A Study on Preparedness and Risk Acceptance among Healthcare Workers in Facing Potential Cases of Middle East Respiratory Syndrome–Corona Virus Outbreak in a Seasonal Emergency Hospital Serving Pilgrims, during Hajj Season 1437H (2016)

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Abstract

The study aimed to assess healthcare workers (HCWs) preparedness in facing MERS-CoV infection and to assess their risk perception, level of concern and their acceptance of risk in an Emergency Hospital in the Holy places in Mina, during the Hajj season 1437H. The study also aimed to explore HCWs views on the impact of the outbreak on the level of awareness and commitment with standard measures for infection control and patient safety.

This work was a cross-sectional study, carried out among HCWs in Mena Emergency Hospital, during 1-5/12/1437H. Physicians, nurses and technicians were invited to participate through a self-administered questionnaire.

Overall, 213 completed questionnaires, of them 80 physicians, 103 nurses and 30 technicians, representing 37.6%, 48.3% and 14.1% of the samples, respectively .

Among respondents, 89.0% reported received influenza vaccination, 90.0% attended infection control training, 94.5% tested for the suitable size of N95 respirator, 79.1% attended scientific session about MERS-CoV infection, 80.6% received/read circulars and guidelines concerned with MERS-CoV infection and 71.4% reported believing that they have sufficient knowledge about the disease.

The results showed that, HCWs expected a high probability of getting infection with MERS-CoV: themselves (20.0%), their families (7.2%) and Hajj pilgrims (40.0%). Near half of the respondents (45.5%) feel very worried for themselves and 40.3% for their families. The majority (84.7%) accepted the risk of infection as a professional and ethical commitment.

For expected infection control practices, as revealed from the participant's reported practices in their original workplaces, 71.1% of them reported always wearing N95 respirator when they are close to suspected patients, and 69.4% reported wearing the full PPEs during aerosol generating procedures.

Our results show an adequate preparedness of healthcare workers in Mena Emergency hospital as an example of other hospitals serving Hajj population in facing the potential dealing with a MERS-CoV. Despite the concern of getting infection, risk acceptance among HCWs was high. Efforts should be directed to mitigate concerns of HCWs of getting infection through awareness programs and ensuring the maximum levels of infection control and other safety measures

BACKGROUND

Middle East Respiratory Syndrome – Corona virus (MERS-CoV), is a new emerging virus first reported in Saudi Arabia in September 2012 [1]. It causes severe human infections resulting in high mortality and has demonstrated the ability to transmit between humans. So far, the observed human-to-human transmission has occurred mainly in healthcare settings [2]. It has been reported that 20.4% of MERS-CoV victims were healthcare workers (HCWs) [3]. This large number of reported cases implies the easy of transmission of this infection in healthcare settings [4]. Transmission of the virus through a hospital clusters, suggests a contact and droplet modes of spread [5]. Healthcare workers are at great risk of acquiring as well as transmitting infection to the patients [6,7]. The mortality rate of MERS-CoV infection is high, found to be ~60% [8].

This dangerous virus requires high vigilance from healthcare workers and strict compliance with infection control precautions. Failure to maintain the strict infection control measures in healthcare facilities at the beginning of the outbreak has been incriminated to be a major cause behind the high number of cases among healthcare workers [9].

In response to the still ongoing outbreak, Ministry of Health in Saudi Arabia, guided by WHO recommendations, issued guidelines to be rigorously followed in all healthcare institutions. These guidelines, basically instruct healthcare workers to strictly follows standard precautions and emphasize contact, droplet and airborne transmission-based precautions in dealing with patients [2,10].

During Hajj season, healthcare facilities are serving mass gathering; in such work environment, transmission of infections is very easy, unless infection control measures are strictly applied and healthcare workers are properly prepared. MERS-CoV outbreak was a concern to health authority in Saudi Arabia for prevention and dealing with a potential occurrence of an outbreak that might occurs during Hajj season, with the risk of spread to other countries.

The objectives of this work were to assess HCWs preparedness in facing Middle East Respiratory Syndrome- Corona virus infection and to assess their risk perception, level of concern and their acceptance of risk. The study also aimed to explore HCWs views on the impact of the outbreak on the level of awareness and commitment with standard measures for infection control and patient safety.

METHODS

Study design and Setting

This work was a descriptive cross-sectional study, conducted in Mena Emergency Hospital, during 1-5/12/1437H (2-6 September 2016). The hospital is a modern well-constructed, well equipped with 214 beds capacity, operating seasonally during Hajj. The hospital run by more than 450 personnel; of them~90 physicians, ~210 nurses and ~50 other HCWs directly involved in patient care. Hospital staff are recruited from all health regions of the country for this temporary period of the year. The hospital is too much congested with patients, receiving large number of emergences, inpatients and outpatients.

Subjects

The eligible participants were health care workers (HCWs) who are engaged in direct patient care, including physicians, nurses and other health care workers (pharmacists, laboratory personnel, therapists, technicians and other staff directly involved in patient care).

Sampling

The investigators received a complete list of the eligible health care workers. A representative stratified random sample was undertaken from the eligible population. Sample size was determined before study initiation and calculated conservatively to allow for maximum sample size, assuming a 50% estimate of the outcome variables: risk perception, risk acceptance and preparedness among the respondents with a margin of error of 5% and 95% confidence level. Consequently, a sample of 208 HCWs was sought. Anticipating 80% response rate, 250 questionnaires were distributed taking into consideration a balanced proportion of HCWs according to assignment, departmental affiliations and work shifts.

Survey instrument and administration

An anonymous structured questionnaire was constructed based on in the literature review and previous research findings. The questionnaire included (1) demographic, professional and work practice characteristics of the respondents; (2) Questions to assess preparedness in facing infectious diseases and MERS-Cov potential cases: receipt of influenza vaccine, received basic infection control training, checked for best fitted size of N95 respirator, attended CME activities regard MERS-CoV outbreak, received/read the official circulars/guidelines regard case definition, infection control measures regard MERS-CoV outbreak and a question exploring belief in self-efficacy of their knowledge and sources of information regard the disease; (3) a set of 14 questions to explore aspects of knowledge about MERS-CoV infection; (4) eight questions to explore risk perception, concern/worry about the disease, acceptance of risk in dealing with the potential cases of the disease, the agreement with efficacy of the preventive measures and their expected infection control practices (5) four questions exploring HCWs views regard the impact of MERS-CoV outbreak on the compliance with infection control measures.

Healthcare workers were invited to participate in the study at the time of their arrival to join the work in the hospital and before commencing the hospital orientation programs. Participation was voluntary. The agreed subjects, self-completed the questionnaire with a briefing for the study objectives by a trained coordinator who did not have medical or administrative responsibilities in the hospital during the study.

Pilot study

The questionnaire was pre-tested and piloted with a convenience sample of 12 HCWs with similar professional and demographic characteristics to the study population to ensure clarity and ease of administration. Based on respondents' recommendations, some changes were incorporated to simplify and improve the final questionnaire.

Ethics

Participation was voluntary for the agreed staff. Filling and returning back the questionnaire was considered a consent for participation. A written approval of the hospital authority was taken to conduct the study. The study was a tool to explore preparedness of the staff and to assess instructive needs to be addressed in the orientation sessions before commencing the hospital operation.

Statistical analysis

Statistical analysis was carried out using EpiInfo 7 program and SPSS Version 23. We generated descriptive statistics for all survey items. A bivariate analysis with Chi-square test and t-test as appropriate was done to explore differences in risk perception, concerns, belief of the efficacy of preventive measures, acceptance of risk, preparedness items and expected infection control practices among HCWs in relation to their assignments.

Three binary outcome variables were created to reflect (1) risk perception, (2) risk acceptance and (3) preparedness of the HCWs. A multivariate logistic regression model with backward selection and cutoff point of <0.2 was developed to capture predictors independently associated with each outcome variable. Odds ratios (ORs) and their 95% confidence intervals (CIs) were reported as measures of association between predictors and outcome of interest. All statistical tests were two-tailed and p-values of 0.05 or less were considered statistically significant.

RESULTS

In total, 250 questionnaires were distributed and 213 were returned complete, representing a response rate of 85·3%. The characteristics of the respondents are summarized in Table 1.

For risk perception, (Table 2), 20.0%, 7.2% and 40.0% of the participant perceived being themselves, members of their families and Hajj pilgrims are at higher risk of getting MERS-CoV infection respectively.

For concerns, (Table 2), about half (45.5%) of the participants reported extremely concerned/very concerned of getting MERS-CoV infection and 40.3% were extremely concerned/very concerned

about their families, meanwhile, the majority (84.7%), reported strongly agree/agree about their belief in the efficacy of the preventive measures.

For preparedness, (table 2), overall, 89.0% of the respondents reported receiving influenza vaccination 2015/2016 season, with significant difference between HCWs; being nurses (93.2%) and other HCWs (96.4%) have higher vaccine uptake compared to physicians (80.8%). Ninety percent reported received basic infection control training, 94.5% checked for N95 respirator fitting, 79.1% reported they have been attended MERS-CoV training/lectures and 80.6% reported the receipt and read official circulars/guidelines regard dealing with MERS-CoV outbreak.

Participants attained reasonable knowledge score about the disease (Figure 1), with median (mean±SD) 10 (10.01±1.80) in a scale of 14 points. A significant difference between physician's knowledge score 11 (10.86±1.80), nurses 9 (9.28±1.81) and other HCWs 10 (10.07±1.59), ($p< 0.001$).

For expected infection control practices, 71.1% of the participants reported that they are always use N95 respirator when around high risk patients and 69.4% wearing always the full personal protective equipment (PPEs) in case of aerosols generating procedures.

In multivariate logistic regression analysis intended to capture predictors that are independently associated with the outcome variables (Table 3). Compared to physicians, risk perception was independently, lower among other healthcare workers (OR 0.13, 95% CI 0.03-0.63; P=0.011), and independently higher among staff working in critical care departments compared to staff working in other departments (OR 2.14, 95% CI 1.14-4.09; P=0.019).

For risk acceptance, females were independently having lower risk acceptance than males (OR 0.34, 95% CI 0.14-0.87; P=0.024); married staff have lower risk acceptance than singles (OR 0.25, 95% CI 0.08-0.79; P=0.018). Staff with chronic diseases were independently more likely to have lower risk acceptance than healthy staff suffering (OR 0.39, 95% CI 0.16-0.95; P=0.038).

For preparedness, the following were independently associated with good preparedness: Physicians and nurses compared to other HCWs (OR 4.86, 95% CI 1.61-14.74; P=0.012) and (OR 3.94, 95% CI 1.36-11.47; P=0.012) respectively; staff working in critical care departments (OR 1.81, 95% CI 1.00-3.29; P=0.05). On the other hand, staff with chronic diseases (OR 0.34, 95% CI 0.17-0.69; P=0.003) possessed lower preparedness.

Table 4, presents the view of HCWs regard the impact of MERS-CoV outbreak on the compliance with infection control measures among HCWs and their institutions. Overall, 92.0% of the participants strongly agree/agree that the outbreak increased awareness of HCWs with infection control measures, 84.9% were strongly agree/agree that the outbreak affected attitudes of HCWs positively towards infection control measures, 85.1%, strongly agree/agree that the outbreak increased skills and competence of HCWs with infection control measures and 85.6% of the participants, strongly agree/agree that the outbreak increased their hospitals commitment to provide and maintain infection control requirements.

DISCUSSION

This work was a cross-sectional survey among health care workers in Mena Emergency Hospital; a seasonally operating institution, providing care to pilgrims during their stay in the holy place Mena. Patient populations in Hajj are very vulnerable, exposed to tense physical stress, most of them are elderly with comorbidities [11], which put them at a higher risk of getting infectious diseases with its subsequent serious complications [12].

The Ministry of Health in Saudi Arabia has issued the requirements and recommendations for those willing to perform Hajj and Umrah during in 1437H, and recommended in the context of estimating the risk of the spread of infection with the Middle East Respiratory Syndrome-Corona virus, the elderly and people with chronic diseases, malignancies, immune deficiency conditions, pregnant women and children to postpone their Hajj for their own safety [10].

In this context, Ministry of Health in Saudi Arabia, has taken strict precautions and intensive preparations for health facilities to prevent and control the spread of infection from this dangerous virus [10]. A good institutional and HCWs preparedness is crucial for providing safe care and preventing outbreaks within health institutions.

This study was conducted to assess preparedness of healthcare workers and their acceptance of risk in facing a potential MERS-CoV outbreak, as well as exploring their risk perception and degree of their concern.

The study highlighted an adequate preparedness of the HCWs as regard dealing with a potential threat of the new emerging infectious disease MERS-CoV and provided a ground for further steps to better preparedness and safer health care for pilgrims.

An overall, 89.0% of the respondents reported receiving influenza vaccination, 90% received basic infection control training, 94.5% checked for N95 respirator fitting, 79.1% reported they have been attended MERS-CoV training/lectures and 80.6% reported the receipt and read official circulars/guidelines regard dealing with MERS-CoV outbreak. This good preparation was reflected on HCWs knowledge and expected safety practices. Participants attained reasonable knowledge score about the disease with median (mean±SD) 10 (10.01±1.80) in a scale of 14 points, attaining more than seventy percent (71.4%) on the maximum score points. This situation could be explained by the intense instructions of Ministry of health that all HCWs recruited for Hajj duty, should be oriented with regulations & guidelines, and trained on the important health issues expected, and to have a favorable attitude towards providing safe healthcare. This ascertain some aspects of the official statistics about HCW's preparation and capacity building for Hajj season [13,14].

For expected infection control practices, 71.1% of the participants reported that they are always use N95 respirator when around high risk patients and 69.4% wearing always the full personal protective equipment (PPEs) in case of aerosols generating procedures. This expected practices are not enough, and could be explained in part by the attitude of some HCWs regard personal situational risk assessment. A full compliance is needed in such dangerous situations. N95 respirator use is essential for protection of getting MERS-CoV infection, especially in case of being near the patient or during

aerosol generating procedures. In a cohort study carried out in King Faisal Specialist Hospital and Research center, in Jeddah, Alraddadi et al. found a lower risk of MERS-CoV infection among HCWs who reported always using N95 respirator and found it to be superior in preventing MERS-CoV infection compared to medical mask [15].

In all situations, it is not always possible to identify patients with MERS-CoV early because like other respiratory infections, the early symptoms of MERS-CoV are non-specific. Therefore, WHO recommend that healthcare workers should always apply standard precautions constantly with all patients, regardless of their diagnosis. Droplet precautions should be added to the standard precautions when providing care to patients with symptoms of acute respiratory infection; contact precautions and eye protection should be added when caring for probable or confirmed cases of MERS-CoV infection; airborne precautions should be applied when performing aerosol generating procedures [2].

Despite the worry expressed by the participants of the probability of getting the dangerous MERS-CoV infection themselves (45.5%) or their families (40.3%), the majority of the them (84.7%) reported accepting the risk. The less than expected concern/worry and the high level of accepting the risk of this dangerous infection might be explained by self-efficacy in dealing with the disease on the ground of good training and long experience with dealing with this outbreak since 2012, the proved efficacy of the infection control measures in preventing infection, availability of infection control requirements, and the obvious decline in the reported cases than before.

The results of the study revealed an important issue regard the experience gained form MERS-CoV outbreak; the vast majority of the participants acknowledged a positive impact of the outbreak on the compliance with standard infection control measurements; 92.0% of the participants strongly agreed/agreed that the outbreak increased awareness of HCWs with infection control measures, 84.9% strongly agreed/agreed that the outbreak affected attitudes of HCWs positively towards infection control measures, 85.1% strongly agreed/agreed that the outbreak increased skills and competence of HCWs with infection control measures and 85.6% of the participants, strongly agreed/agreed that the outbreak increased the commitment of their institutions to provide and maintain infection control requirements. This highly perceived positive impact of the MERS-CoV outbreak on HCW's knowledge, attitude and practices as long as institutional commitment to satisfy infection control requirements is not only favorable in combating MERS-CoV infection, but also in prevention and control of other healthcare associated infections.

CONCLUSION

Our results show an adequate preparedness of healthcare workers in Mena Emergency hospital as an example of other hospitals serving Hajj population in facing the potential dealing with a MERS-CoV. However, a subsequent observational study may be of value to confirm practices. Despite the concern of getting infection, risk acceptance among HCWs was high. Efforts should be directed to mitigate concerns of HCWs of getting infection through awareness programs and ensuring maximum infection control and other safety measures.

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Table 1: Characteristics of the participants (n=213)

Characteristic	**N***	**(%)**
Assignment		
- Physician	80	37.6
- Nurse	103	48.4
- Other HCWs	30	14.1
Gender		
- Male	116	54.5
- Female	97	45.5
Nationality		
- Saudi	106	49.8
- Non-Saudi	107	50.2
Age in years		
- <30	58	27.2
- 30-39	83	39.0
- =>40	72	33.8
Median (Mean ±SD)	34 (36.56±9.87)	
Length of practice in years		
- <5	50	23.6
- 5-10	77	36.3
- >10	85	40.1
Marital Status		
- Single	70	32.8
- Married	139	65.3
- Others	4	1.9
Health Region Affiliation. "Recruited From:"		
- Makkah Region	85	40.7
- Other Health Regions	124	59.3
Permanent Work Setting		
- Hospital	165	85.1

- PHC Center	19	9.8
- Other Settings	10	5.2
Working at any critical care department		
- No	116	54.5
- Yes	97	45.5
Have any chronic disease		
- No	156	73.6
- Yes	56	26.4

* Numbers may be less than the total of 213 due to missed responses.

Table 2: Risk Perception, Concerns, Acceptance, Preparedness and Expected Practices among Healthcare Workers (HCWs) regard dealing with MERS-CoV potential outbreak cases in Mena Emergency Hospital, during Hajj season 1437 H (2016) (n=213)

Variable	Assignment				
	Overall	Physician	Nurse	Other HCWs	P value
	N@ (%)	n (%)	n (%)	n (%)	
Risk Perception of getting MERS- CoV infection.					
-Perception of being at high risk of getting MERS-CoV infection. (High chance)	40 (20.0)	16 (21.3)	22 (22.9)	2 (6.9)	0.157
-Perception of being his/her family at high risk of getting MERS-CoV infection. (High chance)	14 (7.2)	6 (8.1)	7 (7.5)	1 (3.6)	0.719
-Perception of a high risk that Hajj pilgrims will get MERS-CoV infection (High chance)	78 (40.0)	29 (38.7)	46 (48.4)	3 (12.0)	0.004*
Concerns/Worry of getting MERS CoV infection.					
-High concern of getting the infection (Extremely concerned/Very concerned)	86 (45.5)	29 (40.8)	49 (54.4)	8 (28.6)	0.034*
-High concern of any family member getting the infection. (Extremely concerned/Very concerned)	79 (40.3)	26 (36.1)	44 (46.3)	9 (31.0)	
Belief in the Efficacy of Preventive Measures					
-Belief that proper use of PPEs and other infection control precautions are highly effective in protection of HCWs of getting MERS-CoV infection. (Strongly agree/ Agree)	150 (84.7)	57 (80.3)	75 (89.3)	18 (81.8)	0.275
Acceptance					

-Risk Acceptance (Yes)	150 (84.7)	57 (80.3)	75 (89.3)	18 (81.8)	0.275
Preparedness					
-Received Influenza Vaccine (Yes)	186 (89.0)	63 (80.8)	96 (93.2)	27 (96.4)	0.012*
-Received Basic Infection Control training (Yes)	189 (90.0)	67 (98.8)	97 (94.2)	25 (92.6)	0.059
-Checked for N95 mask fitting (Yes)	190 (94.5)	67 (83.2)	100 (98.0)	23 (100.0)	0.007**
-Attend MERS CoV training/Lecture (Yes)	163 (79.1)	69 (86.3)	81 (81.0)	13 (50.0)	<0.001** *
-Read Guidelines regards MERS-CoV (Yes)	166 (80.6)	70 (88.6)	81 (81.8)	15 (53.6)	<0.001** *
-Knowledge Score # Median (Mean ±SD)	10 (10.01±1.80)	11 (10.86±1.48)	9 (9.28±1.81)	10 (10.07± 1.59)	<0.001** *
-Self-efficacy of having sufficient Knowledge regard MERS-CoV (Yes)	135 (71.4)	59 (78.7)	64 (68.1)	12 (60.0)	0.156
Expected Infection Control Practices					
-Frequency of use of N95 mask when around high risk patients (Always)	140 (71.1)	45 (60.0)	68 (73.9)	27 (90.0)	0.007**
-Wearing full PPEs in case of aerosols generating procedures (Always)	136 (69.4)	49 (65.3)	62 (68.1)	25 (83.3)	0.183

Abbreviations: MERS-CoV, Middle East Respiratory Syndrome-Corona Virus; PPEs, Personal Protective Equipment;
@ Numbers may be less than the total of 213 due to missed responses;
# Knowledge Score (maximum Score of 14 points);
* < 0.05;
** < 0.01;

Table 3: Adjusted Multivariate Logistic Regression analyses for Demographic, Professional and workplace Characteristics Associated with Risk Perception, Risk Acceptance and Preparedness of Healthcare Workers regard dealing with MERS-CoV potential outbreak cases in Mena Emergency Hospital, during Hajj season 1437 H (2016) (n=213)

	Risk Perception[a]		**Risk Acceptance[b]**		**Preparedness[c]**	
	aOR(95% CI)	*p-Value*	aOR (95% CI)	*p-Value*	aOR (95% CI)	*p-Value*
Assignment						
Physician	1				4.86 (1.61-14.74)	P=0.012
Nurse	0.56 (0.25-1.27)	0.168			3.94 (1.36-11.47)	P=0.012
Other HCWs	0.13 (0.03-0.63)	0.011 *			1	

Gender						
Male			1			
Female			0.34 (0.14-0.87)	0.024*		
Marital Status						
Single			1			
Married/ Others			0.25 (0.08-0.79)	0.018*		
Working at any critical care department						
No	1				1	
Yes	2.16 (1.14-4.09)	0.019*			1.81(1.00-3.29)	0.05*
Have any chronic disease						
No			1		1	
Yes			0.39 (0.16-0.38)	0.038*	0.34 (0.17-0.69)	0.003**

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval;
[a]Final -2*Log-Likelihood: 238.40; Likelihood Ratio: 20.28; df:4; Model*P*-Value: <0.001;
[b]Final -2*Log-Likelihood: 138.74; Likelihood Ratio: 12.12; df:3; Model *P*-Value: 0.007;
[c]Final -2*Log-Likelihood: 263.75; Likelihood Ratio: 29.98; df:5; Model *P*-Value: <0.001;
* < 0.05;
** < 0.01.

Table 4: The Impacts of the MERS CoV. Outbreak in Saudi Arabia on the Compliance with Infection Control Measures: Views of Healthcare Workers (HCWs) in Mena Emergency Hospital, during Hajj season 1437 H (2016). (n=213)

Impact	**Assignment**				
	Overall	**Physician**	**Nurse**	**Other HCWs**	**P value**
	n (%)	**n (%)**	**n (%)**	**n (%)**	
- Increased awareness of HCWs with infection control measures (Strongly agree/Agree)	185 (92.0)	71 (93.4)	86 (90.5)	28 (93.3)	0.755
- Positively affected attitude of HCWs towards infection control measures (Strongly agree/Agree)	169 (84.9)	70 (92.1)	75 (80.6)	24 (80.0)	0.084
- Increased skills and competence of HCWs with infection control measures (Strongly agree/Agree)	171 (85.1)	68 (89.5)	77 (81.1)	26 (86.7)	0.297
- Increased the hospitals commitment to provide and maintain infection control requirements. (Strongly agree/Agree)	172 (85.6)	70 (92.1)	75 (78.9)	27 (90.0)	0.039*

* < 0.05.

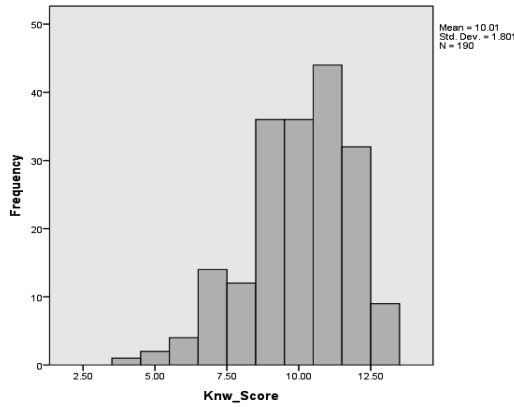

Figure 1: Histogram of Knowledge about Middle East Respiratory Syndrome–Corona Virus (MERS-CoV) Infection among Healthcare Workers in Mena Emergency Hospital, Mena Holy Place, Makkah, Saudi Arabia Hajj season 1437H/2016.