

Awareness of healthcare workers regarding preventive measures of communicable diseases among Hajj pilgrims at the entry point in Western Saudi Arabia

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ABSTRACT

الأهداف: تحديد مستوى الوعي بين العاملين في الرعاية الصحية حول الإجراءات الوقائية من الأمراض الانتقالية بين الحجاج، بالإضافة إلى تسليط الضوء على الصعوبات التي تواجه هؤلاء في تطبيق هذه الإجراءات.

الطريقة: أُجريت هذه الدراسة المقطعية في قاعات وصول الحجاج بمطار الملك عبد العزيز الدولي، جدة، المملكة العربية السعودية خلال الفترة من أكتوبر إلى نوفمبر 2009م. لقد شملت الدراسة 325 من العاملين في الرعاية الصحية، وتم جمع بيانات الدراسة باستخدام استمارة استبيان تم تعبئتها ذاتياً من قبل المشاركين في الدراسة.

النتائج: لقد كان من بين المصاعب التي تواجه العاملين الصحيين رفض التطعيم أو العلاجات الوقائية من قبل بعض الحجاج، بالإضافة إلى حواجز اللغة وصعوبة تنظيم الحجاج. وقد أجاب العاملون بصورة صحيحة عن معظم الأسئلة الخاصة بالوقاية من مرض التهاب السحايا بالمكورات السحائية فيما عدا الإجراءات الوقائية لهذا المرض بين الأطفال. وقد تبين أن أقل من نصف المشاركين في الدراسة على دراية بفترة صلاحية شهادة التطعيم ضد الحمى الصفراء، والإجراءات الواجب اتخاذها مع الحجاج الغير مطعمين. وتبين أن 32.9% فقط كان لديهم معرفة بالإجراءات الوقائية ضد مرض أنفلونزا الخنازير، كما تبين أن الأطباء والعاملين الصحيين الذين أطلعوا على الأدلة الإرشادية وذوي الخبرة الطويلة كان لديهم مستوى أعلى من الوعي مقارنة بالفئات الأخرى.

خاتمة: يواجه العاملون الصحيون صعوبات في تطبيق بعض الإجراءات الوقائية خاصة بين غير الأطباء وذوي سنوات الخبرة الأقل والذين لم يطلعوا على الأدلة الإرشادية مما يبين أهمية تنفيذ دورات تدريبية لهم قبل موسم الحج.

Objectives: To determine the level of knowledge of healthcare workers (HCWs) towards preventive measures for communicable diseases among pilgrims, and to highlight the difficulties faced by HCWs in implementing preventive measures at entry point.

Methods: A cross-sectional study was conducted at King Abdulaziz International Airport Hajj Terminals in Jeddah, Kingdom of Saudi Arabia during Hajj season from October to November 2009 including 325 healthcare workers (HCWs). Data were collected using a self-administered questionnaire.

Results: Difficulties reported by HCWs were refusal of vaccine, or chemoprophylaxis by some pilgrims, language barriers, and difficulties in organizing pilgrims. The different items related to meningococcal meningitis were answered correctly by most HCWs except for preventive measures applied to infants and children. Less than one half were aware of the period of validity for Yellow Fever vaccine certificate and measures to be taken for unvaccinated pilgrims. Only 32.9% were aware of preventive measures that should be applied against influenza A (H1N1). Physicians, those reading guidelines, and those with high experience showed significantly better level of knowledge than other categories.

Conclusion: The HCWs have difficulties in some preventive measures, especially among non-physicians, those with less years of experience, and those who did not read the written guidelines, which highlighted the importance of training courses before Hajj season.

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The mass gathering of pilgrims during the Hajj season from different countries with various epidemiological backgrounds creates a situation, which increases the risk of spread of communicable diseases both to the visiting pilgrims and their contacts on return home.¹ Outbreak of multiple infectious diseases have been reported repeatedly during and following the Hajj. The first reported international outbreak of *Neisseria meningitidis* serogroup A meningitis following Hajj occurred in 1987.² Before this outbreak, vaccination against *Neisseria meningitidis* was required only for pilgrims from sub-Saharan countries to obtain a visa for the Kingdom of Saudi Arabia (KSA). After this outbreak, vaccination with bivalent A and C vaccine became compulsory for all pilgrims, and oral ciprofloxacin became compulsory to pilgrims from sub-Saharan countries.³ An international outbreak of serogroup W₁₃₅ meningococcal disease occurred during the Hajj pilgrimages of 2000 and 2001.⁴ Several reports from all over the world have shown that this W₁₃₅ outbreak strain affected not only the pilgrims, but also the household contacts of returning pilgrims, and the community at large with the potential of non-Hajj-related further epidemics.⁵ As a result, the Ministry of Health (MOH) in KSA changed its policy for meningococcal vaccination for the Hajj season in 2002, and mandated quadrivalent meningococcal vaccination (A, C, Y, and W₁₃₅) for all pilgrims.⁶ Cholera has also reached Hajj areas, and caused epidemics recorded as far back as 1846. The last epidemic in Hajj was in 1989 affecting 102 pilgrims.⁷ Improved water supply and sewage systems have eliminated cholera outbreaks since then. However, the MOH mandates the surveillance of pilgrims arriving from cholera-affected countries, and the suspected cases are isolated in quarantine.^{7,8} In accordance with the revised International Health Regulations in 2005, all pilgrims arriving from countries, or areas at risk of Yellow Fever transmission must present a valid certificate of Yellow Fever vaccination.⁹ Since 2005, the MOH in KSA requires that all individuals, aged less than 15 years traveling to KSA from countries re-infected with poliomyelitis should be vaccinated against poliomyelitis with oral poliovirus vaccine (OPV). Proof of OPV vaccination is required 6 weeks prior to application for an entry visa. Irrespective of previous vaccination history, all individuals aged less than 15 years arriving in KSA will also receive one dose of OPV at border points.¹⁰ This study was conducted to assess awareness of health care workers (HCWs) at King Abdulaziz International Airport, Jeddah, KSA during the Hajj season regarding preventive measures for communicable diseases among pilgrims, and to highlight the difficulties faced by HCWs in implementing preventive measures at entry point.

Methods. This descriptive cross-sectional self-administered questionnaire-based study was conducted during the Hajj seasons from October to November 2009 at King Abdulaziz International Airport Hajj Terminals, Jeddah, KSA. There is a checkpoint at entry of each arrival hall before the custom checking offices. These check points are supported by medical teams mainly consisting of physicians, health inspectors, and nurses. The HCWs are distributed in 14 terminals, where they screened all pilgrims for diseases of international concern, and checked for the required vaccination certificates. The study population was all HCWs assigned at the Hajj terminals of King Abdulaziz International Airport during the 2009 Hajj season. The HCWs consisted of physicians, health inspectors, and nurses. The total number was estimated to be 339 HCWs. A self-administered structured questionnaire was designed to collect information from all HCWs in line with the study objectives. The questionnaire was validated by being subjected to review by 3 experts and peer reviewing. It covers information regarding demographic characteristics, total years of experience, number of participation in Hajj, and receiving training courses regarding communicable diseases in Hajj. It also included information of HCWs knowledge on preventive measures applied at King Abdulaziz International Airport Hajj terminals, their attitude towards these measures, and difficulties they encountered when applying them. Regarding the assessment of knowledge of HCWs, 16 questions were asked regarding every disease targeted by preventive measures at the entry points: 9 questions on preventive measures applied against meningococcal meningitis; 2 questions on preventive measures applied against poliomyelitis, 2 questions on preventive measures applied against Yellow Fever; and 3 questions on preventive measures applied against novel influenza A (H1N1). A score of zero was given for wrong answers, and one for correct ones with a total score of 15. The level of knowledge of the studied subjects was presented as a percentage from the total score. Three levels of knowledge were identified; <50% corrected answers as having poor level knowledge, >50% and <75% corrected answers as having suboptimal level of knowledge, and >75% corrected answers as having good level of knowledge. Questionnaire sheets showed missing data for some variables, which resulted in different total for each variable. The total number was stated whenever it was less than the total recruited sample of 325 HCWs. The permission from the Director of Health Services Center at King Abdulaziz International Airport was obtained for visiting the Hajj terminals, where health teams performed their duties. Meeting with supervisor of each health team was carried out, and with their collaboration, the questionnaires were distributed to all HCWs to be filled and returned back on the spot.

The Epi Info version 3.5.1 (Center of Disease Control and Prevention, Atlanta, USA in collaboration with WHO) computer software package was used for data entry, tabulation, and analysis. The frequencies of all the studied variables were calculated and for scale variables, the mean and standard deviation were calculated. The effect of different explanatory variables on different outcomes was estimated by chi-square test. A $p < 0.05$ was used as a cutoff point for statistical significance.

Results. A total number of 325 HCWs returned the completed questionnaires, representing a response rate of 96%. Physicians constituted 12.9%, nurses (36.6%), health inspectors (41.5%), and other health specialties represented 8.9%, in which most of them were pharmacists and lab technicians. All HCWs were males. Most of them were in the age group between 30-40 years (41.2%) with a mean age of 36.2 ± 8.7 years. Saudis constituted most of the HCWs (88.9%). Most HCWs had work experience of one to 10 years (47.9%), and most of them participated in working at entry points between 2-5 times (49.1%), whereas 29.9% participated for the first time. Only 19.1% of HCWs received training courses on infectious diseases in Hajj, and only 8.6% of HCWs received training courses on preventive measures applied at entry points. Regarding the availability of written guidelines, 68.0% of HCWs reported receiving one, and 57.2% had read it (Table 1). The HCWs reported some difficulties when they applied preventive measures, which mostly concentrated on 3 items; refusal of vaccine and or chemoprophylaxis by some pilgrims (52.6%); language barrier (54.2%); and difficulties in organizing pilgrims (38.8%). Only 20% of HCWs did not report any difficulties during their duties. Physicians who reported no difficulties represented 35.7% compared to 19.3% among health inspectors, and 17.6% of nurses with statistically significant difference ($p=0.028$) (Table 2). The different items related to *Meningococcal meningitis* were answered correctly by most of the studied HCWs except for preventive measures applied to infants and children. The type of vaccine for infants was known by only 13.2%, while chemoprophylaxis for children was correctly answered by 38.8%. Only 41.2% knew correctly the situation in which chemoprophylaxis was indicated for pilgrims. The questions regarding polio were properly known by most HCWs. Less than one half (45.8%) knew the period of validity for Yellow Fever vaccine certificate, while 53.5% knew the measures that should be taken for unvaccinated pilgrims. Only 32.9% were aware of preventive measures that should be applied against influenza A (H1N1) at entry point (Table 3).

Table 1 - Sociodemographic characteristics of the studied healthcare workers in King Abdulaziz International Airport, Jeddah, Kingdom of Saudi Arabia.

Characteristics	n	(%)
Age, years (n=318)		
20-29	106	(33.3)
30-39	131	(41.2)
40-49	56	(17.6)
50-60	25	(7.9)
Mean \pm standard deviation	36.2 ± 8.7	
Nationality, (n=325)		
Saudi	289	(88.9)
Non-Saudi	36	(11.1)
Occupation, (n=325)		
Physicians	42	(12.9)
Nurse	119	(36.6)
Health inspector	135	(41.5)
Others	29	(8.9)
Years of experience, (n=313)		
1-10	150	(47.9)
11-20	108	(34.5)
>20	55	(17.6)
Mean \pm standard deviation	12.9 ± 8.5	
Number of times participated in Hajj, (n=318)		
First	95	(29.9)
2-5	156	(49.1)
6-10	46	(14.5)
>10	21	(6.6)
Received training in infectious diseases, (n=325)	62	(19.1)
Received training on preventive measures at entry points (n=325)	28	(8.6)
Received written guidelines (n=325)	221	(68.0)
Reading the written guidelines (n=325)	186	(57.2)

Physicians showed better level of knowledge than other HCWs. Physicians with >75% score represented 61.9%. This is to be compared with 29.6% among health inspectors, and 20.1% among nurses, and 20.7% for other health specialty. On the other hand, 24.1% of HCWs from other health specialty reported low score (<50%). Differences in knowledge level in relation to occupation were found statistically significant ($p < 0.001$). Forty-nine percent of HCWs with >20 years of experience scored more than 75%, which was higher than HCWs who had 11-20 years of experience (27.8%), and those with years of experience between one to 10 years (22.7%). Moreover, 18% of HCWs who had experience between one to 10 years scored less than 50% compared to 11.1% for HCWs who had experience between 11-20 years, and 7.3% for HCWs with >20 years of experience. These differences were statistically significant ($p=0.002$). The study revealed no statistical significant difference between HCWs regarding their level of knowledge in relation to their previous Hajj participation, or receiving previous training. The HCWs who got a score >75% was higher

Table 2 - Distribution of reported difficulties in conducting preventive measures by healthcare workers during Hajj at King Abdulaziz International Airport, Jeddah, Kingdom of Saudi Arabia (N=325).

Items of difficulties	Physicians n=42	Nurses n=119	Health inspectors n=135	Others n=29	Total	X ²	P-value
	n (%)	n (%)	n (%)	n (%)	n (%)		
No difficulties	15 (35.7)	21 (17.6)	26 (19.3)	3 (10.3)	65 (20.0)	9.09	0.028
Not knowing some preventive measures at entry points	1 (2.4)	9 (7.6)	13 (9.6)	6 (20.7)	29 (8.9)	7.50	0.057
Some preventive measures at entry points are not clear	10 (23.8)	34 (28.6)	31 (23.0)	8 (27.6)	83 (25.5)	1.17	0.758
Refusal of vaccine and or chemoprophylaxis by some pilgrims	15 (35.7)	64 (53.8)	76 (56.3)	16 (55.2)	171 (52.6)	5.68	0.127
Difficulties in organizing pilgrims	16 (38.1)	54 (45.4)	44 (32.6)	12 (41.4)	126 (38.8)	4.45	0.216
Difficulties in communication with some pilgrims	18 (42.9)	64 (53.8)	78 (57.8)	16 (55.2)	176 (54.2)	2.89	0.408
Difficulties in coordination with colleagues	8 (19.0)	18 (15.1)	10 (7.4)	3 (10.3)	39 (12.0)	5.84	0.119
Unavailability of vaccine and or chemoprophylaxis	2 (4.8)	7 (5.9)	2 (1.5)	1 (3.4)	12 (3.7)	3.60	0.307

Table 3 - Distribution of correct answers of healthcare workers regarding preventive measures at entry points in King Abdulaziz International Airport, Jeddah, Kingdom of Saudi Arabia (N=325).

Items of knowledge	Number (%)
Meningococcal meningitis	
Checking for presence of vaccination certificate	289 (88.9)
Checking for validity of vaccination certificate	303 (93.2)
Type of vaccine against <i>M. meningitis</i> required by adult pilgrims	282 (86.7)
Type of vaccine against <i>M. meningitis</i> for infants	43 (13.2)
Type of chemoprophylaxis given to adults	294 (90.5)
Chemoprophylaxis given to children <15 years	126 (38.8)
Type of chemoprophylaxis given to pregnant women	228 (70.2)
Countries of African meningitis belt	297 (91.4)
Situations in which chemoprophylaxis against <i>M. meningitis</i> is indicated	134 (41.2)
Poliomyelitis	
Age of children from polio affected countries given polio vaccine	266 (81.8)
Countries in which oral polio given to all age groups	278 (85.5)
Yellow Fever	
The period of validity of Yellow Fever vaccination certificate	149 (45.8)
Measures that should be taken for unvaccinated pilgrims	174 (53.5)
H1N1 influenza	
Definition of suspected case of influenza A (H1N1)	311 (95.7)
Preventive measures applied against influenza A (H1N1) at entry points	107 (32.9)
The suspected symptoms that must be notified for influenza A (H1N1)	222 (68.3)
<i>M. meningitis</i> - Meningococcal meningitis	

among those who read the written guideline (32.8%) compared to those who did not (25.4%). This difference was found statistically significant ($p=0.018$) (Table 4).

Discussion. Hajj is the largest and the most diverse mass gathering of people in the world. This mass gathering entails some of the world's most important public health and infectious disease hazards. Many of these infections can be avoided or averted by adopting appropriate preventive measures. Prevention of these infections needs effort to raise awareness on the health hazards during Hajj among HCWs, especially those working with pilgrims to be able to conduct effectively preventive measures, such as immunization and health education.⁸ This study revealed that all study participants were males. This dominance of male gender may be attributed to the work place, which is only having one single room to stay in during the 12 hours duty period. The local culture prevents females from working in such environment. Regarding the age of study participants, they were mainly in the middle age category, which is preferable to the work environment as it involves a lot of moving around for long hours. Training and in-service continuous medical education was proven by many studies to increase knowledge level, create positive attitude at work, and improve the quality of service provided by HCWs.¹¹⁻¹³ This study revealed that most HCWs did not receive any training courses. This could be explained by the paucity of the MOH competent trainers in preventive measures applied at

Table 4 - Factors affecting knowledge level of studied healthcare workers in King Abdulaziz International Airport, Jeddah, Kingdom of Saudi Arabia (N=325).

Occupation	Level of knowledge as percentage of total score				X ²	P-value
	<50 n (%)	50-75 n (%)	>75 n (%)	Total n (%)		
<i>Occupation, n=325</i>					31.37	<0.001
Physicians	0 (0.0)	16 (38.1)	26 (61.9)	42 (100)		
Nurses	19 (16.0)	76 (63.9)	24 (20.1)	119 (100)		
Health inspectors	18 (13.3)	77 (57.0)	40 (29.6)	135 (100)		
Others	7 (24.1)	16 (55.2)	6 (20.7)	29 (100)		
<i>Years of working experience, n=313</i>					16.13	0.002
1-10	27 (18.0)	89 (59.3)	34 (22.7)	150 (100)		
11-20	12 (11.1)	66 (61.1)	30 (27.8)	108 (100)		
>20	4 (7.3)	24 (43.6)	27 (49.1)	55 (100)		
<i>Number of times working in Hajj, n=318</i>					4.49	0.343
First time	16 (16.8)	47 (49.5)	32 (33.7)	95 (100)		
2-5	19 (12.2)	97 (62.2)	40 (25.6)	156 (100)		
>5	8 (12.0)	37 (55.2)	22 (33.3)	67 (100)		
<i>Previous training in infectious diseases, n=325</i>					0.66	0.717
Yes	8 (12.9)	33 (53.2)	21 (33.9)	62 (100)		
No	36 (13.7)	152 (57.8)	75 (28.6)	263 (100)		
<i>Received training on preventive measures, n=325</i>					1.25	0.535
Yes	2 (7.1)	18 (64.3)	8 (28.6)	28 (100)		
No	42 (14.1)	167 (56.2)	88 (29.6)	297 (100)		
<i>Reading the guidelines, n=325</i>					7.94	0.018
Yes	17 (9.1)	108 (58.1)	61 (32.8)	186 (100)		
No	27 (19.4)	77 (55.4)	35 (25.2)	139 (100)		

entry points during the Hajj season, or might be due to the difficulties to arrange training sessions as the HCWs at entry points of the airport came from different areas throughout the kingdom.

Applying preventive measures toward pilgrims at entry points is a crucial step in preventing the possible outbreaks during Hajj. Identifying HCWs' difficulties is of concern in order to improve the quality of work. The most frequent difficulties facing HCWs were refusal of vaccine and chemoprophylaxis by some pilgrims, language barriers, and difficulties in organizing pilgrims. The MOH statistics during 2009 showed that the total number of pilgrims was 1,774,992 from 146 different countries.¹⁴ This number did not include pilgrims coming from different regions of KSA. This wide diversity of nationalities with different languages impose a real challenge for HCWs to provide high quality service, as they have to communicate with them. Sometimes, language barrier hinders understanding of pilgrims to the necessary procedures at entry points, and are reflected as poor compliance with HCW's instructions. Appropriate training courses before the Hajj season may solve this problems.

Meningococcal meningitis is a major public health concern. The epidemiology of the disease changes rapidly. Effective protective and control measures with immunization for major serogroup is crucial, in order to reduce the impact of the disease in communities all over the world.¹⁵ Overcrowding, high humidity,

and dense air pollution during the Hajj contributed to carrier rates for meningococcal disease as high as 80%.³ With this crowded condition prevalent at Hajj, antimicrobial prophylaxis like single-dose oral ciprofloxacin can be a powerful tool for limiting the spread of meningococcal infection.¹⁶ In the present study, awareness of studied HCWs were not sufficient on the indications of chemoprophylaxis, and measures applied for the prevention of meningococcal meningitis among infants and children. In spite of the fact that most pilgrims are of adult age, some pilgrims came in families accompanying their young siblings, who are more vulnerable to infection compared to adults, and should be addressed properly by preventive measures.

Wild poliovirus transmission has ceased in most countries due to improved immunization, and the global initiative to eradicate poliomyelitis. Importation remains a threat, especially from Afghanistan, India, Nigeria, and Pakistan.¹⁷ The present study revealed that most HCWs had good level of knowledge regarding the preventive measures against poliomyelitis. The HCWs in this study were working mainly in preventive medicine departments, and most of them shared in the campaigns against poliomyelitis in KSA.

In the present study, knowledge on the validity of Yellow Fever vaccination certificate, and measures to unvaccinated pilgrims were not known by nearly one-half of the studied HCWs. Yellow Fever can cause epidemics.¹⁹ When epidemics occur in unvaccinated

populations, case-fatality rates may exceed 50%. The risk of international spread is greater than before. So far, the virus circulation has remained within the borders of historically endemic countries.¹⁸ The virus can spread quickly and cause epidemics in areas with a high density of vectors (*Aedes aegypti* mosquitoes), and non-immune population, such as Makkah and Jeddah.

Respiratory infections are the most frequently reported complaints among pilgrims.¹⁹ Influenza is the most common vaccine preventable respiratory virus infection identified among pilgrims.^{20,21} In the present study, most of the study subjects revealed poor knowledge regarding preventive measures for influenza H1N1 that could be attributed to the lack of appropriate educational activity for HCWs, as was observed in the present study.

This study revealed that the level of knowledge among HCWs was widely varied according to job categories. Most of the physicians showed better level of knowledge than other HCWs. This difference regarding knowledge in different job categories can be explained in part by the different educational level. The present study revealed also that the level of knowledge of HCWs workers increased with increasing work experience, but not associated with number of participation in entry points during Hajj. This could be explained in part by the theoretical nature of the questions asked in this study, which was supported by the significant association between increasing level of knowledge, and reading the written guidelines revealed in this study. The findings of the present study indicated the need for regular monitoring, and evaluation of the services offered by HCWs for prevention of infectious diseases among pilgrims to avoid the spread of these diseases among contacts of pilgrims at their countries. In-service training program should be designed and implemented before the Hajj season, and its effect should be evaluated to be further tailored according to the needs of HCWs at the port of entry of Hajjis.

There are factors that had limited our studies. The study shows knowledge and attitude of HCW towards methods of prevention, but cannot measure their actual performance. The high rate of influx of pilgrimage during a short period poses a great overload on HCWs that may affect their performance even with a good level of knowledge. There is a high rate of turn-over among HCWs working in Hajj season from one year to another. The level of knowledge and performance should be monitored regularly as it could be liable to change with the change of the working team personnel. This is one of the limitations of the study that knowledge could be variable from one year to another due to high rate of turnover of HCWs.

In conclusion, a large proportion of HCWs at King Abdulaziz International Airport did not receive training courses regarding common infectious diseases during Hajj, or the preventive measures that should be applied at entry points before the Hajj season. They had difficulties in some preventive measures, especially among non-physicians, those with less years of experience, and those who did not read the written guidelines of preventive measures, which highlighted the importance of arrangement of training courses before Hajj season.

Further studies are needed to monitor changes in knowledge, attitude, and practices of HCWs at entry point at different periods of time due to high turnover of personnel.

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References

1. World Health Organization. Communicable disease alert and response for mass gatherings. [Accessed 2010 May 25. Updated 2008 June] Available from URL: http://www.who.int/csr/mass_gathering/en/
2. Moore PS, Harrison LH, Telzak EE, Ajello GW, Broome CV. Group A meningococcal carriage in travelers returning from Saudi Arabia. *JAMA* 1988; 260: 2686-2689.
3. al-Gahtani YM, el Bushra HE, al-Qarawi SM, al-Zubaidi AA, Fontaine RE. Epidemiological investigation of an outbreak of meningococcal meningitis in Makkah (Mecca), Saudi Arabia, 1992. *Epidemiol Infect* 1995; 115: 399-409.
4. Wilder-Smith A, Memish Z. Meningococcal disease and travel. *Int J Antimicrob Agents* 2003; 21: 102-106.
5. Mölling P, Bäckman A, Olcén P, Fredlund H. Comparison of Serogroup W-135 Meningococci Isolated in Sweden during a 23-Year Period and Those Associated with a Recent Hajj Pilgrimage. *J Clin Microbiol* 2001; 39: 2695-2699.
6. Memish, ZA, Venkatesh S, Ahmed QA. Travel epidemiology: the Saudi perspective. *Int J Antimicrob Agents* 2003; 21: 96-101.
7. Ahmed QA, Arabi YM, Memish ZA. Health risks at the Hajj. *Lancet* 2006; 367: 1008-1015.
8. Shafi S, Booy R, Haworth E, Rashid H, Memish ZA. Hajj: health lessons for mass gatherings. *J Infect Public Health* 2008; 1: 27-32.
9. World Health Organization. International Health Regulations 2005. [Accessed 2010 May 26; Updated 2011] Available from URL: <http://www.who.int/csr/ihr/en/>
10. World Health Organization. International travel and health 2009. [Accessed 2010 May 26; Updated 2011] Available from URL: <http://www.who.int/ith/en/>
11. Mockiene V, Suominen T, Valimaki M, Razbadauskas A, Martinkenas A, Caplinskas S. The impact of an education intervention to change nurses' HIV-related knowledge and attitudes in Lithuania: a randomized controlled trial. *J Assoc Nurses AIDS Care* 2011; 22: 140-149.

12. Kuusisto H, Virkki M, Wuolijoki E, Keränen T. Hospital training program increases awareness of Good Clinical Practice (GCP). *Contemp Clin Trials* 2011; 32: 339-341.
13. Khader YS, Batayha W, Al-Omari M. The effect of evidence-based medicine (EBM) training seminars on the knowledge and attitudes of medical students towards EBM. *J Eval Clin Pract* 2011; 17: 640-643.
14. Entry Points Surveillance Unit. Cumulative report for pilgrims' entry according to nationality, Hajj season 1431 H. Riyadh (KSA); Preventive Medicine Department, Ministry of Health: 2011.
15. Memish ZA, Alrajhi AA. Meningococcal disease. *Saudi Med J* 2002; 23: 259-264.
16. Center for Disease Control and Prevention. Prevention and Control of Meningococcal Disease. Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep* 2005; 54: 1-21.
17. Heymann DL. Poliomyelitis acute. In: Control of Communicable Diseases Manual. 19th ed. Washington (DC): American Public Health Association; 2008. p. 684-690.
18. World Health Organization. Global Alert and Response. Yellow Fever Fact Sheet. [Accessed on 2010 May 30; Updated 2011] Available from URL: <http://www.who.int/csr/disease/yellowfev/en/>
19. El-Sheikh SM, El-Assouli SM, Mohammed KA, Albar M. Bacteria and viruses that cause respiratory tract infections during the pilgrimage (Haj) season in Makkah, Saudi Arabia. *Trop Med Int Health* 1998; 3: 205-209.
20. Balkhy HH, Memish ZA, Bafageer S, Almuneef MA. Influenza a common viral infection among Hajj pilgrims: time for routine surveillance and vaccination. *J Travel Med* 2004; 11: 82-86
21. Freedman DO, Leder K. Influenza: changing approaches to prevention and treatment in travelers. *J Travel Med* 2005; 12: 36-44.

Related topics

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Arafa MA, Rabah DM, Abdel-Gawad E, Ibrahim FK. Association of physicians' knowledge and behavior with prostate cancer counseling and screening in Saudi Arabia. *Saudi Med J* 2010; 31: 1245-1250.

Shahbic HE, Said HA. Flu vaccine among health workers in Qatar. *Saudi Med J* 2010; 31: 1157-1160.

Al-Asmary SM, Al-Shehri AS, Al-Omari FK, Farahat FM, Al-Otaibi FS. Pattern of use and impact of patient sitters on the quality of healthcare in Saudi Arabia. *Saudi Med J* 2010; 31: 688-694.