

Patterns of diseases and preventive measures among domestic hajjis from Central, Saudi Arabia

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ABSTRACT

الأهداف: تحديد معدل حدوث أمراض الجهاز التنفسي العلوي والإسهال والإصابات أثناء موسم الحج والإجراءات الوقائية المتبعة بين الحجاج.

الطريقة: أُجريت هذه الدراسة المقطعية خلال الفترة من نوفمبر إلى ديسمبر 2009م 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 و9.3% 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 وحدوث الإسهال. ولم يلاحظ وجود علاقة إحصائية واضحة بين مستوى التعليم وحدوث أمراض الجهاز التنفسي العلوي أو الإصابات، بينما كان هناك ارتباط ذو دلالة معنوية بين مستوى التعليم وحدوث الإسهال. كما لم يتبين وجود علاقة إحصائية واضحة بين الجنسية وحدوث الإسهال والإصابات، بينما كان علاقة إحصائية واضحة بين الجنسية وحدوث 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.

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 cross-sectional 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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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).

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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), diarrheal 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 centers (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 centers. 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 Diarrhea 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 diarrheal 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 centers. In the second stage, study subjects were systematically selected from each of the 11 centers 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 analyzed using SPSS software statistical package version 19. The number and percentage distribution for each variable was calculated. Observed differences were statistically analyzed 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 ± 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 ± 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 diarrheal 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).

Facemasks 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 wearing a face cover and 90.1% reported

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

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

*More than one disease were sometimes reported

†Allergy, chest pain, hemorrhoids, joint pain, blocked nose, neck pain, sinusitis, sputum, URTI - upper respiratory tract illnesses

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 diarrhea 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 diarrhea. The incidence of diarrhea was highest among hajjis who stayed 4 days or less (11.5%). Longer durations of stay were found to have lower risk for diarrhea, 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 diarrhea 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 facemask was found to significantly increase the risk for URTI (RR= 1.17 and RR=1.21)

Table 2 - Use of preventive measures among domestic hajjis from Riyadh.

Preventive measures	n	(%)
Face mask (n= 1507)		
Most of the time	216	(14.3)
Sometimes	368	(24.4)
Occasionally	267	(17.7)
Never	656	(43.5)
Face cover (n=577)		
Most of the time	300	(52.0)
Sometimes	25	(4.3)
Occasionally	8	(1.4)
Never	244	(42.3)
Eat usually (n=1507)		
Street vendor	272	(18.0)
Hamla	1109	(73.6)
Self cooked food	126	(8.4)
Eat raw food/vegetables: (n=1507)	1265	(83.9)
Shaved head (n=930)		
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)
Animal slaughter: (n=930)	11	(1.2)
Hand washing (n=1507)		
Less than 5 times/day	146	(9.7)
More than 5 times/day	1361	(90.3)
Using hand sanitizer: (n=1507)	686	(45.5)
Source of drinking water (n=1507)		
Bottled water	1340	(88.9)
Shared water	41	(2.7)
Public water	334	(22.2)
Smoking (n=1507)	307	(20.4)
More than one source of drinking water were reported		

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)		
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		

Table 4 - Factors affecting incidence of diarrhea among Hajjis from Riyadh (1431 Hijra [2009 Gregorian]).

Source of food	Total hajjis (n=1507)	Cases of diarrhea (n=800)	Incidence (%)	Relative risk	95% confidence interval	P-value
<i>Gender</i>						
Male	930	59	6.3	2.03	1.21 - 3.41	0.006
Female	577	18	3.1	1		
<i>Nationality</i>						
Saudi	610	31	5.1	1	0.65 - 1.57	0.968
Non-Saudi	897	46	5.1	1.01		
<i>Educational level</i>						
Illiterate	53	2	3.8	1	0.13 - 3.54	0.632
Primary school	159	4	2.5	0.67		
Intermediate school	188	8	4.3	1.13		
High school	362	12	3.3	0.88		
University	745	51	6.8	1.81		
<i>Duration of stay in Hajj area in days</i>						
≤4	26	3	11.5	1	0.14 - 1.70	0.254
5	144	8	5.6	0.48		
6	520	28	5.4	0.47		
7	344	10	2.9	0.25		
>8	473	28	5.9	0.51		
<i>Source of food</i>						
Street vendor	272	13	4.8	1	0.39 - 2.56	0.994
Hamla	1109	58	5.2	1.09		
Self cooked food	126	6	4.8	1.00		
<i>Eat raw vegetable</i>						
Yes	1265	64	5.1	1	0.59 - 1.90	0.840
No	242	13	5.4	1.06		
<i>Hand washing</i>						
<5 times/day	146	8	5.5	1	0.45 - 1.89	0.831
>5 times/day	1361	69	5.1	0.93		
<i>Use of hand sanitizer</i>						
Yes	686	42	6.1	1	0.45 - 1.08	0.103
No	821	35	4.3	0.70		

The reference group is the one with relative risk = 1

compared to those who used it most of times. On the other hand, the use of face cover was not found to significantly decrease the risk of infection (Table 5).

Discussion. Acute respiratory tract infections, diarrheal 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.

Table 5 - Factors affecting incidence of diarrhea among Hajjis from Riyadh (431 Hijra [2009 Gregorian]).

Source of food	Total hajjis (n=1507)	Cases of diarrhea (n=800)	Incidence (%)	Relative risk	95% confidence interval	P-value
Gender						
Male	930	59	6.3	2.03	1.21 - 3.41	0.006
Female	577	18	3.1	1		
Nationality						
Saudi	610	31	5.1	1	0.65 - 1.57	0.968
Non-Saudi	897	46	5.1	1.01		
Educational level						
Illiterate	53	2	3.8	1	0.13 - 3.54	0.632
Primary school	159	4	2.5	0.67		
Intermediate school	188	8	4.3	1.13		
High school	362	12	3.3	0.88		
University	745	51	6.8	1.81		
Duration of stay in Hajj area in days						
≤4	26	3	11.5	1	0.14 - 1.70	0.254
5	144	8	5.6	0.48		
6	520	28	5.4	0.47		
7	344	10	2.9	0.25		
>8	473	28	5.9	0.51		
Source of food						
Street vendor	272	13	4.8	1	0.61 - 1.97	0.763
Hamla	1109	58	5.2	1.09		
Self cooked food	126	6	4.8	1.00		
Eat raw vegetable						
Yes	1265	64	5.1	1	0.59 - 1.90	0.840
No	242	13	5.4	1.06		
Hand washing						
<5 times/day	146	8	5.5	1	0.45 - 1.89	0.831
>5 times/day	1361	69	5.1	0.93		
Use of hand sanitizer						
Yes	686	42	6.1	1	0.45 - 1.08	0.103
No	821	35	4.3	0.70		

The reference group is the one with relative risk = 1

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 facemask provide some protection.¹⁵

Use of a facemask in our study population, was the most important practical protective factor against development of an URTI, although the research evidence regarding the effectiveness of facemasks does not include consensus agreement. The use of facemasks 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 facemask.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 facemask. As most of the female hajjis were Saudis, who practices face cover more often during Hajj as compared to other nationalities, the usage of facemask 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 facemask 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 facemask in

female may be leading to misclassification of exposure status. This change of practice within tents may not be so prominent in men, who are using facemask 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 diarrheal disease during or immediately after the Hajj. The high risk of diarrhea 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 favor of food born diseases. Also, most of the study participants ate food prepared by a Hamla 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 diarrhea among those with high educational level may be contributed to their chance to live in better housing conditions and neighborhood 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 diarrhea

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 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. Behavioral 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 non-respondents 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 behavioral 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 facemask 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, diarrheal diseases, injuries and exacerbations of chronic diseases.

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