



Health care workers' awareness and infection control practices about Ebola virus disease in Hajj 2015

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ABSTRACT

Background: Saudi Arabia being a major pilgrimage center with an annual turnover of millions of pilgrims from all over the world has a high risk for transmission of infections; Ebola virus disease (EVD) being one of them. Health care workers (HCWs) are particularly vulnerable to these infections. The objectives of this research were to assess the overall knowledge and infection control practices of HCWs about EVD, and to evaluate and compare the role of pre deployment Hajj training of HCWs assigned Hajj duties with those HCWs who did not receive this training.

Methods: Through a comparative cross sectional study design a randomly selected representative sample of HCWs who performed Hajj duties in 2015 were compared with those who were not part of Hajj. Participants were taken from different Makkah and Jeddah region hospitals. A validated self-administered questionnaire was used to assess EVD awareness of 1216 HCWs. Chi square test was applied to check the association between the two groups using SPSS 22.

Results: Overall, medical practitioners had a higher level of knowledge (76.5%) about EVD (in-terms of average correct answers) compared to nurses (59.6%) and other HCWs (56.7%). There was relatively poor knowledge about the EVD management, the Ebola cases fatality rate and the risk of the health care workers from this infectious disease. However, it was obvious that the HCWs who performed Hajj duties and underwent pre-deployment training had more knowledge and better practices about EVD compared to the Non Hajj HCWs and the difference was statistically significant ($p < 0.001$).

Conclusion: This study concludes that even though the HCWs were well aware about EVD but there was a lack of practice. As infection control routine trainings are limited, gaps have been identified in knowledge and practice of infection control.

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Introduction

Hajj is the annual pilgrimage to Makkah, the epicenter of migration of millions of Muslims. Hajj is a unique, largest and oldest mass gathering known to mankind [1]. Muslims of enormous ethnic diversity visit Makkah at a specific date and time hosting on average more than 3 million pilgrims performing same rituals [1,2]. No other mass gathering can be compared with this annual religious event in scale with more than 65% pilgrims come from other countries [1,2].

Pilgrims around the globe attend the Hajj together with different medical backgrounds and many co-morbidities [1]. With this increased migration in a densely occupied space within a limited time period, physical exhaustion, congregation and prayers, extreme weather conditions and crowded accommodations results in higher risk of emerging communicable diseases during and following Hajj [3]. Gathering of such a huge number of pilgrims compromises the local health system; health care workers (HCWs) being at the highest risk [4–6]. Once the Hajj days are over, pilgrims quickly disperse throughout the world likely to increase the risk of spreading epidemics not only in the host country but also on an international scale [3,7].

Amplified risk of transmitting infectious diseases associated with such mass gathering vary, ranging from mild respiratory or gastrointestinal diseases to more severe diseases like Ebola, MERS etc. [4,7]. Ebola Virus Disease (EVD); a zoonotic infection is a

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severe, often fatal illness with high mortality rates. EVD recent and largest outbreak was reported in some West African countries; the hardest-hit countries included Guinea, Liberia, Nigeria and Sierra Leone [8]. The average number of pilgrims in the last two years (i.e. 2013–14) from these four West Africa countries were more than 95,000 pilgrims [8]. According to the World Health Organization case counts for current outbreak there are more than 11,000 deaths and about 28,600 probable and suspected cases of EVD [9]. As of March 17, 2019 Ebola has infected 960 persons and has caused a total of 603 deaths in Congo alone [9].

Kingdom of Saudi Arabia (KSA) being the host of this singularly rigorous mega religious event has to face and manage all these challenges. Its government has accumulated a wealth of knowledge through decades of planning and innovations for the Hajj [10,11]. Each year there is an early planning and coordination of efforts to maintain highest level of excellence not only between multiple KSA agencies/committees but also in collaboration with international agencies [10–12]. Aim of these coordination meetings is to identify occurrence of any emerging or potential public health emergency of an international concern or emergence of any infectious disease outbreak [12]. To curtail the introduction and subsequent spread of any infection during Hajj, Public Health authorities and Ministry of Health (MOH) (one of the major contributors of planning and strategizing for pilgrims well-being) take extra precautions by constantly updating the health regulations and recommendations. Keeping recent EVD outbreak in view, MOH has put a travel ban on pilgrims from the West African Ebola hard hit countries [13]. However, EVD transmission cannot be fully controlled by the travel ban [12].

Free quality healthcare is provided to all the pilgrims during Hajj exposing the assigned HCWs to various infectious diseases. The threat posed by the infectious diseases to the HCWs incite the authorities and shows the importance of advance planning, training and public health surveillance [12,14,15]. Hence, a proactive public health program is initiated by MOH to train HCWs before each Hajj. The focus of such trainings are not only to train HCWs just for the health care provision and treatment of ailments during the pilgrimage but also on the prevention and surveillance of health hazards along with HCW's self-protection [12]. The aim of this current study was to assess the overall knowledge of HCWs about one such recent outbreak of EVD and their infection control practices. Moreover, to compare the knowledge and evaluate the role of pre deployment Hajj training of HCWs about EVD who performed Hajj duties with the HCWs who did not participate in the Hajj duties.

Methodology

The current survey was a comparative cross-sectional study aimed to evaluate the awareness and practices of HCWs in Hajj session about EVD infection. A group of HCWs who participated in Hajj duties and another who did not participate in Hajj duties in the current year was selected and evaluated for the outcome variables. Ethical approval for conducting this survey was obtained from the department of medical research and studies, Jeddah, Kingdom of Saudi Arabia (H-02-J-002-A00298). A validated and pre-designed self-administered questionnaire adapted from previous studies [16] and from Center for Disease Control and Prevention (CDC) [17] was prepared to achieve the study objectives. Permission and facilitation to distribute the printed copies of the questionnaire was acquired from the General Directorate Departments of Health in Makkah, Medina and Jeddah Ministry of Health, Saudi Arabia.

Keeping EVD knowledge at 50%, confidence interval at 95%, desired precision 0.05 the calculated sample size was 378 individuals in each group using epitool sample size online calculator (<http://epitools.ausvet.com.au/content.php?page=SampleSize>). This cal-

culated sample size was then further enhanced by a percentage of 50% to accommodate for possible non-response/refusal/ non-availability among the eligible study participants. The overall sample size for the survey was thus proposed to be at-least 565 participants per group. HCWs in each professional group (doctors, nurses and other paramedical staff) made up a stratum. The number of HCWs in each profession stratum was obtained from Ministry of Health and Ministry of Hajj. Proportional allocation to size was then used to calculate the number of health workers per stratum. Around 1500 randomly selected HCWs were invited to participate in this survey during and after Hajj season between September 9th, 2015 to November 8th, 2015. However, only 1216 HCWs responded, 570 of them had worked in current years Hajj (i.e. 2015) and 646 were working in different health care institutes of Makkah and Jeddah region but not part of Hajj duties. All the students (medical, nurses or paramedical staff) were excluded from the study.

Data entry and analysis was performed using SPSS 22 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Categorical variables were used for descriptive epidemiology. Chi-square test was used to establish the associations of dependent variables (EVD knowledge and practices) with other independent variables.

Results

Majority HCWs (46.4% HCWs who performed Hajj duties and 54.3% in the other group) in this survey were aged between 30–39 (± 7.3) years and most of them were males (64.2%) and (51.5%) respectively. Majority HCWs were Saudis (76.8%) and (97.7%) respectively and more than half of them were nurses (57.0%) and (55.7%). It was noted that most study participants (63.9% Hajj duties group) and (67.8% non-Hajj duties group) had overall <10 years' experience (Table 1).

The knowledge of HCWs about EVD

In general, medical practitioners had a higher level of overall knowledge (76.5%) about EVD (in-terms of average correct answers) compared to nurses (59.6%) and other HCWs (56.7%). A significant proportion (85.2%) of non-practicing HCWs reported that they were unaware of EVD. Only 70.4% of the physicians, 58.2% of the nurses and 54.5% of the other HCWs were aware that healthcare providers caring for EVD patients are at highest risk of infection. Also, only (57.3%) of the physicians, (27.3%) of the nurses and (20.1%) of the other HCWs knew that EVD cannot be cured with antibiotics (Table 2). There was relatively poor knowledge about the EVD management, the Ebola cases fatality rate and the risk of the health care workers from this infectious disease (Table 2). However, it was obvious that the HCWs in Hajj 2015 had more knowledge about EVD than the Non Hajj HCWs and that difference was statistically significant in all EVD Knowledge Questions in this current study (Table 2).

Similarly, a significant difference (p -value = 0.024) in the knowledge was seen among the HCWs who performed Hajj duties in 2015, physicians were more knowledgeable compared to other HCWs. Physician's percentage of the right answers ranged from (60.4 to 96.5%) as shown in Fig. 1.

Infection control measures

More than (83%) of the HCWs in both groups reported good compliance with hand hygiene and two third of them (64.6% of the Hajj group and 69.8% of the other group) were practicing regular use of surgical masks while contacting the patient. However, a higher proportion (70.7%) of the Hajj group reported compliance

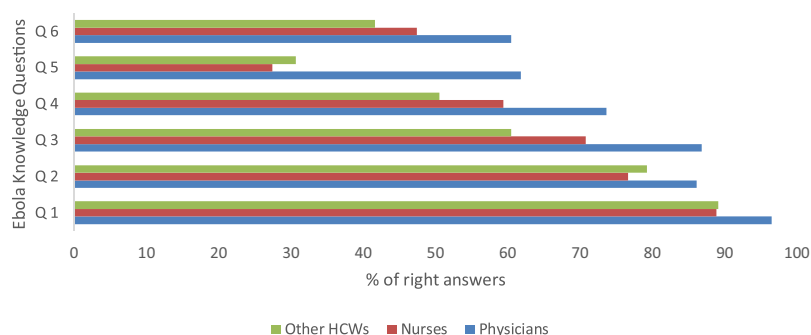
Table 1
Characteristics of the study groups: HCWs in Hajj 2015 (n = 570) and Non Hajj HCWs (n = 646).

Socio-demographic Characteristics					
Variables	Sub-groups	HCWs in Hajj 2015		Non Hajj HCWs	
		N.	%	N.	%
Age (years)	<30 years	151	37.3	109	16.9
	30–39 years	265	46.4	351	54.3
	≥40 years	154	16.4	186	28.8
Gender	Males	366	64.2	333	51.5
	Females	204	35.8	313	48.5
Nationality	Saudi	438	76.8	631	97.7
	Non Saudi	132	23.2	15	2.3
	Diploma	338	59.3	446	69.0
Qualifications	Bachelor	199	34.9	165	25.5
	Master	12	2.1	4	0.6
	Doctorate	21	3.7	9	1.4
	Other	0	0	22	3.4
Jobs titles	Physician	144	25.3	123	19.0
	Nurse	325	57.0	360	55.7
	Other HCWs	101	17.7	163	25.2
	<10 years	364	63.9	438	67.8
Experience in years	10–19 Years	139	24.4	164	25.4
	20–29 Years	60	10.5	41	6.3
	≥30 Years	7	1.2	3	0.5

Table 2
Knowledge of HCWs about Ebola virus infection according to their profession and comparison of these knowledge in HCWs of Hajj 2015 with the Non Hajj HCWs. (n = 1216).

Ebola knowledge questions	Correct answer			p value
	Physicians N (%)	Nurses N (%)	Other HCWs N (%)	
Q1: Did you hear about Ebola	260(97.4)	600(87.6)	225(85.2)	<0.001
Q2: Ebola viruses are found in several African countries the 2014 Ebola epidemic is the largest in history and is affecting multiple countries in West Africa.	234(87.6)	498(72.7)	197(74.6)	<0.001
Q3: People get Ebola through direct contact (through broken skin or mucous membranes in, for example, the eyes, nose, or mouth) with: blood or body fluids and contaminated objects.	227(85)	454(66.3)	163(61.7)	<0.001
Q4: Healthcare providers caring for Ebola patients are at highest risk to get infection with Ebola.	188(70.4)	399(58.2)	144(54.5)	<0.001
Q5: Ebola can be cured with antibiotics.	153(57.3)	187(27.3)	53(20.1)	<0.001
Q6: The average fatality cases of Ebola virus infection about 50%, but this rate may reach 90%.	165(61.8)	314(45.8)	117(44.3)	<0.001
Overall HCWs knowledge about EVD	76.5%	59.6%	56.7%	

Ebola knowledge questions	Correct answer HCWs in Hajj 2015		Non Hajj HCWs		p value
	N.	%	N.	%	
Q1	518	90.9	567	87.8	<0.001
Q2:	453	79.5	476	73.7	<0.001
Q3:	416	73.0	429	66.4	<0.001
Q4:	350	61.4	381	59.0	<0.001
Q5:	209	36.7	184	28.5	<0.001
Q6:	283	49.6	313	48.5	<0.001

**Fig. 1.** Percentage of right answers for 570 HCWs on Hajj duties in 2015 about Ebola infection.

with N95 respirators when required (Table 3). Although the compliance with recommended vaccinations for an annual influenza, meningococcal and hepatitis B was not on the optimal state in both groups, but Hajj HCWs had more compliance compared to the other group and that difference was statistically significant. In the Hajj

HCWs around 74.2% reported receiving annual influenza vaccine within the last 12 months, 78.9% reported receiving meningococcal vaccine in the last 3–5 years, and 74.0% reported to have received hepatitis B immunization or testing for immunity during their work career (Table 3).

Table 3
Infection control measures among Hajj HCWs compared with non-Hajj HCWs (n = 1216).

	HCWs in Hajj 2015		Non Hajj HCWs		p value
	N	%	N	%	
Always or very often hand washing after patient contact.	474	(83.2)	540	(83.6)	0.634
Always or very often surgical mask wearing while contacting the patient.	368	(64.6)	541	(69.8)	0.226
Always or very often N95 mask wearing while contacting the patient.	403	(70.7)	383	(59.2)	< 0.001
Received an annual Influenza vaccine in the last 12 months.	423	(74.2)	300	(46.4)	< 0.001
Received Meningitis vaccine in the last 3–5 years.	450	(78.9)	455	(70.4)	< 0.001
Received Viral Hepatitis (B) immunization or were investigated for its antibodies.	422	(74.0)	191	(29.6)	< 0.001
Received Infectious disease outbreak training.	223	(39.1)	54	(8.4)	< 0.001
Infection control policies and procedures.	311	(54.6)	139	(21.5)	< 0.001
Hand washing techniques training.	434	(76.1)	228	(35.3)	< 0.001
N95 mask wearing techniques training.	429	(75.3)	125	(19.3)	< 0.001
Numbers of the HCWs who know that there are guidelines or protocols for some Infectious diseases	343	(60.2)	98	(15.2)	< 0.001

Table 4
HCWs educational needs and preparedness for Ebola and other emerging infectious diseases (n = 1216).

		HCWs in Hajj 2015		Non Hajj HCWs		p value
		N	%	N	%	
To what extent you think the health care providers are knowledgeable about Ebola and other emerging infectious diseases?	Low	254	(44.6)	391	(60.5)	<0.001
	Moderate	271	(47.5)	230	(35.6)	
	High	45	(7.9)	25	(3.9)	
To what extent you think health care providers need more educational courses about Ebola and other emerging infectious diseases?	Low	21	(3.7)	27	(4.2)	0.023
	Moderate	141	(24.7)	118	(18.3)	
	High	408	(71.6)	501	(77.6)	
To what extent you think that our health care institute is prepared for Ebola and other emerging infectious diseases?	Low	253	(44.4)	397	(61.5)	<0.001
	Moderate	235	(41.2)	228	(35.3)	
	High	82	(14.4)	21	(3.3)	

This survey showed that overall the 2015 Hajj HCWs received more educational and training courses than the non-Hajj group HCWs and that difference was statistically significant. These included training on infection control & its policies, hand washing and surgical/N95 masks use (Table 3). Almost two third Hajj HCWs were aware of the guidelines or protocols for the care of patients with infectious diseases. More than 75% in Hajj group reported having received training about hand washing techniques and training on N95 mask wearing techniques, 54.6% reported being trained in infection control policies and procedures, and 39.1% reported having received training about infectious diseases outbreaks (Table 3).

HCWs Educational needs and preparedness for Ebola and other emerging infectious diseases

Despite the statistically significant difference between the two groups in educational needs questions, the study showed that less than half (44.6%) Hajj HCWs and about two third (60.5%) in the other HCWs group perceived that they had less knowledge about EVD and others emerging infectious diseases (Table 4). Overall, the majority of the responders of this study ($\geq 71.6\%$) in both HCWs groups indicated that they required educational courses and training about the EVD and others emerging infectious diseases. The perception of more than half (55.6%) Hajj HCWs in this study reflected moderate to high preparedness of their work places for EVD and other emerging infectious diseases compared to (38.6%) of the non-Hajj group and that difference was statistically significant (Table 4).

Discussion

The current study aimed to evaluate the awareness and infection control practices of HCWs in Hajj 2015 about EVD infection. This survey indicates that most HCWs were aware of the EVD recent outbreak. HCWs who were assigned Hajj duties and participated in training sessions were more informed than non-Hajj group. This

high level of awareness among HCWs was attributed to the education and training on EVD owing to the nature of their profession. A study conducted in Nigeria [18] reported a lower level of HCW's knowledge as only 41–45% of the respondents possessed satisfactory general knowledge about Ebola as compared to 55–75% correct responses from our study participants. This is in line with findings from Ethiopian [19] study where around 80% HCWs were aware of EVD. However, a significant within group knowledge difference was noted between the physicians, nurses and other HCWs performing Hajj duties; physicians as expected had the highest level of overall knowledge.

The care of confirmed or suspected EVD case is a stressful job and the training of the HCWs is corner stone in this situation [20]. Majority Hajj HCWs who sought pre-Hajj health training adhered to hand washing and use of surgical or N95 masks especially while contacting the patients. Memish et al. [14] in his study conducted in Saudi Arabia showed high compliance with hand washing 98%, and 90% using face masks but our study indicated that about 83% reported good compliance with hand hygiene, two third of Hajj group (64.6%) practiced regular use of surgical masks and the use of N95 respirators when required was adequate. Studies conducted in South Korea [21], India [22] and China [23] also showed that training improves knowledge and compliance with standard precaution. A study conducted in Nigeria [24] showed a gap between the knowledge and practices on standard precautions among HCWs which was also observed in our study participants especially those who did not receive training.

In order to induce a positive behavior change of adopting these standard precautions in the HCWs there is a need to address concerns faced by them in the field and reinforcing knowledge through frequent refresher training sessions [25]. Varieties of training methods can be used to educate, implement and improve the concepts of infection control. The hazard and personal protection equipment (PPE) simulation trainings emanated during West Africa Ebola outbreak, showed improvement in EVD outcome, prevention and control [26,27]. In Hajj season, these concepts could be used for such emerging infectious diseases.

Handling any public health emergency during a mass gathering in an effective and timely way cannot be accomplished without proper and extensive coordination and cooperation between all stake holders [12,14]. The lessons from Ebola outbreak in Uganda and previous major disasters elaborate the importance of good multisectoral approach /coordination, surveillance and attitude of HCWs towards PPE use in dealing with such outbreaks [28–30]. Not only a rapid response, but good preparedness and availability of outbreak guidelines regarding EVD are crucial factors for controlling its outbreak [31]. A highly coordinated and efficient system is developed by the Saudi government in hosting such mega events. Proper planning, coordination and management from Ministry of Health and other stake holders during Hajj ensures the availability of drugs and personal protection equipment (PPE) [10,11]. Studies conducted in developing countries identifies limited resources, lack of training on PPE use, excess workload and time constraint as major factors influencing the poor practice of infection control in healthcare facilities [25,32]. Even though the availability of PPE like hand sanitizers or face masks was not limited for our study participants, yet the identified gap between knowledge and practice is alarming; as this carelessness poses a threat to HCW's life as well [24,25]. The only possible explanation can be HCW's increased workload and time constraints with no stringent measure to ensure compliance during such mega events. This knowledge and practice gap needs to be bridged especially at events of such mass gatherings. HCWs taking precautions as instructed can be most important means of prevention [25].

According to World Health Organization, globally around 40% of infections in HCWs are attributed to their occupational exposure [25,28]. It is known that, the HCW's occupation is an important determinant for their perception towards EVD [18]. However, the preparedness perception of the Hajj HCWs in our study was better than the non-Hajj HCWs, as they were in a higher exposure risk. This may be attributed to refresher trainings of Hajj group for infection control measures. A study conducted in Saudi Arabia during 2014 Hajj indicated the low immunization status of HCWs. According to that study findings the immunization of hepatitis B, meningococcal and seasonal influenza vaccines were 73%, 67% and 51%, respectively [12]. In our survey, almost same percentage of vaccination coverage for hepatitis B was observed, however, an improvement in compliance for meningococcal and annual influenza vaccines was reported.

A major limitation of this study was the self-report method to assess the practices of infection control, as compliance could have been more accurately assessed by observation.

Conclusion

This study concludes that even though the HCWs were well aware about EVD but there was a lack of infection control practice. As infection control routine trainings are limited, gaps have been identified in knowledge and practice of infection control. This underscores the need for management to focus on provision of personal protective equipment as well as training and re-training of staff so that the standard precautions are adhered to especially for those going on Hajj duties. With the recent EVD emergence in African countries and massive migration of pilgrims from around the globe, it becomes imperative to adopt strict infection control measures during Hajj. We can improve our healthcare institute preparedness from the international experiences and help of CDC Rapid Ebola Preparedness teams for assisting and training our health care workers. Moreover, immediate intervention for the suspected cases of emerging infectious diseases patients, good compliance to infection control practice, ongoing continuous training, following the national and international guidelines and

assessment of preparedness all are important factors to minimize the infection exposure risk of the HCWs.

Authors contribution

Abdullah J. Alshahfi: Wrote the first draft, analysis and interpretation of data, designed the methodology, literature review.

Allen C. Cheng: Designed the study /basic concept, contributed to the writing of the manuscript and assisted the interpretation of results.

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Competing interests

None declared.

Ethical approval

Not required.

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