

# Adherence to influenza vaccination and reasons of hesitance to get the vaccine among Umrah and Hajj attendants, Makkah, 1439

Hassan Kasim Haridi<sup>(1)</sup>, Ibrahim Hussein Abbd EL-Rahim<sup>(2)</sup>, Tariq Al-Malki<sup>(3)</sup>,  
Wael Hamzah Motair<sup>(4)</sup>, Arwa Al-Malki Atiah<sup>(5)</sup>

<sup>(1)</sup> General Directorate of Health Affairs, Hail Region

<sup>(2)</sup> The Custodian of the Two Holy Mosques Institute for Hajj and Umrah Research, Umm Al-Qura University

<sup>(3)</sup> Preventive Medicine Saudi Board resident, Makkah

<sup>(4)</sup> Directorate of Health Affairs, Makkah

<sup>(5)</sup> Graduate physician under training

## مدى التزام الحجاج والمعتمرين بالتطعيم بلقاح الإنفلونزا ، وأسباب عدم تلقي اللقاح للعام ١٤٣٩ هـ بمكة المكرمة

حسن قاسم هريدي<sup>(١)</sup>، إبراهيم حسين عبد الرحيم<sup>(٢)</sup>، طارق عطية المالكي<sup>(٣)</sup>، وائل بن حمزة مطير<sup>(٤)</sup>، أروى عطية المالكي<sup>(٥)</sup>  
<sup>(١)</sup> المديرية العامة للشئون الصحية بمنطقة حائل  
<sup>(٢)</sup> معهد خادم الحرمين الشريفين لأبحاث الحج والعمرة والزيارة – جامعة أم القرى  
<sup>(٣)</sup> البرنامج المشترك لطب المجتمع بمكة المكرمة  
<sup>(٤)</sup> مديرية الشئون الصحية بمكة المكرمة  
<sup>(٥)</sup> طبيبة تحت التدريب

### ملخص البحث (Abstract):

خلفية الدراسة: يعتبر التجمع الكبير للمعتمرين وحشود الحجاج بيئة مناسبة لانتشار عدوى فيروس الأنفلونزا مع مضاعفاته الخطيرة. وقد أثبت لقاح الأنفلونزا فعاليته في الوقاية من المرض أو التخفيف من مضاعفاته. أهداف الدراسة: تقييم مدى التزام الحجاج والمعتمرين بمكة المكرمة بالتطعيم ضد الإنفلونزا، وكذلك التعرف على أسباب عدم تلقي اللقاح بين غير المطعمين. منهجية الدراسة: هي دراسة مقطعية مسحية تم إجراؤها على عينة من الحجاج والمعتمرين البالغين القادمين لمكة المكرمة خلال عام ١٤٣٩.

نتائج الدراسة: تم إجراء ٩٩٧ مقابلة ناجحة، منها ٩١٢ للقادمين من خارج المملكة بنسبة ٩١,٥%. بلغ عدد المشاركين القادمين للعمر ٣٩٨ بنسبة ٣٩,٩%، وللحج ٥٩٩ بنسبة ٦٠,١%. بلغ عدد المشاركين من الدول العربية، جنوب شرق آسيا، جنوب آسيا إفريقيا، الدول الغربية الأعداد والنسب التالية على الترتيب: ١٧٣ (١٧,٤%)، ٤٠٢ (٤٠,٣%)، ٢١١ (٢١,٢%)، ١١١ (١١,١%)، و ١٠٠ (١٠,٠%). وقد بلغ عدد الإناث المشاركات ٢٩٣ بنسبة ٢٩,٤%.

أظهرت النتائج تلقي لقاح الأنفلونزا لدى ٧٠,٩% من إجمالي المشاركين بنسبة تغطية ٧١,١%. ووجد فارقا كبيرا في نسب التغطية باللقاح بين الحجاج (٩١,١%) وبين المعتمرين (41.8%) ( $p < 0.001$ ). كانت غالبية المشاركين (٨٠,٣%) على دراية بلقاح الأنفلونزا بنسبة ٨٠,٩%. وأن ٥٠,٣% منهم (٦١,٧%) لديهم معرفة جيدة حول مرض الأنفلونزا ولقاحه. كشفت نتائج تحليل الانحدار اللوجستي متعدد المتغيرات أن فئات المشاركين من داخل المملكة، والقادمين للحج، والقادمين من جنوب شرق آسيا وأفريقيا والدول الغربية والحاصلين على تعليم جامعي، ومن لديهم دراية بلقاح الإنفلونزا، كانت عوامل ذات ارتباط مستقل منبئة بتلقي لقاح الأنفلونزا بين المشاركين.

وكشفت الدراسة أن عدم الدراية باللقاح (٥٩,٧٪)، وعدم معرفة متى ينبغي التطعيم به (٣٣,٧٪)، وكونه مكلفًا (٢٩,٥٪)، وعدم معرفة كيفية الحصول عليه (٢٢,٢٪)، وعدم معرفة أن اللقاح موصى به (١٥,٦٪) هي أهم أسباب عدم التطعيم. الخلاصة: أن نسبة الالتزام بتلقي لقاح الانفلونزا بين القادمين للحج كانت جيدة، ولكنها كانت ضعيفة بين القادمين للعمرة، والقادمين من بلدان جنوب آسيا. وكان عدم معرفة اللقاح وتكلفته والحصول عليه أهم عوائق تلقي اللقاح. الكلمات الدالة: لقاح الانفلونزا؛ الالتزام؛ الحج؛ العمرة

**Background:** Mass gathering in Makkah during Umrah and Hajj is coincidental to the spread of influenza virus infection with its serious complications. Influenza vaccine proved effective in disease prevention or mitigating its complications.

**Objectives:** To assess adherence to influenza vaccination among Muslims visiting Makkah to perform Umrah and Hajj, and to explore reasons behind hesitancy to receive the vaccine among the unvaccinated.

**Methods:** This work was a cross-sectional interview survey carried out on a conventional sample of adult Muslims coming to Makkah for Umrah/Hajj during 1439.

**Results:** Overall, 997 successful interviews were completed, of them 912 (91.5%) were coming from outside Saudi Arabia; 398 (39.9%) were coming for Umrah and 599 (60.1%) for Hajj. Participants affiliated to Arab, Southeast Asia, South Asia, African and Western countries were 173 (17.4%), 402 (40.3%), 211 (21.2%), 111 (11.1%) and 100 (10.0%) respectively. Females (293) constituted 29.4%.

Overall, 709 (71.1%) were influenza vaccinated with high difference in coverage between Umrah and Hajj attendants (41.8% vs 91.1%;  $p < 0.001$ ) respectively. Majority 803 (80.9%) were aware about the vaccine and 503 (61.7%) of the participants have good knowledge about influenza disease and vaccine.

Multivariate logistic regression analysis revealed that, participants who are KSA domestic, coming for Hajj, coming from Southeast Asia, Africa and Western countries, university educated and aware about influenza vaccine, were independently associated with receiving the vaccine. Important reasons for not vaccinating were being not aware about the vaccine (59.7%), not aware when to receive the vaccine (33.7%), the vaccine is costly (29.5%) had no access (22.2%) and not aware that the vaccine is recommended (15.6%).

**Conclusion:** Despite good vaccination coverage among participants coming for Hajj, influenza vaccination was poor among Umrah attendants. Likewise, poor vaccination among participants coming from south Asian countries. Vaccine unawareness, cost and access were important barriers to receive the vaccine.

**Key Words:** influenza Vaccine; adherence; Hajj; Umrah

## Introduction

Mass gathering in Hajj and Umrah increase the risk of acquisition and transmission of respiratory tract infections including influenza; which remains a major concern and common health hazard for pilgrims. [1] Since 2005, Ministry of Health recommends that international pilgrims be vaccinated against seasonal influenza before arrival into the Kingdom of Saudi Arabia, particularly those at increased risk of severe influenza diseases, including pregnant women, children under 5 years, the elderly, and individuals with underlying health conditions such as HIV/AIDS, asthma, and chronic heart or lung diseases. [2,3] At least one-fourth of the pilgrims suffer from one or more of these risk factors. [4,5] This recommendation is also applying for internal pilgrims, particularly those at risk described above, and all health-care workers in the Hajj premises. [2,3]

Pooled estimates from observational studies indicate that influenza vaccine is effective against laboratory-proven influenza among Hajj pilgrims. [6] Influenza vaccination also has been shown in several studies to reduce severity of illness in people who get vaccinated but still get sick. Influenza vaccination reduced deaths, intensive care unit (ICU) admissions, ICU length of stay, and overall duration of hospitalization among hospitalized influenza patients. [7] Among adults hospitalized with influenza, vaccinated patients were 59 percent less likely to be admitted to the ICU than those who had not been vaccinated. Among adults in the ICU with influenza, vaccinated patients on average spent 4 fewer days in the hospital than those who were not vaccinated. [8] Therefore, influenza vaccination is recommended, and important to be monitored frequently among pilgrims from different countries.

### **Research aims**

The aim of this work is to assess adherence to influenza vaccination among Muslims visiting Makkah to perform Umrah and Hajj, and to explore reasons behind hesitancy to receive the vaccine among the unvaccinated.

### **Research methodology**

#### **Study design and participants**

This work was a cross-sectional interview survey carried out on a conventional sample of adult Umrah and Hajj attendants during the year 1439. Participants, during their stay in Makkah to attend Umrah or Hajj, were asked to participate in the study after explanation of the study objective. Those who agreed to participate were interviewed after taking a verbal consent. Participants were recruited randomly from those who were available at hotel lobbies around and near Haram after prayers in the day time. Inclusion criteria were: being adult man or woman  $\geq 18$  years, coming for Umrah or Hajj, from any country including domestic participants and have no contraindication for influenza vaccination.

#### **Data collection tool**

Upon inclusion, the participants were interviewed by two investigators (male and female) using a standardized questionnaire that collected information on: (1) demographics, (2) influenza vaccination status, (3) knowledge about influenza disease and vaccine, (4) reasons receiving/not receiving influenza vaccine. Those who reported receiving seasonal influenza vaccine before coming to Umrah or Hajj by at least two weeks were considered having a valid vaccination.

#### **Statistical analysis**

Differences in the proportions were tested by Pearson's chi-square, or Fisher's exact tests when appropriate. Student's t-test was used to test for differences in means. Knowledge scale was created for the 8 knowledge questions, where correct answers scored 1 and incorrect or don't know scored 0, with a maximum score of 8 points. Univariate and multivariate logistic regression model were used to examine factors associated with influenza vaccine receipt among participants. Any variable resulting in a value  $\leq 0.25$  in the univariate analysis was included in the multivariable model. The variables included in the model were then subjected to a backward selection to determine the significant independent predictors for the vaccine receipt. The results of the logistic regression analysis are presented as odds ratios (ORs) and 95% confidence intervals (CIs). All statistical tests were two-sided and P value for all tests  $< 0.05$  was considered significant.

Statistical analysis was undertaken using Epi Info 7.1.3 (CDC, Atlanta, GA, USA) and Statistical Package for the Social Science (SPSS), Version 30 for Windows.

### **Ethical consideration**

The study done under collaborative umbrella of Saudi Community Board of Postgraduate studies, the Custodian of the Two Holy Mosques Institute for Hajj and Umrah Research, Umm Al-Qura University, and Ministry of Health in Makkah. The study was performed in accordance with the Declaration of Helsinki and its amendments. All participants provided oral informed consent.

## **Results and discussion**

### **Results**

Table 1 describe characteristics of the participants and their influenza vaccination status. Overall, 997 successful interviews were completed, of them 398 (39.9%) were coming for Umrah, and 599 (60.1%) were coming for Hajj. The majority 912 (91.5%) came from outside Saudi Arabia. The mean age (SD) of the participants in our sample was 37.7 (8.82) distributed as 17.0, 40.3, 33.4 and 9.3 percentages for the age groups <30, 30-39, 40-49 and ≥50 years respectively. Females (293) constituted 29.4%. More than forty percent (45.5%) of the participants were university educated. Participants belongs to Arab countries, Southeast Asia, south Asia, Africa and western countries were 17.4, 40.3, 21.2, 11.1 and 10.0% respectively. More than forty percent (43.3%) of the participants frequently attended Umrah and most of them (76.7%) came for Hajj first time. About seventy percent (71.1%) of the participants reported influenza vaccination before coming to attend Umrah and/or Hajj, with significant difference in coverage between Umrah and Hajj attendants (41.8% vs 91.1%;  $p<0.001$ ) respectively. Majority 803 (80.9%) of the participants were aware about influenza vaccine. More than sixty percent (503; 61.7%) have good knowledge about influenza disease and vaccine, they attained 6 points or higher on a scale of 8 points maximum. However, a high difference between vaccinated (86.0%) and unvaccinated (14.0%) was there. Figure 1 depicts a histogram of participants' knowledge score as a continuous variable. Important sources of participant's information were social media (71.0%), Internet sites (31.4%), flu vaccination campaigns (10.7%) (Table 2).

The highest vaccine uptake (90.4) was reported among domestic participants compared to 69.9% for those coming from outside KSA ( $p<0.001$ ) and those who were coming for Hajj (91.1%) compared to 41.8% for participants coming for Umrah ( $p<0.001$ ). Females have higher vaccination rate (82.9%) compared to males (66.9%;  $p<0.001$ ). The uptake of the vaccine was higher among older age groups with statistically significant rising trend; vaccination coverage was 44.6%, 65.3%, 85.2% and 96.8% for the age groups <30, 30-39, 40-49 and ≥50 years respectively ( $p<0.001$ ). The highly educated participants reported higher vaccine uptake, with statistically significant up trend; the uptake among ≤ primary, middle, secondary and ≥ university education participants were 17.8%, 38.6%, 81.3% and 97.8% respectively. The vaccine uptake was also higher (86.3%) among aware participants about the vaccine compared to very low uptake (13.7%) among unaware ( $p<0.001$ ) and among those who possessed higher knowledge score (≤ 6 points) about influenza vaccine and disease (86.0%) compared to participants with lower knowledge score (14.0%;  $p=0.004$ ) (Table1).

Table 3 presents results of multivariate logistic regression analysis carried out to explore the association between influenza vaccine uptake and different characteristics of the participants. Both crude and adjusted Odds ratio were estimated and factors independently affecting the vaccine uptake were revealed. Participants who are KSA domestic (OR=5.60, 95% CI 1.97-15.96;  $p<0.01$ ); coming for Hajj (OR=4.14, 95% CI 2.02-8.49;  $p<0.001$ ); coming from southeast Asia (OR=25.06, 95% CI 5.06-124.16;  $p<0.001$ ), south Asia (OR=0.37, 95% CI 0.15-0.94,  $p<0.01$ ), African countries (OR=4.75, 95% CI 2.36-9.54;  $p<0.001$ ) and western countries (OR=8.12, 95% CI 2.21-29.86;  $p<0.01$ ) compared to Arab countries; those who attained secondary (OR= 2.64, 95% CI 1.18-5.93;  $p<0.05$ ) or  $\geq$ university education (OR=8.98, 95% CI 2.95-27.29;  $p<0.001$ ) compared to  $\leq$ primary education; as well as participants aware about influenza vaccine (OR= 5.72, 95% CI 2.45-13.31;  $p<0.001$ ) were independently associated with receiving the vaccine. The coefficient of determination  $R^2$  of linear correlation that measured the strength and the direction of a linear relationship between influenza vaccine uptake and other predictor variables in the model was 0.72, which indicates that 72% of the total variation in influenza vaccine uptake among participants can be explained by these predictor variables in the model (not shown in tables).

Table 4, enlists the important reasons cited by the participants for not receiving influenza vaccine. Being not aware about the vaccine (60.1%), the vaccine is costly (30.2%), had no access to receive the vaccine (22.4%) and rely on self-natural immunity (13.2.6%).

## Discussion

The role of the influenza vaccine has been established in reducing mortality and morbidity of influenza. Pooled estimates from observational studies indicate that influenza vaccine is effective against laboratory-proven influenza among Hajj pilgrims. [6,9] Studies showed a low rate of influenza among vaccinated pilgrims compared to an unvaccinated. [10-14]

Our study uncovered high difference in the vaccine coverage between Umrah and Hajj attendants; being much higher among Hajj compared to Umrah attendants, which comes in line with other studies highlighted a high influenza vaccination coverage among Hajj pilgrims. [15] This can be explained by the well-organized efforts of the governments and Hajj groups organizers to aware their pilgrims with the importance of receiving influenza vaccine as an important preventive measure and to comply with the Saudi Arabia health regulations, which highly recommend influenza vaccine uptake for pilgrims before coming.

The markedly lower influenza vaccination coverage among Umrah attendants imply the need to increase efforts to raise awareness with the importance of receiving the vaccine and strongly emphasize on the vaccine uptake recommended by Saudi health authority for all travelers intend to come for Umrah. Being not aware about the vaccine (60.1%) was the most frequent factor reported by participants in our study to describe their hesitance to receive influenza vaccine. Alqahtani et al in 2016, reported also a similar result, where 56% of Australians pilgrims cited "not being aware of vaccine" as the main reason for influenza vaccine non-receipt. [16].

Recent pre-Hajj vaccine-related studies have measured pilgrims' knowledge, attitudes, and practice, with the results indicating a significant continuing lack of Hajj vaccination awareness among pilgrims. [15] Those who obtained pre-travel advice were twice as likely to be vaccinated as those who did not seek advice. [16]

The high influenza vaccine uptake (90.4%) among domestic participant in our study, confirms the escalating trend of the vaccine uptake in Saudi Arabia in the last years. Alfelali et al. in 2018, reported vaccination rates for the years 2013, 2014 and 2015 were 21.4%, 48.2% and 58.1%, respectively. [17]

Compared to participants coming from Arab countries, south Asian, Western and African countries participants, reported higher influenza vaccine uptake, but on the other side, participants coming from south Asia have reported very low uptake. This marked variation denote different degrees of commitment among countries to ensure their citizens' vaccination. This imply the need to send this information to countries with deficient influenza vaccine coverage, emphasizing on the Saudi health authority's recommendations and requirements for vaccination to those who intend to attend Umrah and/or Hajj.

Important reasons cited by the participants as barriers to receive influenza vaccine were cost (30.2%) and access to the vaccine (22.4%). This indicate the importance to making the vaccine free and providing an easy access to receive the vaccine. We think that Saudi health authority can apply an initiative of providing the vaccine in Saudi embassies or consuls at the time of applying for Hajj or Umrah visa, especially in countries with low vaccine uptake.

Results of the present study also highlighted the important role of social media as a tool for health information seeking behavior. Compared to other sources, by far participants (71.0%) cited social media as their source of information regard influenza vaccine compared to navigating internet (31.4%) or through flu vaccination campaigns (10.7%). This implies the need to consider this important tool by health authorities and governments. For example, sending health awareness messages to all who apply for Umrah or Hajj visa, emphasizing on the recommended health regulation. A well designed short scientific videos can be rapidly spread to millions through social media and can specially targeting Hajj and Umrah attendants.

#### **Study Limitations**

The findings in this report are subject to at some limitations. First, all results are based upon self-report, and vaccination status was not validated with medical records; and respondents might not have accurately reported which vaccine(s) they received. Second, survey bias might have resulted from the unbalanced sample participants according their country and demographic criteria compared to characteristics of the actual Hajj population and interviewers' selection bias.

#### **Summary and conclusion**

Despite the convenient influenza vaccination coverage among participants coming for Hajj, vaccination among Umrah attendants was inadequate. A special concern about influenza vaccine uptake among participants coming from south Asian countries. Unawareness about the vaccine, cost and access to the vaccine were the important barriers to receive the vaccine. The study revealed the importance of social media and internet sites as preferable sources for knowledge seeking behavior about flu vaccine.

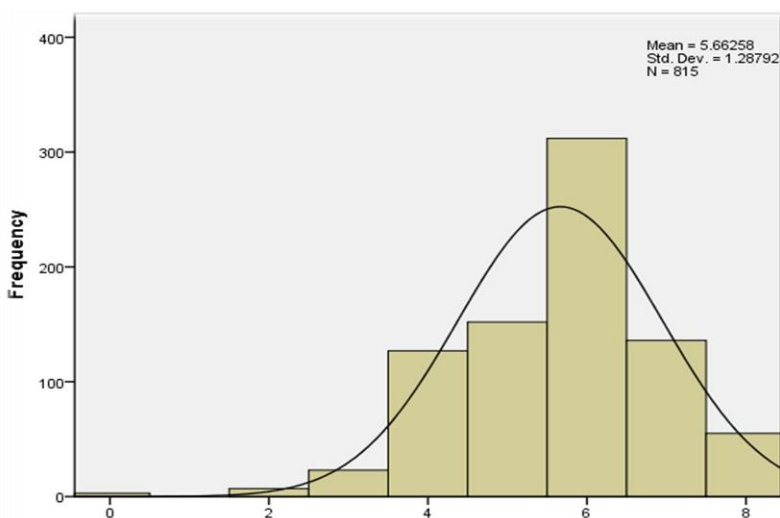
#### **Recommendations**

- 1- Mandatory influenza vaccination could be a good choice to ensure high vaccination coverage.
- 2- Communication with countries with deficient influenza vaccine coverage, emphasizing on the Saudi health authority's recommendations and requirements for vaccination to those who intend to attend Umrah and/or Hajj.
- 3- Considering influenza vaccination service in Saudi embassies or consuls at the time of applying for Hajj or Umrah visa, especially in countries with low vaccine uptake.
- 4- Utilization of social media to increase awareness with the importance of influenza vaccination among pilgrims.

Table 1: characteristics of the participants and their influenza vaccination status (n=997)

Participants	Overall n (%)	Vaccination Status n (%)		p
		Vaccinated	Unvaccinated	
<b>All Participants</b>	997 (100.0)	709 (71.1)	288 (28.9)	
<b>Coming from</b>				< 0.001
- KSA	85 (85.5)	75 (90.4)	8 (9.6)	
- Outside KSA	911 (91.5)	634 (69.9)	273 (30.1)	
<b>Coming for</b>				< 0.001
- Umrah	398 (39.9)	164 (41.8)	228 (58.2)	
- Hajj	599 (60.1)	545 (91.1)	53 (8.9)	
<b>Nationalities</b>				< 0.001
- Arab countries	175 (17.4)	114 (67.5)	55 (32.5)	
- Southeast Asia	402 (40.3)	400 (99.5)	2 (0.5)	
- South Asia	211 (21.2)	19 (9.1)	189 (90.9)	
- African countries	111 (11.1)	80 (72.1)	31 (27.9)	
- Western countries	100 (10.0)	96 (96.0)	4 (4.0)	
<b>Gender</b>				< 0.001
- Male	704 (70.6)	446 (66.9)	231 (33.1)	
- Female	293 (29.4)	243 (82.9)	50 (17.1)	
<b>Age in years</b>				< 0.001
- <30	169 (17.0)	74 (44.6)	92 (55.4)	
- 30-39	402 (40.3)	263 (65.3)	137 (34.3)	
- 40-49	333 (33.4)	282 (85.2)	49 (14.8)	
- ≥50	93 (9.3)	90 (96.8)	3 (3.2)	
Mean (SD)	37.7 (8.82)	39.7 (8.59)	32.8 (7.31)	< 0.001
<b>Education level</b>				< 0.001
- Primary	177 (17.8)	31 (17.8)	143 (82.2)	
- Middle	141 (14.3)	54 (38.6)	86 (61.4)	
- Secondary	225 (22.6)	182 (81.3)	42 (18.8)	
- University/Higher	453 (45.5)	441 (97.8)	10 (2.2)	
<b>Umrah frequency</b>				< 0.001
- Once	564 (56.7)	431 (76.6)	132 (23.4)	
- Frequent	431 (43.3)	277 (65.2)	148 (34.8)	
<b>Hajj frequency</b>				< 0.001
- None	131 (13.2)	53 (41.4)	75 (58.6)	
- Once	762 (76.7)	571 (75.2)	188 (24.8)	
- Frequent	101 (10.2)	84 (84.0)	16 (16.0)	
<b>Aware about influenza vaccine</b>				< 0.001
- Yes	803 (80.9)	693 (86.3)	110 (13.7)	
- No	190 (19.1)	12 (6.3)	178 (93.7)	
<b>Knowledge score about influenza and vaccine</b>				0.004
- ≤5 points	312 (38.3)	243 (78.1)	68 (21.9)	
- 6-8 points	503 (61.7)	430 (86.0)	70 (14.0)	
Mean (SD)	5.66 (1.92)	5.77 (1.26)	51.13 (1.26)	< 0.001

\*Knowledge score of maximum 8 points



**Figure 1: Histogram of Knowledge score about influenza vaccine/disease among study participants, Umrah and Hajj season, Makkah, 1439.**

Table 2: Sources of knowledge about influenza vaccine of Umrah and Hajj participants, Makkah, 1439.

Knowledge source*	Frequency	Percent (95% CI)
- Social Media	708	71.0 (68.1-73.8)
- Internet sites	313	31.4 (28.5-34.4)
- Health campaigns	107	10.7 (8.9-12.9)
- Healthcare staff	44	4.4 (3.3-5.9)
- Friends	35	3.5 (2.5-4.9)

Abbreviations: CI, confidence interval;

\*Participants may cite more than one knowledge source.

Table 3: Logistic regression analyses for background information and other potential factors associated with influenza vaccine receipt among Umrah and Hajj attendants in Makkah, 1439.

Factors	cOR (95% CI)	aOR (95% CI)
<b>Coming from</b>		
- KSA	4.04 (1.92-8.48)***	5.60 (1.97-15.96)**
- Outside KSA	1	1
<b>Coming for</b>		
- Umrah	1	1
- Hajj	14.30 (10.11-20.21)	4.14 (2.02-8.49)***
<b>Nationalities</b>		
- Arab countries	1	1
- Southeast Asia	96.50 (23.22-400.94)***	25.06 (5.06-124.16)***
- South Asia	0.05 (0.03-0.09)***	0.37 (0.15-0.94)*
- African countries	1.25 (0.74-2.10)	4.75 (2.36-9.54)***
- Western countries	11.58 (4.05-33.11)***	8.12 (2.21-29.856)**
<b>Gender</b>		
- Male	1	
- Female	2.41 (1.71-3.39)***	
<b>Age in years</b>		
- <30	1	
- 30-39	2.39 (1.65-3.45)***	



- 40-49	7.16 (4.65-11.01)***	
- ≥50	37.30 (11.34-122.64)***	
<b>Education level</b>		
- ≤ Primary	1	1
- Middle	2.90 (1.73-4.85)***	0.84 (0.38-1.84)
- Secondary	20.00 (11.97-23.39)***	2.64 (1.18-5.93)*
- University/Higher	203.43 (97.32-425.22)***	8.98 (2.95-27.29)***
<b>Umrah frequency</b>		
- Once	1	
- Frequent	0.57 (0.43-0.76)***	
<b>Hajj frequency</b>		
- None	1	
- Once	4.30 (2.91-6.34)***	
- Frequent	7.45 (3.92-14.85)***	
<b>Aware about influenza vaccine</b>		
- No	1	1
- Yes	95.34 (51.31-177.16)***	5.72 (2.45-13.31)***
<b>Knowledge score# about influenza and vaccine</b>		
- ≤5 points	1	
- 6-8 points	1.72 (1.19-2.48)**	

Abbreviations: cOR, crude odds ratio; aOR, adjusted odds ratio; CI, confidence interval;

Final -2\*Log-Likelihood: 282.51; Likelihood Ratio: 455.57; Model *P*-Value: <0.001.

\* < 0.05; \*\* < 0.01; \*\*\* < 0.001;

# Maximum 8 points Score.

Table 4: Frequent reasons cited for non-adherence to influenza vaccination among Umrah and Hajj participants, Makkah, 1439.

<b>Reason*</b>	<b>Frequency</b>	<b>Percent (95% CI)</b>
- Not heard about the vaccine	169	60.1 (54.2-65.9)
- The vaccine is costly	85	30.2 (24.9-36.8)
- The vaccine not available	63	22.4 (17.7-27.8)
- Rely on self-natural immunity	37	12.2 (9.4-17.7)

Abbreviations: CI, confidence interval;

\*Participants may cite more than one reason.

## References

- [1] Gautret P, Benkouiten S, Al-Tawfiq JA, Memish ZA. Hajj-associated viral respiratory infections: a systematic review. *Travel Med Infect Dis.* 2016; 14: 92-109
- [2] WHO. Health conditions for travellers to Saudi Arabia for the pilgrimage to Mecca (Hajj), 2015. *Wkly Epidemiol Rec* 2015;90(31):381–92.
- [3] Memish ZA, Al Rabeeah AA. Health conditions for travellers to Saudi Arabia for the Umra and pilgrimage to Mecca (Hajj)—2014. *J Epidemiol Glob Health.* 2014; 4: 73-75
- [4] Deris, ZZ, Hasan, H, Ab Wahab, MS, Sulaiman, SA, Naing, NN, Othman, NH. The association between pre-morbid conditions and respiratory tract manifestations amongst Malaysian Hajj pilgrims. *Trop Biomed* 2010;27:294–300
- [5] Memish, ZA, Assiri, AM, Hussain, R, Alomar, I, Stephens, G. Detection of respiratory viruses among pilgrims in Saudi Arabia during the time of a declared influenza A(H1N1) pandemic. *J Travel Med* 2012;19:15–21
- [6] Alqahtani AS, Rashid H, Heywood AE. Vaccinations against respiratory tract infections at Hajj. *Clin Microbiol Infect.* 2015; 21: 115-127
- [7] Arriola C, Garg S, Anderson EJ, Ryan PA, George A, Zansky SM, et al. Influenza Vaccination Modifies Disease Severity Among Community-dwelling Adults Hospitalized With Influenza. *Clin Infect Dis.* 2017 Oct 15;65(8):1289-1297. doi: 10.1093/cid/cix468
- [8] Thompsona G, NevilPierseb, Sue Huang Q, Prasad N, Duquead J, Newbern E, et al. Influenza vaccine effectiveness in preventing influenza-associated intensive care admissions and attenuating severe disease among adults in New Zealand 2012–2015. *Vaccine.* Volume 36, Issue 39, 18 September 2018, Pages 5916-5925
- [9] Nichol KL, Nordin J, Mullooly J, Lask R, Fillbrandt K, Iwane M. Influenza vaccination and reduction in hospitalizations for cardiac disease and stroke among the elderly. *N Engl J Med.* 2003;348:1322–32.
- [10] Rashid H, Shafi S, Haworth E, El Bashir H, Memish ZA, Sudhanva M, et al. Viral respiratory infections at the Hajj: Comparison between UK and Saudi pilgrims. *Clin Microbiol Infect.* 2008;14:569–74.
- [11] Adler A, Eames K, Funk S and Edmunds W. Incidence and risk factors for influenza-like-illness in the UK: online surveillance using Flu survey. *BMC Infectious Diseases.* 2014;14:232. <https://doi.org/10.1186/1471-2334-14-232> 10.
- [12] Eames KT, Brooks-Pollock D, Paolotti D, Perosa M, Gionannini C, Edmunds WJ: Rapid assessment of influenza vaccine effectiveness: analysis of an internet-based cohort. *Epidemiol Infect.* 2012, 140 (7): 1309-1315. 10.1017/S0950268811001804.
- [13] Razavy S, Dabiran S, Ziaee H Ardekani. The incidence of influenza like illness and determination of the efficacy of Flu vaccine in Iranian pilgrims during Hajj Pilgrimage. *Acta Medica Iranica* 2004; 42(6):397-401.
- [14] Alfelali M, Barasheed O, Tashani M, Irfan Azeem M, Heron L, Khandaker G, et al. Changes in the prevalence of influenza-like illness and influenza vaccine uptake among Hajj pilgrims: A 10-year retrospective analysis of data. *Vaccine.* Volume 33, Issue 22, 21 May 2015, Pages 2562-2569
- [15] Abd El Ghany M, Sharaf H, Hill-Cawthorne G. Hajj vaccinations—facts, challenges, and hope. *International Journal of Infectious Diseases.* 2016;47:29–37.
- [16] Alqahtani AS, Wiley KE, Tashani M, Willaby HW, Heywood AE, BinDhim NF, et al. Exploring barriers to and facilitators of preventive measures against infectious diseases among Australian Hajj pilgrims: cross-sectional studies before and after Hajj. *Int J Infect Dis.* 2016 Jun;47:53-9. doi: 10.1016/j.ijid.2016.02.005. Epub 2016 Feb 10.
- [17] Alfelali M, Barasheed O, Badahdah AM, Bokhary H, Azeem MI, Habeebullah T, et al. Influenza vaccination among Saudi Hajj pilgrims: Revealing the uptake and vaccination barriers. *Vaccine.* 2018 Apr 12;36(16):2112-2118. doi: 10.1016/j.vaccine.2018.03.007. Epub 2018 Mar 16.