

# Patterns of diseases and preventive measures among domestic hajjis from Central, Saudi Arabia [complete republication]

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**الخلاصة: الأهداف:** تحديد معدل حدوث أمراض الجهاز التنفسي العلوي والإسهال والإصابات أثناء موسم الحج والإجراءات الوقائية المتبعة بين الحجاج. **الطريقة:** أجريت هذه الدراسة المقطعية خلال الفترة من نوفمبر إلى ديسمبر 2009 م بين الحجاج المسجلين بمراكز الرعاية الصحية الأولية للحصول على تطعيم التهاب السحائي. وقد تم جمع البيانات من الحجاج فور عودتهم من الحج من خلال الهاتف حيث تم سؤالهم عن الإصابة بأمراض الجهاز التنفسي العلوي، والإسهال، بالإضافة إلى السلوكيات الوقائية المتبعة أثناء الحج. **النتائج:** من بين 1507 حاج تبين إصابة 54.7٪ منهم بأعراض مرضية، وكان 97٪ منها بالجهاز التنفسي العلوي و 9.3٪ حالات إسهال. لقد كان الحجاج الذين تقل أعمارهم عن 40 عاماً هم أكثر عرضة للإصابة بأمراض الجهاز التنفسي العلوي، غير أنه لم يكن هنالك علاقة إحصائية واضحة بين العمر و حدوث الإسهال. ولم يلاحظ وجود علاقة إحصائية واضحة بين مستوى التعليم و حدوث أمراض الجهاز التنفسي العلوي أو الإصابات، بينما كان هناك ارتباط ذو دلالة معنوية بين مستوى التعليم و حدوث الإسهال. كما لم يتبين وجود علاقة إحصائية واضحة بين الجنسية و حدوث الإسهال والإصابات، بينما كان علاقة إحصائية واضحة بين الجنسية و حدوث أمراض الجهاز التنفسي العلوي. كما تبين أيضاً أن استعمال قناع الفم والأنف بصورة مستمرة يقلل بدرجة إحصائية واضحة من حدوث أمراض الجهاز التنفسي العلوي. **خاتمة:** أظهرت هذه الدراسة بأن أمراض الجهاز التنفسي العلوي مشكلة هامة وشائعة بين الحجاج الذين اتضح بصورة عامة التزامهم بشكل جيد بالإجراءات الوقائية إلا أن استخدام قناع الفم والأنف مازال محدوداً على الرغم من كفاءته في التقليل من حدوث الإصابة بأمراض الجهاز التنفسي العلوي.

**ABSTRACT Objectives:** To identify the occurrence of upper respiratory tract infections (URTI), diarrheal diseases and trauma during the Hajj season, and the practice of some preventive measures by pilgrims. **Methods:** A cohort study during November and December 2009 among hajjis registered while visiting Primary Health Care Centers of Riyadh, Kingdom of Saudi Arabia to get mandatory meningococcal meningitis vaccination. On return from hajj, hajjis were contacted on telephone to collect information on occurrence of URTI and diarrhea along with other associated activities in Hajj. **Results:** Out of 1507 hajjis, 54.7% developed symptoms; 97% reported upper respiratory tract symptoms, and 9.3% reported diarrheal symptoms. Those <40 years of age were more likely to develop an URTI. The incidence of diarrheal diseases or trauma was not statistically associated with age. No statistical difference for educational level was found for URTI or trauma, but there was a statistically significant difference for diarrheal diseases. There was no statistical difference for nationality in relation to diarrheal diseases and trauma, but there was a statistically significant difference for URTI. There was a statistically significant difference of URTI between those pilgrims who used the face mask most of the time and those who used it sometimes. **Conclusion:** Upper respiratory tract infections is a common health problem among studied domestic hajjis. Generally, there is room for improvement in the adoption of preventive measures by hajjis; and there is still limited information on the use of facemasks in spite of the fact that using it significantly decreases the risk for URTI.

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## Introduction

Hajj (pilgrimage) is a yearly event in which more than 2 million Muslims from around the world gather in Mecca, Saudi Arabia. It is the largest annual gathering of its kind in the world bringing millions of people in a small and geographically confined area. All adult Muslims who are physically and financially able to do so have a religious obligation to make the pilgrimage once in their lifetime. The limited time and space in which this mass gathering takes place exposes these hajjis to several risk factors [1]. Overcrowding increases the chances of trauma and transmission of communicable diseases. Transportation to the Hajj area is mainly through air for international hajjis. Domestic hajjis can reach the Hajj area either by air or surface transport, which is a cheaper mode of transport. Hajjis can use buses for transport within the Hajj area or can move around on foot. In this Hajj season, the services of train transportation between key locations in the Hajj area were made available. A hamla is a company that is specialized in Hajj services. These hamlas are responsible for travel arrangements, accommodation and food arrangements for every hajji who paid for their services [2–5]. The changing of Hajj season from summer to winter changes the pattern of diseases that are detected among hajjis. Since Hajj season has changed in the last few years from summer to winter, diseases that were seen in summer season (such as heat stroke, food poisoning and exhaustion) are not seen anymore [6]. In Hajj season diseases are expected to be more common such as influenza, asthma and chronic obstructive pulmonary disease. During Hajj rituals, hajjis are exposed to several health risks. Physical exertion is a health risk itself and it can aggravate pre-existing health conditions (such as diabetes mellitus, cardiovascular and renal disease) [2,4]. During animal

slaughter, as part of Hajj rituals the risk of exposure to zoonotic diseases is increased [7]. Another Hajj ritual which poses a health risk is head shaving for men. Head shaving is performed with razors or blades which if used without changing for several hajjis can transmit blood borne infections (HIV, hepatitis B and hepatitis C) [8]. Many Hajj studies showed a change in the pattern of diseases detected among hajjis from infectious diseases to chronic diseases [9–11]. Mina is a key place in the Hajj area. It is where the hajji spends the most of the time in the Hajj season (at least 4 days). This relatively long duration account for the burden on health services in this area. Many researchers studied pattern of diseases among hajjis visiting Mina hospitals. Those cases that reach hospitals are usually the tip of the iceberg and they are mostly advanced stages of the disease, which can be less representative to the real Hajj population [5,12–14]. Currently there is no surveillance system for some hajj-related and post hajj illnesses. The primary objectives of this study were to assess the incidence of selected diseases and injuries among hajjis and to use this information by the Ministry of Health (MOH) for future surveillance of specified conditions at the Hajj, and to assess preventive measures practiced by hajjis. Specific conditions of interest included upper respiratory tract illnesses (URTI), diarrhoeal illnesses, and injuries.

## Methods

### Study setting

This cohort study was conducted during November and December 2009 in Riyadh City, the capital of Saudi Arabia with a population of nearly 5 million. Since there is no common station to identify and recruit hajjis returning to Riyadh from Hajj, subjects were recruited as they sought their required pre-Hajj meningococcal vaccination.

Riyadh City has 87 primary health care centres (PHCC) that give meningococcal vaccination as an obligatory requirement for those who will perform the Hajj. These PHCC are distributed in 7 health sectors. The number of PHCCs in each health sector ranges from 7-20 centres. Therefore, the study population consisted of all adults older than 20 years of age living in Riyadh City with the intention to perform the Hajj in 2010, who sought their required meningococcal immunization at a PHCC. Vaccinations started on 16th October 2010 and continued on daily basis until 7 November 2010, which was the first day in the Hajj season.

### Case definition

For the purpose of this study, URTI was defined as any person who reported having developed at least one of the constitutional symptoms (fever, headache, myalgia) and one of the local symptoms (running nose, sneezing, throat pain, cough with /or without sputum) after reaching Makkah for the Hajj or within 2 weeks from return to Riyadh [15]. Diarrhoea was defined as the passage of 3 or more loose or liquid stools per day after reaching Makkah for the Hajj or within 2 days from return to Riyadh to ensure that diarrhoea infection was acquired during hajj period not after return home.

### Sampling

A 2 stage sampling technique was used. In the first stage, Riyadh City was stratified into 7 strata according to the number of health sectors. Simple random sampling of 1-2 PHCC from each stratum was carried out according to the number of PHCC in each health sector. From health sectors with 10 or fewer PHCC, one PHCC was selected. Two PHCC were randomly selected from health sectors with more than 10 PHCC, resulting in a total of 11 centres. In the second stage, study subjects were systematically selected from each of the 11 centres by selecting every third

person seeking meningococcal vaccination for their Hajj requirement.

A sample size of 1499 was calculated using Epi-Info version 3.5.1 to estimate diseases with proportion of 1% or more in the study sample with a precision of 0.5% at 95% confidence level; and was then increased to 1804 to account for the anticipated non-responders.

Recruits were asked to give their contact information and consent at the time of recruitment so that they could be contacted 48 hours upon return from the Hajj up to a period of 4 weeks after return. A standardized phone-based questionnaire regarding selected illnesses (which include diabetes, hypertension, cardiac diseases, renal diseases and bronchial asthma), injuries, and preventive measures was developed and pilot-tested prior to administering it to returning hajjis. Three trained interviewers contacted participants during working hours, with follow-up calls at other times to improve the response. Those who were not contacted after 4 days of attempts were classified as non-responders and were excluded.

## Statistical analysis

The collected data were organized, tabulated, and statistically analysed using SPSS software statistical package version 19. The number and percentage distribution for each variable was calculated. Observed differences were statistically analysed using Chi square test and risk estimation was carried out using relative risk and 95% confidence intervals. The level of significance was adopted at  $P < 0.05$ .

## Results

Out of 1804 initial enrolled, 1507 Hajj pilgrims responded and were included into the study. Males predominated the study population (61.7%). The mean age was  $37.9 \pm 12.1$  years with a range of 21–83 years of age. The main nationalities were Saudi and Arabs

(84.5%). Hajjis from South Asia comprised 7.4%, South East Asia 4.9%, and Africa 3.2% of the study population. Half of the study population (49.5%) had a university education, including Master's and Doctorate degrees. The occupational status of study participants was reported as 31.4% unemployed, 13.7% manual workers, 21.4% employee, 21.3% professional, 3.8% retired, 4.9% were students, and 3.5% self employed. All participants were vaccinated for meningococcal meningitis. Some hajjis received vaccines upon their request other than meningococcal meningitis ( $n = 218$ ); 5.9% were vaccinated against Hepatitis A, 6.4% against Hepatitis B, and 94.4% were vaccinated for seasonal flu (categories not mutually exclusive). Different modes of travel to Makkah were available; 50.6% of hajjis travelled by bus, 20.2% by plane and 29.2% by car. The travel coordination services of a Hamla were utilized by nearly all Hajjis (95.7%). The average

length of stay at the Hajj (Makkah and Mina) was  $7.04 \pm 1.78$  days and all but 2 pilgrims were able to complete the Hajj.

Illness symptoms were reported by 825 (54.7%) of the returning Hajjis. These symptoms were used to categorize participants into disease groups. Of the 825 reporting symptoms, 97% reported upper respiratory tract symptoms (53% of total studied group), and 9.3% reported diarrhoeal symptoms (5.1% of total studied group) (not mutually exclusive). Of the 825 with symptoms, 51% reported contact with a person having similar symptoms and 43.2% sought medical care at a health care facility whether during hajj or upon return home. Traumatic injuries were reported by 2.9% (Table 1).

Face masks were used by 851 (56.5%) of participants. Of those, 216 (25.4%) reported using it most of the time and 635 (74.6%) reported using it sometimes. Of the 577 females in the study population, 333 (57.7%) reported

**Table 1 Distribution of domestic hajjis in relation to health problems in Hajj**

Health problems in Hajj	n	%
<b>Having symptoms: <math>n = 1507</math></b>		
Yes	825	54.7
No	682	45.3
<b>Diseases<sup>a</sup> <math>n = 825</math></b>		
URTI	800	97.0
Diarrheal diseases	77	9.3
Others <sup>b</sup>	16	1.9
<b>Contact with similar case: <math>n = 825</math></b>		
Yes	421	51.0
No	259	31.4
Do not know	145	17.6
<b>Visited any health care facility: <math>n = 825</math></b>	356	43.2
<b>Trauma: <math>n = 1507</math></b>	44	2.9
<b>Type of trauma: <math>n = 44</math></b>		
Fractures	1	2.3
Cut wounds	16	36.4
Contusions	13	29.5
Strain	14	31.8

<sup>a</sup>More than one disease were sometimes reported.

<sup>b</sup>Allergy, chest pain, hemorrhoids, joint pain, blocked nose, neck pain, sinusitis, sputum, URTI - upper respiratory tract illnesses.

**Table 2 Use of preventive measures among domestic hajjis from Riyadh**

Preventive measures	n	%
<b>Face mask (n = 1507)</b>		
Most of the time	216	14.3
Sometimes	368	24.4
Occasionally	267	17.7
Never	656	43.5
<b>Face cover (n = 577)</b>		
Most of the time	300	52.0
Sometimes	25	4.3
Occasionally	8	1.4
Never	244	42.3
<b>Eat usually (n = 1507)</b>		
Street vendor	272	18.0
Hamla	1109	73.6
Self cooked food	126	8.4
<b>Eat raw food/vegetables: (n = 1507)</b>		
	1265	83.9
<b>Shaved head (n = 930)</b>		
Did not shave	375	40.3
Shaved:	555	59.7
By licensed barber	392	70.6
By unlicensed barber	56	10.1
By another hajji	107	19.3
Ask for new blade	532	95.9
Scalp wounds	126	13.5
<b>Animal slaughter: (n = 930)</b>		
	11	1.2
<b>Hand washing (n = 1507)</b>		
Less than 5 times/day	146	9.7
More than 5 times/day	1361	90.3
<b>Using hand sanitizer: (n = 1507)</b>		
	686	45.5
<b>Source of drinking water (n = 1507)</b>		
Bottled water	1340	88.9
Shared water	41	2.7
Public water	334	22.2
<b>Smoking (n = 1507)</b>		
	307	20.4

More than one source of drinking water were reported.

wearing a face cover and 90.1% reported wearing it most of the time while 33 (9.9%) wore it sometimes. Food service was provided by a Hamla for 73.6%; the remainder reported consuming self cooked meals (8.4%) and food from street vendors (18.0%). Consumption of raw food or vegetables from any source was reported by 83.9% and most used bottled water for drinking during participation in the Hajj (88.9%). (Table 2).

The services of a licensed barber were utilized by 392 (70.7%) of the 555 male participants who shaved their heads. Unlicensed barbers (10.1%) and other hajjis (19.3%) were also utilized; 40.3% did not shave. Requests for a new shaving blade were made by 95.9%. Scalp wounds from shaving were reported by 13.5%. Few of the hajjis reported being involved in animal slaughter (1.2%). A majority of hajjis washed their hands more than 5 times per day (90.3%).

Nearly half of the hajjis used hand sanitizer during Hajj (45.5%). None of the females reported smoking, and among males, 307 (33.3%) were smokers (Table 2).

Selected chronic diseases were reported by 278 (18.4%) of study participants. Of those, diabetes was reported in 55.7%, hypertension in 60.7%, other cardiac disease (7.5%), and bronchial asthma (11.5%) (not mutually exclusive). Hajjis who had a chronic disease were using their medications regularly (82.0%); of those with a chronic disease, 89.2% reported that they had enough supply of their medications (Table 3). Gender was found to be significantly associated with the occurrence of diarrhoea were males reported an incidence of 6.3% compared to 3.1% for females (RR=2.03,  $P=0.006$ ). On the other hand, nationality (whether Saudi or non-Saudi) did not affect the risk of diarrhoea. The incidence of diarrhoea was highest among hajjis who stayed 4 days or less (11.5%). Longer durations of stay were found to have lower risk for diarrhoea, which was lowest for those 7 days of stay where the incidence was reported to be 2.9% (RR= 0.25,  $P=0.021$ ). Source of food, eating raw vegetables, frequency of hand washing and use of hand sanitizers did not significantly affect the incidence of diarrhoea among studied hajjis (Table 4). Gender, nationality whether Saudi or non-Saudi did not show significant effect on risk of occurrence of URTI. The incidence of UTRIs significantly increased with increased level of education where it was highest among those with primary education (RR= 1.65,  $P=0.002$ ). Concerning duration of stay in hajj areas, those who stayed 8 days or more were significantly suffering from lower risk of infection (RR=0.78,  $P=0.006$ ) compared to other hajjis spending shorter periods. Never or sometimes using face mask was found to significantly increase the risk for URTI (RR= 1.17 and RR=1.21) compared to those who used it most of times. On the other hand,



**Table 3 Distribution of chronic diseases among domestic hajjis from Riyadh**

Chronic diseases	n	%
Any chronic disease (n = 1507)	278	18.4
Type of chronic diseases (n = 278)		
Diabetes	155	55.7
Hypertension	169	60.7
Cardiac diseases	21	7.5
Bronchial asthma	32	11.5
Renal diseases	1	0.3
Having exacerbations of current disease (n = 278)	79	28.4
Diabetics (n = 155)	50	32.2
Hypertensive's (n = 169)	57	33.7
Using medications regularly during Hajj (n = 278)	228	82.0
Have enough supply of medications during Hajj (n = 278)	248	89.2

*Types of chronic diseases were not mutually exclusive.*

the use of face cover was not found to significantly decrease the risk of infection (Table 5).

## Discussion

Acute respiratory tract infections, diarrhoeal diseases and injuries occur worldwide throughout the year and are not limited to any specific age, gender, or nationality. For example, several factors contribute to the wide spread of URTIs including direct contact with affected person, change in climate, and crowded places; all of these contributing factors are present in the Hajj environment [16]. Significant proportion (53%) of hajjis from Riyadh reported experiencing an URTI during or immediately after the Hajj. This high incidence of an illness reveals a high burden of disease. While outside the scope of this study, potential secondary spread among the susceptible population in the hometown of returning hajjis can occur. The disease is uniformly distributed between both genders both old age and diabetes mellitus is known to reduce the immunity and increase the risk for URTIs and other viral infections. The reduced risk between these 2 groups can be due to the reduced mobility of these groups making them less exposed

to URTI cases [11]. The present study showed that those who stayed more than 8 days suffered less URTIs. This could be explained by the fact that hajjis who tend to spend shorter periods were in hurry to perform all rituals during the rush time, which increases the physical burden and possibility of getting infected. On the other hand those spending a relatively longer duration had more opportunity to avoid periods of overcrowdings and perform rituals relatively more comfortably.

As in many mass gatherings, it is important to understand how to prevent the occurrence of a heavy burden of URTI. Given the circumstances of Hajj, it is almost impossible to adequately control the spread of illnesses, facilitated by crowding. The use of personal protective measures such as vaccination, chemoprophylaxis, frequent hand washing/sanitizing, and the use of a face mask provide some protection [15].

Use of a face mask in our study population, was the most important practical protective factor against development of an URTI, although the research evidence regarding the effectiveness of face masks does not include consensus agreement. The use of face masks has been advocated to protect

from inhalation of aerosols containing organic and inorganic particulates [17]. Therefore, as a preventive measure, the recommendations for the prevention of influenza include wearing face mask [18]. Although wearing mask may not provide complete protection from infection; it may reduce exposure to droplet nuclei, considered one of the main modes of transmission of most URTIs [18].

The use of face cover (Hijab/Niqab) by women can also be treated as use of face mask. As most of the female hajjis were Saudis, who practices face cover more often during Hajj as compared to other nationalities, the usage of face mask was quite frequent. But there was no evidence of significant decrease in the incidence of URTI, among women in the present study related to using face mask or face cover. This difference from males can be explained on the basis of other customary practices. Women when alone in their tents with other females do not cover their face (as the use is meant mainly for Hijab and not for personal hygiene) thus having the same high risk of disease transmission in a closed environment with exposure to droplet infection. Thus, the use of face cover as proxy of face mask in status. This change of practice within tents may not be so prominent in men, who are using face mask as personal hygiene measure, independent of the place where they were.

In this study, 9.3% of hajjis from Riyadh who reported symptoms had an attack of diarrhoeal disease during or immediately after the Hajj. The high risk of diarrhoea among males could be explained by the liability of males to get food from different sources due to their wide range of movement compared to females who are usually in the tents most of the time. The Hajj season this year was in the month of November, which means that the weather was cool and that was not in favour of food born diseases. Also, most of the study participants ate food prepared by a Hamla

**Table 4 Factors affecting incidence of diarrhoea among Hajjis from Riyadh (1431 Hijra [2009 Gregorian])**

Source of food	Total hajjis (n = 1507)	Cases of diarrhoea (n = 77)	Incidence (%)	Relative risk	95% confidence interval	P-value
<b>Gender</b>						
Male	930	59	6.3	2.03	1.21-3.41	0.006
Female	577	18	3.1	1		
<b>Nationality</b>						
Saudi	610	31	5.1	1		
Non-Saudi	897	46	5.1	1.01	0.65-1.57	0.968
<b>Educational level</b>						
Illiterate	53	2	3.8	1		
Primary school	159	4	2.5	0.67	0.13-3.54	0.632
Intermediate school	188	8	4.3	1.13	0.25-5.15	0.876
High school	362	12	3.3	0.88	0.20-3.82	0.863
University	745	51	6.8	1.81	0.45-7325	0.385
<b>Duration of stay in Hajj area in days</b>						
<4	26	3	11.5	1		
5	144	8	5.6	0.48	0.14-1.70	0.254
6	520	28	5.4	0.47	0.15-1.44	0.186
7	344	10	2.9	0.25	0.07-0.86	0.021
>8	473	28	5.9	0.51	0.17-1.58	0.248
<b>Source of food</b>						
Street vendor	272	13	4.8	1		
<b>Hamla</b>						
Self cooked food	1109	58	5.2	1.09	0.61-1.97	0.763
<b>Eat raw vegetable</b>						
Yes	1265	64	5.1	1		
No	242	13	5.4	1.06	0.59-1.90	0.840
<b>Hand washing</b>						
<5 times/day	146	8	5.5	1		
>5 times/day	1361	69	5.1	0.93	0.45-1.89	0.831
<b>Use of hand sanitizer</b>						
Yes	686	42	6.1	1		
No	821	35	4.3	0.70	0.45-1.08	0.103

The reference group is the one with relative risk = 1.

and drank bottled water. Nearly half of the studied hajjis were using hand sanitizers and mostly was washing their hands more than 5 times per day. The high percentage of diarrhoea among those with high educational level may be contributed to their chance to live in better housing conditions and neighbourhood compared to those with low educational level and low income. At hajj, and due to overcrowdings, the environment suffers much from pollution which can be relatively tolerated

better by the low educated who may be exposed to similar conditions at their homes while the highly educated cannot leading to their more suffering from diarrhoea

In the present study, more than half of the hajjis had used the razor blades to shave their head during hajj. Head shaving exposes hajjis to scalp wounds especially in case of unexperienced barbers, hastiness due to rush or the hajjis shaving for each other. Due to inability to find barber shops and their

crowdedness, hajjis were forced to rely on other hajjis for head shaving or hair cutting, which gave a good chance for the unlicensed mobile barbers to be active or hajjis learning head shaving on their fellow hajjis with increased risks of cuts. Less than 15% of hajjis who get their head shaved were aware of having at least one cut wound in their scalps. Excessive scalp wounds with the added risk of poor personal hygiene create ideal environment for skin infections and wound contaminations. It is good

**Table 5 Factors affecting incidence of upper respiratory tract illnesses (URTI) among Hajjis from Riyadh (431 Hijra [2009 Gregorian])**

Source of food	Total hajjis (n = 1507)	Cases of URTI (n = 800)	Incidence (%)	Relative risk	95% confidence interval	P-value
<b>Gender</b>						
Male	930	483	51.9	1		
Female	577	317	54.9	1.06	0.96-1.16	0.256
<b>Nationality</b>						
Saudi	610	326	53.44	1		
Non-Saudi	897	474	52.84	0.99	0.90-1.09	0.819
<b>Educational level</b>						
Illiterate	53	20	37.73	1		
Primary school	159	99	62.26	1.65	1.14-2.38	0.002
Intermediate school	188	99	52.65	1.40	0.96-2.02	0.055
High school	362	190	52.48	1.39	0.97-1.99	0.045
University	745	392	52.61	1.39	0.98-1.98	0.036
<b>Duration of stay in Hajj area in days</b>						
<4	26	14	53.84	1		
5	144	84	58.33	1.08	0.74-1.59	0.670
6	520	296	56.92	0.98	0.83-1.14	0.762
7	344	192	55.81	0.96	0.81-1.13	0.609
>8	473	214	45.24	0.78	0.65-0.92	0.006
<b>Used face mask</b>						
Most of the time	216	98	45.37	1		
Sometimes	635	341	53.70	1.17	1.00-1.38	0.045
Never	656	361	55.03	1.21	1.03-1.43	0.014
<b>Used face cover (Hijab/Niqab)*</b>						
Most of the time	300	164	54.66	1		
Sometimes	33	22	66.66	1.22	0.94-1.59	0.188
Never	244	131	53.68	0.98	0.84-1.15	0.820

The reference group is the one with relative risk = 1.

\*total number was 577 as the question was for females only.

to find that 95.5% of hajjis asked for a new blade before shaving which was similarly found by other studies where the hajjis who got their head shaved with the used razor were only 6% (Choudhry et al. Behavioural risk factors for diseases during the pilgrimage to Makkah, [unpublished]). This reflects an increase in awareness about the danger of using used blades for head shaving and reduces transmission of blood-borne disease such as HIV, Hepatitis B and C.

### Study limitations

Limitations of this study included the self-reported nature of information

collection, and possibly recall bias since some of our recruits were contacted a week post Hajj while others were contacted 4 weeks post Hajj. Also demographic data of nonrespondents were not available to determine if they differed from respondent or not. The strengths of this study included the use of trained interviewers, use of standardized questionnaire and collecting information regarding symptoms rather than disease names, which should reduce variation in participant description. A substantial study size (n=1507) provided for ample statistical power. While comparing the results of the present

study with previous behavioural risk factors studies conducted in 1998, 2002, and 2006 [19,20] improvements were noticed in some of the variables, such as increase in proportion of hajjis for whom Hamla was the main source of cooked food, for whom sealed plastic bottles/ bags were the main source of drinking water, who get their hair cut by professional barber, who used face mask during hajj, who had both influenza and Hepatitis A vaccination coverage; and decrease in proportion of hajjis who suffered from injuries.

In conclusion, URTI is a common health problem among studied

domestic hajjis. Generally, there is improvement in the adoption of preventive measures by hajjis, however still face mask use is limited in spite of the fact that using it significantly decreases the risk for URTI.

In recommendations, the surveillance system for URTI need to be enhanced by the Ministry of Health due to its high incidence and the burden it has on health system both in Hajj area and the city of residence of the hajjis

Health education programs should be organized to all those who intended to perform hajj to increase the awareness about protective measures against URTI, diarrhoeal diseases, injuries and exacerbations of chronic diseases.

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