabia, 2017 which revealed that the nurses were more willing to receive the vaccine compared to other HCWs (26).

Despite the importance of the influenza vaccine, especially for this occupational group, who are expected to be vaccinated even when not serving at Hajj one quarter of participants in this study reported not receiving the vaccine before attending Hajj. Half of the other healthcare cadres, including the administrative officers and one-third of the pharmacists, were among this quarter. Also, we found that one-third of the HCWs who were working in hospitals were also not vaccinated for the current Hajj season. The lower uptake of the vaccine among them is a big concern. A cross-sectional study was conducted by Alabbad et al. in a tertiary hospital in Riyadh, Saudi Arabia, to determine the reasons for influenza vaccine hesitancy during the 2015–2016 winter season. The prevalence of vaccine hesitancy was 18% among the participants, lower than what we found in our study results (27).

Age is a significant factor influencing the uptake of vaccination among healthcare workers. As shown in the results, vaccination compliance improved with the age of the healthcare personnel. 95% of those aged more than 35 years were vaccinated before in their life. Furthermore, 80% of them were vaccinated before attending this Hajj compared to those aged less than 35 years. These results are (much) the same to the findings of Asma et al., who also found a positive relevance between rising age of healthcare workers and the likelihood of vaccination uptake (39). The relationship between uptake of the vaccine and the age of healthcare workers implies that the older staff have a better awareness of the benefits of the vaccine (18). Moreover, old age could be a risk factor for the complications of influenza disease, another possible explanation (26).

One of the main reasons among the participants for getting the vaccine was to follow the Ministry of Health recommendations (74%). The health authorities in Saudi Arabia adopted a mandatory vaccination policy for all healthcare workers in all settings. Besides, a consequence

was unvaccinated staff were not permitted to participate in the Hajj as well as not receiving the incentives (26). Yet, relying on mandatory immunization policy to reach a sufficient level of the vaccine uptake among healthcare workers does not revoke the need to understand and deal with other reasons that improve voluntary vaccine uptake. Another reason for receiving the vaccine was to protect themselves and avoid sickness during Hajj (more than 60%). The same reason was demonstrated by Mytton et al., who found that protecting healthcare workers from the disease was an important factor in receiving the vaccine (40). Other cited reasons to receive the vaccine were:

- prevent passing the infection to others,
 - protect my friends and family’;
- these reasons were also explained by other studies (20, 26).

The majority of the HCWs in this study agreed that the influenza vaccine is effective, and all HCW should be vaccinated. Likewise, this is similar to what Alshammari et al. found regarding the positive attitude regarding the influenza vaccine (28). However, 25% of the participants in our study responded with “No” when asked whether they would have an influenza vaccine in the future. Also, Rehmani et al. found that two-thirds of the participants did not intend to take the vaccine for the following year (20). This attitude is alarming and needs more action to be avoided. The non-receipt of the influenza vaccine by HCWs discloses a wide range of misconceptions and lack of knowledge about the vaccine. 70% of those vaccine rejecters in our study did not know that the vaccine is given annually. Furthermore, they had some concerns regarding vaccine efficacy, and 46% of them were afraid of the side effects of the vaccine.

Cobos Muñoz et al. (27) conducted a systematic review in some low and middle-income countries located in Asia, Africa, South America, and Oceania regarding the concerns of vaccination. It revealed that the idea of possible harm caused by the vaccine and the belief that the vaccine can cause severe side effects were the most frequently reported barriers, like the reasons mentioned in our study.

Good knowledge regarding vaccination against influenza is not only necessary for sustaining good vaccine uptake, but it is also important for the commitment of the healthcare workers to recommend the vaccine to the susceptible target high-risk groups. Vaccination of healthcare workers, together with their belief in the effectiveness of the vaccine, was associated with good coverage in their patients (26). Healthcare workers have often been considered as the main supporters for vaccination and the most significant source of information regarding the vaccine for the general population (29).

This study has several strengths. It was conducted in all Al Mashaer primary health centers and hospitals, with different professionals from several professions. Therefore, this study clarifies the vaccination coverage among different occupations. Also, the large sample size

and the high response rate are considerable strengths of our study. On the other hand, the use of self-reporting for data gathering from the participants could be a limitation. The correctness of the responses, therefore, depends on each participant's willingness, and were not subject to independent verification due to anonymity.

Conclusion

There was a good uptake of the influenza vaccine during the last Hajj season in 2019 before the COVID-19 pandemic. The main reason for getting the vaccine was following the authority's guidelines, which meant adopting mandatory vaccination policy. However, there are still misconceptions about the efficacy of the vaccine and concerns about its side effects, which were the main barriers for not receiving the vaccine. Awareness programs are required to address the concerns for those who are less compliant to receive it, especially younger staff, pharmacists, other cadres, and encourage them to get vaccinated. Ultimately, higher vaccine uptake among healthcare workers will impact vaccination of the general population as well.

Recommendation:

Based on findings of the present study, it is recommended to continue the educational programs and campaigns for all healthcare workers that emphasize the benefits of the influenza vaccine, and reduce fears and misconceptions. It is important to ensure the availability of the vaccine, on all work shifts, and also on the weekend, and to enhance access to the vaccine by going to the staff departments, meeting rooms, and provide the vaccine at convenient times and places where the staff gathers. Measuring the vaccination coverage regularly, and making vaccination of HCWs a standard medical practice is essential.

Acknowledgements:

I would like to thank all staff of Al-Qatif Central Hospital Infection Control and Preventive Department and all ICU employees for their cooperation and facilitating data collection. My sincere thanks also go to the General Directorate of Infection Prevention and Control, Ministry of Health, for logistically assisting the investigation mission.

References

- (1) WHO. Influenza (Seasonal) Fact sheets [Internet]. 2018. Available from: [https://www.who.int/news-room/fact-sheets/detail/influenza-\(seasonal\)](https://www.who.int/news-room/fact-sheets/detail/influenza-(seasonal))
- (2) Soema PC, Kompier R, Amorij JP, Kersten GFA. Current and next generation influenza vaccines: Formulation and production strategies. *European Journal of Pharmaceutics and Biopharmaceutics* [Internet]. 2015;94:251–63. Available from: <http://dx.doi.org/10.1016/j.ejpb.2015.05.023>
- (3) Centers for Disease Control and Prevention NC for I and RD (NCIRD). Seasonal Influenza (Flu) [Internet]. 2019. Available from: <https://www.cdc.gov/flu/about/index.html>
- (4) Division I, Diseases R, Genetic SH, Foundation G, Foundation MG, Seika M, et al. *Clinical Practice Guidelines by the Infectious Diseases Society of America: 2018 Update on Diagnosis, Treatment*. 2019;68(6):1–99.
- (5) Dakkak W TAR. HHS Public Access. *Physiology & behavior*. 2017;176(5):139–48.
- (6) Saeed Al-Asmary, Abdul-Salam Al-Shehri, Alaa Abou-Zeid, Moataz Abdel-Fattah, Tamer Hifnawy, & Tarek El-Said. "Acute respiratory tract infections among Hajj medical mission personnel, Saudi Arabia." *International Journal of Infectious Diseases* 11 (2007): 268–272.
- (7) Alfelali M, Barasheed O, Badahdah A-L, & Bokhary H, et al., "Mandatory meningococcal vaccine, and other recommended immunisations: Uptake, barriers, and facilitators among health care workers and trainees at Hajj." *World Journal of Clinical Cases* 6.16 (2018): 1128-1135.
- (8) Abubakar A, Melhem N, Malik M, Dbaibo G, Mehmood KG, Zaraket H. "Seasonal influenza vaccination policies in the Eastern Mediterranean Region: Current status and the way forward." *Vaccine* 37 (2019): 1601-1607.
- (9) Luliano AD, Roguski KM, Chang HH, Muscatello DJ, Palekar R, Tempia S, & Cohen C. "Estimates of global seasonal influenza-associated respiratory mortality: a modelling study." *Lancet* 391 (2018): 1285-3000.
- (10) Al-Tawfiq JA, Memish ZA. Mass gatherings and infectious diseases: prevention, detection, and control. *Infectious Disease Clinics*. 2012 Sep 1;26(3):725-37.
- (11) Alfelali M, Barasheed O, Badahdah A-L, & Bokhary H. "Influenza vaccination among Saudi Hajj pilgrims: Revealing the uptake and vaccination barriers." *Vaccine* 36 (2018): 2112-2118.
- (12) Balkhy HH, Memish ZA, Bafaqeer S, & Almuneef MA, "Influenza a Common Viral Infection among Hajj Pilgrims: Time for Routine Surveillance and Vaccination." *J Travel Med* 11 (2004): 81-86.
- (13) Tashani M, Alfelali M, Azeem MI, Fatema FN, Barasheeda O, & Alqahtania AS, et al. "Barriers of vaccinations against serious bacterial infections among Australian Hajj pilgrims." *Postgraduate Medicine* 128.6 (2016): 541-547.
- (14) Zaraket H, Melhem N, Malik M, Khan WM, Ddaibo H, & Abubakar A. "Review of seasonal influenza vaccination in the Eastern Mediterranean Region: Policies, use and barriers." *Journal of Infection and Public Health* 951 (2018): 1-7.
- (15) Kuster SP, Shah PS, Coleman BL, Lam, P-P, Tong A, & Wormsbecker A. "Incidence of Influenza in Healthy Adults and Healthcare Workers: A Systematic Review and Meta-Analysis." *PLoS One* 6.10 (2010): 1-9.
- (16) Dolan GP, Harris RC, Mlarkson M, Sokal R, Morgan G, & Mukaigawara M. "Vaccination of healthcare workers to protect patients at increased risk of acute respiratory disease: summary of a systematic review." *Influenza and Other Respiratory Viruses* 7.Suppl. 2 (2013): 93-96.
- (17) Tuckerman JL, Shrestha L, Collins JE, & Marshall HS "Understanding motivators and barriers of hospital-based obstetric and pediatric health care worker influenza vaccination programs in Australia." 12.7 (2016): 1749-1756.

- (18) Alenazi BR, Hammad SM, & Mohamed AE, "Prevalence of seasonal influenza vaccination among primary healthcare workers in Arar city, Saudi." *Electronic Physician* 10.8 (2018): 7217-7223.
- (19) Soc'an M, Erc'ulj V, & Lajovic J. "Knowledge and attitudes on pandemic and seasonal influenza vaccination among Slovenian physicians and dentists." *European Journal of Public Health* 23.1 (2012): 92-97.
- (20) Rehmani R, Memon JI. Knowledge, attitudes and beliefs regarding influenza vaccination among healthcare workers in a Saudi hospital. *Vaccine*. 2010 Jun 11;28(26):4283-7.
- (21) Alshammari TM, AlFehaid LS, AlFraih JK, Aljadhey HS. Health care professionals' awareness of, knowledge about and attitude to influenza vaccination. *Vaccine*. 2014 Oct 14;32(45):5957-61.
- (22) Petek D, Kamnik-Jug K. Motivators and barriers to vaccination of health professionals against seasonal influenza in primary healthcare. *BMC health services research*. 2018 Dec;18(1):853.
- (23) Muruganathan, A. et al. Recommendations for Vaccination Against Seasonal Influenza in Adult High Risk Groups: South Asian Recommendations." *Journal of The Association of Physicians of India* (2016): 3-11. <http://www.japi.org/july_2016_special_issue_recommendations_for_various/01_recommendations_for_vaccination.pdf>.
- (24) Lee SI, Aung E, Chin I, Hing JW, Mummadi S, Palaniandy GD, & Jordan R. "Factors Affecting Medical Students' Uptake of the 2009 Pandemic Influenza A(H1N1) Vaccine." *Influenza Research and Treatment* (2012): 1-10.
- (25) Zeitouni MO, Al Barrak AM, Al-Moamary MS, Alharbi NS, Idrees MM, Al Shimemeri AA, Al-Hajjaj MS. The Saudi Thoracic Society guidelines for influenza vaccinations. *Annals of thoracic medicine*. 2015 Oct;10(4):223.
- (26) 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." *Journal of Hospital Infection* 96.3 (2017): 268-275. <https://www.sciencedirect.com/science/article/pii/S0195670117300919>
- (27) Cobos Muñoz D, Monzón Llamas L, Bosch-Capblanch X. Exposing concerns about vaccination in low- and middle-income countries: a systematic review. *Int J Public Health* 2015;60:767–80.
- (28) 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 services research*. 2019 Dec;19(1):229.
- (29) Alabbad AA, Alsaad AK, al Shaalan MA, Alola S, Albanyan EA. Prevalence of influenza vaccine hesitancy at a tertiary care hospital in Riyadh, Saudi Arabia. *Journal of Infection and Public Health* [Internet]. 2018;11(4):491–9. Available from: <http://dx.doi.org/10.1016/j.jiph.2017.09.002>