

Original article

The prevalence and preventive measures of the respiratory illness among Malaysian pilgrims in 2013 hajj season

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Accepted 10 November 2015

Abstract

Background. Respiratory illness continues to exert a burden on hajj pilgrims in Makkah. The purpose of this study is to determine the prevalence of respiratory illness and its associated factors among Malaysian hajj pilgrims in 2013 and to describe its preventive measures.

Methods. A cross-sectional study was conducted in Makkah and Malaysia during the 2013 hajj season. A self-administered proforma on social demographics, previous experience of hajj or umrah, smoking habits, co-morbid illness and practices of preventive measures against respiratory illness were obtained.

Results. A total of 468 proforma were analysed. The prevalence of the respiratory illness was 93.4% with a subset of 78.2% fulfilled the criteria for influenza-like illness (ILI). Most of them (77.8%) had a respiratory illness of <2 weeks duration. Approximately 61.8% were administered antibiotics but only 2.1% of them had been hospitalized. Most of them acquired the infection after a brief stay at Arafat (81.2%). Vaccination coverages for influenza virus and pneumococcal disease were quite high, 65.2% and 59.4%, respectively. For other preventive measures practices, only 31.8% of them practiced good hand hygiene, ~82.9% of pilgrims used surgical face masks, N95 face masks, dry towels, wet towels or veils as their face masks. Nearly one-half of the respondents (44.4%) took vitamins as their food supplement. Malaysian hajj pilgrims with previous experience of hajj (OR 0.24; 95% CI 0.10–0.56) or umrah (OR 0.19; 95% CI 0.07–0.52) and those who have practiced good hand hygiene (OR 0.35; 95% CI 0.16–0.79) were found to be significantly associated with lower risk of having respiratory illness. Otherwise, pilgrims who had contact with those with respiratory illness (OR 2.61; 95% CI 1.12–6.09) was associated with higher risk.

Conclusions. The prevalence of respiratory illness remains high among Malaysian hajj pilgrims despite having some practices of preventive measures. All preventive measures which include hand hygiene, wearing face masks and influenza vaccination must be practiced together as bundle of care to reduce respiratory illness effectively.

Key words: Respiratory illness, hajj pilgrims, Malaysia, preventive measures, face mask, hand hygiene

Introduction

The hajj is an Islamic pilgrimage to Makkah. It draws in ~3 million Muslims surging from all over the world which accounts for the largest gathering of people globally on an annual basis.

The 2013 hajj season began from 13 October to 17 October 2013 (8–12 Dhu al-Hijjah). They perform specific rituals and follow a detailed route. The pilgrims perform their first circumambulations by walking seven times anticlockwise around the Kaaba. Then, they are required to walk for a total distance of ~2.1 km between the hills of Safa and Marwah seven times. On the 13 October, they travel to Mina and spend one night there for prayers and additional rituals. The next day, the pilgrims around the world gather at Arafat. When the sun sets, they leave Arafat and move to Muzdalifah, located between Arafat and Mina. They stay at Mina in crowded tents for at least two nights. For the completion of the umrah pilgrimage, which is called the lesser pilgrimage; it is different as it can be performed throughout the year, the pilgrims are not required to perform the brief stay at Arafat.

For ~1400 years, the mass gathering during hajj has been associated with the risk of communicable diseases, particularly respiratory infection.¹ Extended stays at hajj sites, physical exhaustion, extreme heat and crowded accommodation encourage disease transmission, especially those deriving from airborne agents.² Crowd densities during hajj are about up to seven people per square metre.³ Respiratory tract infection during hajj continues to exert a burden on pilgrims. The respiratory problems account for 74% of all medical illnesses reported during hajj seasons.⁴ Pneumonia being the leading reason for hospital admission in 39% of all patients.⁵ A recent study involving Malaysian hajj pilgrims found that 90% of them had at least one respiratory symptom.⁶ Respiratory illness is a disease affecting the respiratory system and can be due to infection or non-infection. It is complex to define the syndromes of respiratory illness due to variation in the severity, duration and types of symptoms.⁷

The purpose of this study is to determine the prevalence of the respiratory illness among Malaysian hajj pilgrims in 2013, to describe its preventive measures and to determine the association between sociodemographic, previous experience of hajj/umrah, co-morbidity, smoking habits, vaccination and preventive measures with respiratory illness. Apart from those preventive measures, we also explored the association between good hand hygiene practice and respiratory illness/ILI.

Methods

This is a cross-sectional study involving all consented Malaysian hajj pilgrims in November, 2013. An expanded definition of respiratory illness was used for this study. Respiratory illness was defined as when the person is having at least one of the respiratory symptoms (non-ILI) or ILI. With references to other studies and some limitations (mainly logistic problems), ILI is defined as the triad of cough, subjective fever and sore throat, those who did not fulfil the criteria of ILI were classified into a non-ILI group.^{8–11}

Sample size was calculated based on two proportion formula. The sample size according to potential associated factors, the largest sample size was given 780. After adding a possible non-respondent rate of 10%, the sample size for this study is 858. The sampling frame was consented to the Malaysian hujjaj in 2013 who attended the hajj course at Universiti Sains Malaysia (USM) Kelantan on 23 August and the 24 August 2013, those who transitted at Hajj Building Complex, Malaysia from the 15th of September until the 19 September 2013 and those at the Kingdom of Saudi Arabia (KSA). The sample selection was based on convenient sampling due to logistic problems. The researchers did not have access to the name of all pilgrims and they did not know about the approval of hajj visa status until a few weeks before their departure. The inclusion criteria were hajj pilgrims above 18 years old and able to comprehend and fill up proforma. Pilgrims who were very ill and unable to independently respond to the proforma were excluded.

Data based on the social demographic, co-morbid illness, smoking habits, symptoms of respiratory illness, history of contact with respiratory ill patients, previous experience of hajj or umrah, the practice of preventive measures, influenza and pneumococcal vaccination and supplement intake against respiratory illness were obtained by a self-administered proforma. Good hand hygiene or optimal handwashing practices is defined as handwashing for 20 s at least five times per day by using water with soap or a hand sanitizer.^{12,13} In this study, we define good hand hygiene practice as those who frequently wash their hands using hand sanitizers indicated by Centres for Disease Control (CDC).¹⁴ Those using water only, handkerchiefs or disposable tissues were considered as poor hand hygiene practices.

History of contact with respiratory illness sufferers is defined as pilgrims who have direct contact or close contact (being within ~6 feet (2 m) or within the room or care area for a prolonged period of time while not wearing recommended personal protective equipment.¹⁵ Brief instructions were given to the hajj pilgrims before receiving proforma. The proforma were given to participants in Malaysia before their departure and also at Makkah before departing for a brief stay at Arafat. All the completed proforma were collected after completion of hajj at Makkah and at the local airport upon arrival in Malaysia or via postage. The pilgrims were required to complete the proforma at least 2 weeks after their stay at Arafat. All respiratory symptoms that occurred ~2 weeks after arrival in KSA were considered significant.

The Statistical Package for the Social Sciences (SPSS version 22.0) was exercised for data entry and statistical analysis. Descriptive statistics were applied to describe the prevalence, practice of deterrent measures and associated factors. The analysis of association between sociodemographic, previous experience of hajj or umrah, co-morbidity, smoking habits, vaccination and the practice of preventive measures with the respiratory illness were done using simple logistic regression and the variables with P value of <0.25 or variables with clinically significant values will be included further with multiple logistic regression analysis. The risk estimation was carried out using the odds ratio (OR) and 95% confidence intervals (CI) and the P value of <0.05 were significant. Variable interaction and multi-collinearity followed by testing on a model assumption was performed before decisions made on the final model. For the final model, the P value of <0.05 were considered as significant.

Ethical approval was obtained from the USM Research and Ethics Committee before this study (Reference number: USMKK/PPP/JEPeM [266.3.(3)]).

Results

A total of 1200 proforma were distributed to the pilgrims, however, only 480 responded, only 40%. Out of 480 pilgrims who returned the proforma, 12 were excluded from the analysis as grossly incomplete. Altogether 468 proforma were analysed. The age for Malaysian Hajj pilgrims in this study ranged from 17 to 84 years old with a mean age of 52.52 (SD 10.15). The males (56.2%) dominated the female pilgrims with an obvious male to female ratio of 1.3.

More than one-half of the pilgrims had at least one medical illness (60.0%). Many of them had hypertension (26.5%), followed by diabetes mellitus (DM) (15.4%), allergic rhinitis (9.0%), bronchial asthma (5.6%) and others (3.6%). Some of the pilgrims still had smoked (12.2%) and 17.9% of them were obese (Table 1).

The prevalence of respiratory illness symptoms was 93.4% with a subset of 78.2% fulfil the criteria for ILI. Most of them had a respiratory illness of <2 weeks (77.8%). Approximately 61.8% were administered antibiotics, only 2.1% of them were hospitalized. One-half of them had a history of contact with

Table 1. Smoking and co-morbidity among Malaysian hajj pilgrims ($n = 468$)

Characteristic	<i>n</i> (%)
Smoking status:	
Currently smoking	57 (12.2)
Co-morbidity:	
Obesity	84 (17.9)
Hypertention	124 (26.5)
Diabetes mellitus	72 (15.4)
Allergic rhinitis	42 (9.0)
Bronchial asthma	26 (5.6)
Others ^a	17 (3.6)

^aHistory of Tuberculosis (TB), history of contact with TB patient, chronic obstructive airway disease (COAD), Cerebrovascular accident (CVA) and others.

Table 2. Respiratory symptoms among Malaysian hajj pilgrims ($n = 437$)

Characteristics	<i>n</i> (%)
Respiratory illness symptoms	437 (93.4)
ILI only	63 (13.5)
Non-ILI only	71 (15.2)
Both ILI & non-ILI	303 (64.7)
Duration of respiratory illness symptoms	
< 2 weeks	340 (77.8)
≥ 2 weeks	97 (22.2)
Hospital admission	9 (2.1)
Required antibiotic treatment	270 (61.8)
History of contact with pilgrims having respiratory illness	228 (52.2)
Onset of the respiratory illness ^a	
Before brief stay at Arafat	309 (70.7)
At Arafat	233 (53.3)
After brief stay at Arafat	355 (81.2)

^a Each pilgrims may presented with more than one episode of respiratory illness during hajj period.

respiratory illness sufferers (52.2%). They acquired the infection intensely at Arafat (81.2%) (Table 2).

For the practice of preventive measures, the total number of pilgrims that received influenza vaccinations was 305 (65.2%). From those, 130 (27.8%) pilgrims had been immunized with influenza and pneumococcal vaccinations. A total of 82.9% of pilgrims wore face mask, i.e. surgical face masks, N95 face masks, dry towels, wet towels or veils as their face mask. Only 31.8% of them practiced good hand hygiene. Nearly one-half of the respondents (44.4%) took vitamins as their food supplement (Table 3).

Factors associated with respiratory illness among Malaysian pilgrims using simple logistic regression analysis was shown in Table 4. All the supplements were seemed able to protect them from the illness, however they were not statistically significant (Table 4). Malaysian hajj pilgrims with previous experience of hajj (OR 0.24; 95% CI 0.10–0.56) or umrah (OR 0.19; 95% CI 0.07–0.52) and those with good hand hygiene (OR 0.35; 95% CI 0.16–0.79) were significantly associated with lower risk of respiratory illness. Otherwise, pilgrims having contact with those with respiratory illness (OR 3.01; 95% CI 1.35–6.68) were associated with higher risk (Table 5).

The percentage of ILI was lower (38.9%) in those vaccinated with the influenza vaccine than those unvaccinated (61.1%). However, it was statistically not significant with a *P* value of 0.15 (Table 6).

Discussion

The prevalence of the respiratory illness varied by country of origin and by year based on the studies conducted over the past few years. In our study, the prevalence of respiratory illness symptoms among Malaysian hajj pilgrims for the 2013 season was 93.4%, with a subset of 78.2% fulfilling the criteria for ILI. The respiratory illness prevalence was consistent with French

Table 3. Vaccination and the practice of preventive measures for respiratory illness among Malaysian hajj pilgrims ($n = 468$)

Variables	<i>n</i> (%)
Vaccination:	
Pneumococcal only	148 (31.6)
Influenza only	175 (37.4)
Both pneumococcal & influenza	130 (27.8)
Not vaccinated ^a	15 (3.2)
Hand hygiene:	
Good hand hygiene	149 (31.8)
Poor hand hygiene	319 (68.2)
Face mask:^b	388 (82.9)
Surgical face mask	322 (68.8)
Dry towel	48 (10.3)
Wet towel	12 (2.6)
N95 face mask	15 (3.2)
Veil	77 (16.5)
Supplement:^b	357 (76.3)
Honey	107 (22.9)
Black seeds	66 (14.1)
Vitamin	208 (44.4)

^aNot vaccinated for both pneumococcal and influenza vaccines.

^bEach pilgrim may practice more than one types of face mask or took more than one supplement.

Table 4. Factors associated with respiratory illness among Malaysian hajj pilgrims using simple logistic regression analysis

Variables	OR (95% CI)	P value(*)
Age	0.98 (0.94–1.02)	0.32
Gender:		
Male		
Female	1.24 (0.59–2.62)	0.57
Currently smoking	0.93 (0.31–2.77)	0.90
Co-morbidity:		
Obesity ^a	1.09 (0.51–2.34)	0.82
Diabetes mellitus ^a	1.80 (0.53–6.02)	0.35
Hypertension ^a	0.48 (0.23–1.01)	0.05
Bronchial asthma ^a	0.88 (0.20–3.90)	0.87
Allergic rhinitis ^a	0.66 (0.22–1.99)	0.46
Others ^b	1.07 (0.14–8.35)	0.95
Previous experience of hajj ^a	0.13 (0.06–0.28)	<0.001
Previous experience of umrah ^a	0.12 (0.05–0.30)	<0.001
Contact with pilgrims having respiratory illness ^a	3.01 (1.35–6.68)	0.01
Vaccination:		
Influenza vaccination only ^a	0.71 (0.23–2.20)	0.55
Pneumococcal vaccination only	1.04 (0.13–8.30)	0.97
Influenza and pneumococcal vaccination	1.05 (0.44–2.48)	0.92
Good practice of hand hygiene	0.41 (0.20–0.85)	0.02
Face mask:		
Surgical face mask	1.65 (0.79–3.47)	0.19
N95 face mask	0.45 (0.10–2.06)	0.30
Wet towel	0.78 (0.10–6.20)	0.81
Dry towel	1.10 (0.31–3.67)	0.91
Veil	0.66 (0.27–1.58)	0.35
Supplement:		
Honey ^a	0.81 (0.35–1.87)	0.62
Black seeds	0.66 (0.26–1.68)	0.39
Vitamins	0.72 (0.32–1.66)	0.44

^aVariables entered in the multivariate model ($P < 0.25$ or clinically important variables).

^bHistory of TB, history of contact with TB patient, COAD, CVA and others.

*significance level was set < 0.05 .

Table 5. Association between respiratory illness with preventive measures and other factors among Malaysian hajj pilgrims using multiple logistic regressions

Variables	Crude OR ^a (95% CI)	Adjusted OR ^b (95% CI)	Wald statistics ^b (df)	P value&(*) ^b
1. Previous experience of hajj	0.13 (0.06–0.28)	0.24 (0.10–0.56)	10.92(1)	0.001
2. Previous experience of umrah	0.12 (0.05–0.30)	0.19 (0.07–0.52)	10.74(1)	0.001
3. Contact with pilgrims having respiratory illness	3.01 (1.35–6.68)	2.61 (1.12–6.09)	4.91(1)	0.03
4. Good practice of hand hygiene	0.41 (0.20–0.85)	0.35 (0.16–0.79)	6.45(1)	0.01

Multiple logistic regressions is reasonably fit (Hosmer–Lemeshow goodness-of-fit: Chi square = 2.11, df = 6; correctly classified = 93.2%; area under receiver operating characteristic (ROC) = 0.84); there is no significant interaction between independent variables.

^aSimple logistic regression.

^bMultiple logistic regression.

*Significance level was set < 0.05 .

pilgrims during the same year (90.7%).⁹ The prevalence for the 2013 African hajj pilgrims was slightly lower (77.6%).¹⁶ The results of our study are in parallel with previous studies, 97.0% and 90.0% for the 2009 Saudi Arabia hajj pilgrims and the 2007 Malaysian hajj pilgrims, respectively.^{6,17} In contradiction,

the percentage was lower for the US pilgrims in 2009 who suffered from respiratory illness symptoms (41.3%).¹⁸

Crowdedness is a major risk factor for the transmission of respiratory illness. All compulsory rituals of hajj involve crowded places, jam-packed with pilgrims. These conditions contributed

Table 6. The association of ILI with influenza vaccination

Influenza vaccination	ILI n (%)	OR (95% CI)	P value
Vaccinated	143 (38.9)	0.71 (0.44,1.13)	0.15
Unvaccinated	225 (61.1)		

to almost one-half of the pilgrims (52.2%) having contact with people suffering from respiratory illness during hajj. They were at a significantly high risk of developing the respiratory illness by three times higher than those who do not have the contact (P value 0.01). Practising contact avoidance during hajj is imperative as it can shorten the duration of respiratory illness.¹⁸ Practising social distancing and contact avoidance is effective in reducing the transmission of the respiratory symptoms during the 2009 US pilgrims and ILI symptoms in 2014 with the Indian pilgrims.^{18,19} The majority of the respondents was inflicted with respiratory illness after a brief stay at Arafat (81.2%). It may be correlated with the incubation period of the illness and the peak exposure of pilgrims whilst performing the hajj rituals. Other studies estimated approximately one in three pilgrims will experience respiratory symptoms which usually occurred at the end or shortly after performing hajj rituals.²⁰

Influenza vaccination is one of the recommended vaccines for high risk pilgrims to reduce mortality and morbidity. The vaccine uptake for influenza in our study is lower (65.2%) in contrast to Malaysian pilgrims in 2007 (72.8%) and Saudi Arabian pilgrims in 2009 (94.4%).^{6,17} The percentage of vaccine uptake among the 2013 hajj pilgrims from other countries were as low as 31.8% for French pilgrims and 31.0% for pilgrims from Saudi Arabia, Qatar and Australia.^{21,22}

Effective influenza vaccine remains debatable and cannot be proven if the study was conducted without virology confirmation. Multiple factors such as mismatch between vaccine strains and circulating strains, inappropriate storage and the handling of the vaccine can reduce its effectiveness or waning of immunity in the population. One study systematically reviewed the available studies assessing the uptake and effectiveness of the influenza vaccine among pilgrims. The effectiveness of the influenza vaccine varied across studies, but was effective against laboratory-confirmed influenza with a P value of <0.001 .²³ In our study, the prevalence of ILI was not significantly associated with the status of the vaccination which was similar with pilgrims in Malaysia (2007), France (2006) and Iran (2006).^{6,24,25} The vaccine was not associated with the reduction and number of acute respiratory symptoms nor any relation to the length of stay for Malaysian hajj pilgrims in 2007.²⁶

The findings were not in accordance with the French pilgrims in 2013 in which the ILI symptoms were less frequently reported in the vaccinated group (34.1%) than unvaccinated group (61.5%) and was statistically significant (P value 0.009).²¹ In another study, they found that the influenza vaccine appeared to provide some protection in 'at risk' hajj pilgrims but not in the 'not at risk' group.¹⁰ The influenza vaccines prevented clinic visits for ILI among Malaysian pilgrims in 2000 and Pakistani pilgrims in 1999.^{11,27} The influenza vaccination is a protective factor for ILI more than for non-ILI, giving 70–77% protection for ILI and just 20% protection against the non-ILI group.¹¹

One hundred and forty-nine of our respondents adopted good hand hygiene during hajj (31.8%). The results were similar to the French pilgrims in 2012 (46.3%) and the US hujjaj in 2009 (45.5%).^{18,28} However, the adherence of French pilgrims towards hand sanitizer practices in 2009 was higher (77.4%) than in the 2012 hajj season.²⁹ Effective hand hygiene practice in this study could significantly decrease the risk of respiratory illness by 60% than pilgrims who practiced poor hand hygiene. It was parallel with the US pilgrims in 2009 and the French pilgrims in 2012, as regularly washing hands and the use of hand sanitizers significantly causes less of the ILI symptoms.^{18,28} A systematic review on hand-hygiene interventions, including education and the use of alcohol-based hand sanitizers towards respiratory illness indicated that some of the interventions were not efficacious against respiratory illnesses.³⁰ The consistent application of hand hygiene during critical points in the chain of transmission is likely to play a major role in shaping the relative effectiveness of hand-hygiene interventions in terms of disease outcome.

Face masks are able to limit the spread of microorganisms, mainly from the respiratory droplets. However, the CDC in USA found that the intermittent use of surgical-type masks was associated with more than a 2.5-fold greater risk of infection. Disposable face masks should be used once and replaced when they become moist and are to be disposed of properly. Most of the Malaysian pilgrims admitted to wearing face masks during hajj (82.9%). This finding was in accordance with other studies, 72.9% for Malaysian pilgrims in 2007 and 79.6% for French pilgrims in 2009.^{8,29} The percentage was higher if compared with other countries in the 2009 hajj season; Saudi Arabia (56%) and USA (42%).^{17,18}

It has been revealed that face masks either offered no significant protection or were associated with a longer duration of sore throat and fever symptoms among hajj pilgrims.^{25,29,31} A recent study illustrated that many pilgrims at the 2009 hajj may not have worn masks correctly (e.g. mistakenly positioning the top of the mask below the nose).³² A recent review by Benkouiten *et al.*³³ in 2014 also mentioned that the effectiveness of the face mask in the prevention of the respiratory symptoms among hajj pilgrims revealed variable results. Regular use of a face mask was the most essential practical protective factor in respiratory illness, using it for more than 8 h led to a substantial decrease in the incidence of ILI among Australian pilgrims in 2011.^{34,35} These masks were potentially effective at preventing respiratory virus acquisition by household contacts of infected people when worn by healthy people. However, the effectiveness depended largely on adherence to mask use.³⁶

Honey is one of the most promising natural substances that can combat or prevent respiratory illness.³⁷ Approximately 22.9% of pilgrims consumed honey during hajj. However, there was no other study to compare the prevalence of honey intake among hajj pilgrims except for one study to determine the effectiveness of honey in reducing respiratory symptoms.³⁸

During the hajj, pilgrims undergo great physical and emotional strain. The experienced hajj veterans or even umrah is an advantage as it can help them to be more physically prepared as well as mentally and spiritually ready. However, every year is different and every person's experience is individually specific but they are able to prepare themselves as much as possible for

the hajj challenges. The association of previous experiences during hajj or umrah with respiratory illness has not been studied before. Malaysian hajj pilgrims with previous experience of hajj or umrah were found to be significantly associated with lower risk of developing respiratory illness (P value of 0.001 for both). Further study needs to be conducted to explore the factors that contribute to the association of respiratory illness in those who have experienced performing hajj or umrah.

The limitations of this study include inadequate sample size and a poor response rate as it could affect the power of the study. The small response rate could be due to a lack of commitment from the respondents following a very packed hajj ritual schedule. Shortage of staff to handle and follow-up the respondents in Makkah, further added to the problem.

In conclusion, the prevalence of respiratory illness remains high among Malaysian hajj pilgrims despite having some practicing preventive measures. Practicing only certain preventive measures are inadequate. All preventive measures including hand hygiene, wearing face masks and influenza vaccination must be practiced together to reduce the respiratory illness effectively. In our study, good hand hygiene practice was lower compared with other preventive measures; therefore, health authorities should find a way to overcome this problem. Further studies are required to develop a health education module to promote a comprehensive preventive measure for hajj pilgrims.

Funding

This study is funded by Ministry of Higher Education Malaysia through Long-term Research Grant Scheme (LRGS) (Grant no: 203.PTS.6728003) and Universiti Sains Malaysia through Research University Grant (1001/PPSP/870026).

Acknowledgements

The authors acknowledge Tabung Haji Malaysia, especially Kelantan Branch and Sultan Ismail Petra Airport for their continuous support and recommendations.

Conflict of interest: None declared.

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