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## Original Article

# “Your Health Essential for Your Hajj”: Muslim pilgrims' knowledge, attitudes and practices regarding Middle East respiratory syndrome coronavirus (MERS-CoV) during Hajj season

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## ABSTRACT

**Background:** Up to date, there have been no studies to evaluate pilgrims' knowledge, attitude and practices regarding MERS-CoV during the annual Hajj pilgrimage in order to see whether there is a need for these aspects to be improved.

**Methods:** A cross-sectional survey study was conducted with a convenience sampling. Participants were pilgrims, aged over 18, and able to speak Arabic or English. A self-administered structured questionnaire was distributed during Hajj season in Mecca. Descriptive and multiple linear regression analysis were used in data analysis.

**Results:** Two hundred and fifty-seven participants completed the study, 80% of whom were female, and the median (IQR) age was 35 (24.5–43.5) years. Pilgrims had moderately correct knowledge and accurate attitudes about MERS-CoV with median scores of 5 (IQR 4–7) and 6 (IQR: 5–7) respectively. Educational level and employment status were significantly associated with knowledge whereas gender and age were significantly associated with attitude and practices respectively ( $P < 0.05$ ). The correlation between knowledge, attitude and practices was significant (correlation coefficient: 0.207;  $P < 0.05$ ). Better knowledge was found to be a predictor for positive practice.

**Conclusions:** These findings will provide insight when designing future interventions to promote specific messages to enhance knowledge, change attitude and improve practice regarding MERS-CoV.

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## 1. Introduction

The Hajj has become the world's largest annually recurring mass-gathering event, attracting more than three million pilgrims from over 184 countries around the world; these pilgrims are often elderly and have underlying medical conditions [1,2]. The factors of old age, presence of comorbidities, extreme weather conditions and overcrowding in mass gatherings such as the annual Hajj pilgrimage in Saudi Arabia, present a high risk of acquisition of airborne infections with the potential for their transmission in the pilgrims' country of origin [3].

The risk of importing serious infections from the Hajj has increased since the emergence of the Middle East respiratory syndrome coronavirus (MERS-CoV) in Saudi Arabia and other

neighbouring countries in September 2012 [4]. While most confirmed MERS-CoV cases originate in the Arabian Peninsula, several MERS-CoV infections have been imported to Europe, Asia, Africa and North America, all with direct or indirect connection with the Middle East [4]. These imported cases highlight the fact that MERS-CoV, like other airborne viruses such as influenza, has the capability for worldwide spread. Clinical presentation of MERS-CoV infection ranges from asymptomatic to very severe pneumonia with acute respiratory distress syndrome (ARDS), septic shock and multi-organ failure resulting in death [3–5].

To prevent the spread of infections during the pilgrimage or in the pilgrims' home countries upon their return, the Saudi Ministry of Health (MoH) publishes annual recommendations for Hajjis with advice for elderly adults  $\geq 65$ , pregnant women, children, and those with multiple chronic conditions preferably to postpone Hajj, and those who do attend are requested to maintain optimum preventive measures such as regular hand washing, using disposable

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materials and using masks [6,7]. Knowledge and application of basic hygiene principles and measures in such an environment is therefore vitally important. However, pilgrims may not be aware of MERS-CoV and the protective measures that should be followed to reduce the spread of infectious diseases during the Hajj as had been reported in previous studies [8,9]. As pilgrims' awareness is highly important to control the disease, this study aimed to evaluate pilgrims' knowledge, attitude and practices regarding MERS-CoV during the annual Hajj pilgrimage in Saudi Arabia.

## 2. Methods

### 2.1. Study setting, recruitment, data collection and sample size

A descriptive cross-sectional survey was performed among pilgrims who attended Hajj 2015. The participants were recruited from one of Saudi Arabia's Hajj campaigns. This campaign was selected via convenience sampling. Approval to conduct the study was obtained from the director of the campaign. The survey was conducted in Mina, Mecca, for a period of three days (i.e., 11th of Dhu Al-Hijjah 1436 Hejre to 13th of Dhu Al-Hijjah 1436 Hejre (25–27 September 2015)). The ritual performed on these days is called the Stoning of the Devil and it takes place at Jamarat, Mina. During this ritual, pilgrims throw seven tiny pebbles at each of three white pillars and then they go back to their place of residence in Mina, where they had plenty of time to fill out the questionnaire.

The Hajj pilgrims were sampled using a convenience sampling technique. The inclusion criteria for eligible participants were: (1) people aged 18 or over, (2) able to speak Arabic or English, and (3) willing to take part. Once identified and informed about the study by the researchers, all potential participants were invited to take part. The data were collected by two researchers using a questionnaire-based survey. In order to have a 95% confidence level with a plus or minus 5% margin of error in the results, the study needed to survey at least 384 individuals (i.e., using the formula for the margin of error). The sample size was increased to 500 during the data collection to take into account non-responses.

### 2.2. Questionnaire

A self-administered structured survey questionnaire was designed and used as a tool for data collection. The survey consists of four sections with a total of 35 questions.

- (1) Section one: This section is comprised of eight items; it is mainly focused on participants' characteristics including age, gender, nationality, etc.
- (2) Section two: The main aim of this section is to evaluate the Hajj pilgrims' general knowledge about coronavirus. Dichotomized “yes”, “no” and “don't know” options were used for the purpose of evaluation using nine items. To make a clear demarcation of participants' knowledge level, the responses were scored. Every correct answer added one mark to a participant's total score, and zero was given for wrong or uncertain answers. The minimum possible score for each section (knowledge, attitude and practices) is zero, while the maximum is nine. To discern the knowledge differences among the groups, the knowledge score was further divided into three categories: a cut-off value of  $\geq 8$  was taken as good knowledge, while between 5 and 7 was considered moderate and a score of  $\leq 4$  was considered as a poor knowledge score.
- (3) Section three: This section evaluated participant attitudes and beliefs about coronavirus. Nine items were provided for the participants to disclose their beliefs using a three-item

Likert-type scale (agree, disagree, uncertain). Every appropriate attitude added one mark to a participant's total score, and zero was given for inappropriate attitude. A cut-off value of  $\geq 8$  was taken as good attitude, while between 5 and 7 was considered moderate and a score of  $\leq 4$  was considered as a poor attitude score.

- (4) Section four: This section is comprised of nine items that assess practices and behaviours of pilgrims regarding coronavirus using dichotomized “yes” and “no” options. Every appropriate behaviour added one mark to a participant's total score, and zero was given for inappropriate behaviour. A cut-off value of  $\geq 8$  was taken as good practice while between 5 and 7 was considered moderate and a score of  $\leq 4$  was considered as a poor practice score.

The median total scores based on responses to the three parts (knowledge, attitude and practices) were estimated, with a maximum possible score of 27 and a minimum score of 5. For quantitative analysis, a score greater than 80% ( $\geq 22/27$ ) of the possible maximum score was considered good, between 60% and 80% (21–16/27) was considered moderate and less than 60% ( $\leq 15/27$ ) was considered poor [10,11]. The median total score and the median score for the knowledge, attitudes and practices parts were compared based on the participants' characteristics.

### 2.3. Questionnaire validity and reliability

An extensive literature search was conducted initially by the chief investigator and research articles were shortlisted for further discussions among the research team in order to design a structured survey questionnaire. An initial draft of the survey questionnaire was developed after the research team had comprehensively reviewed the Centers for Disease Control and Prevention (CDC), World Health Organization (WHO) and MoH websites [4,6,7,12] and all the selected articles [13,14]. The questionnaire was then subjected to face validity and content validity.

The draft was sent to an expert panel of one clinical pharmacist, one community pharmacist and one academic who are professionally trained and familiar with the concepts being examined in the study for their opinion and comments on the contents of the questionnaire. A second version of the questionnaire was developed after taking the panel's recommendations into account. The questionnaire was then sent to a small sample of five people who performed Hajj last year for their comments and suggestions on making the questionnaire more accommodating. The data were then subjected to analysis by the Statistical Package for the Social Sciences (SPSS) to gain the reliability coefficient. A Cronbach's alpha of 0.82 was computed. Any necessary changes were incorporated after a series of discussions among the research team and expert panel. Since no inherent difficulties in understanding and answering were reported by the respondents, the same questionnaire was used without any major modifications. This final version of the questionnaire was then distributed to pilgrims for data collection. The questionnaire was translated into Arabic, using forward-backward translation [15].

### 2.4. Data analysis

SPSS version 22.0 was used for data analysis. Data were checked for normality before analysis by the Kolmogorov–Smirnov test and by examining normality plots. Specific procedures including descriptive statistics, t-test (for normally distributed data), Mann–Whitney test and Kruskal–Wallis test (for not-normally distributed data), and Chi-square (for non-parametric data) were used as appropriate to identify possible contributory factors

associated with poor knowledge, attitude and practices regarding coronavirus. For all statistical tests a P value of <0.05 was considered significant. Descriptive data were expressed as percentage, frequency, mean  $\pm$  S.D, or median (IQR). The results were presented in tabular and graphic forms. The records were double-checked and cleaned by two researchers. Data were then analysed using descriptive statistics. Incomplete responses were dropped from the analysis. Linear regression analysis was used to determine whether participants' knowledge and attitude regarding coronavirus can predict their practice. P value of less than 0.05, two-tail probability was considered to be statistically significant with a 95% confidence interval (95% CI).

### 3. Results

#### 3.1. Response rates and characteristics of participants

Of the 500 questionnaires distributed, there were 292 complete returns (response rate: 58%). Thirty-five questionnaires were subsequently excluded because of incomplete responses, so the final response rate was 51.4% (257/500). A full overview of the participants' characteristics is provided in Table 1. The relationships between the median knowledge, attitude, practice and total score based on participants' characteristics are demonstrated in Table 2. Because the knowledge, attitude, practice and total scores were not normally distributed, Mann–Whitney test and Kruskal–Wallis test were used to evaluate associations between the median score and the participants' characteristics. The median total score for all participants was 19 (interquartile range, IQR: 16–21) of a possible maximum score of 27, meaning that the overall score for participants was at the intermediate level.

#### 3.2. Knowledge

In the knowledge part of the questionnaire, a median score of 5 (IQR: 4–7) was obtained from a maximum of 9. This demonstrated intermediate knowledge regarding coronavirus. The evaluation of the difference in the median score based on participants' characteristics revealed significant difference in terms of education ( $P = 0.045$ ; Mann–Whitney test) and employment status ( $P = 0.034$ ; Kruskal–Wallis test), as illustrated in Table 1. People who were employed and had a high level of education (i.e., above high school) had significantly better knowledge about coronavirus than other Hajj pilgrims.

**Table 1**  
Characteristics of participants recruited into the study.

Parameter	Results
Age (years)	Median (IQR) 35 (24.5–43.5)
Gender N (%)	Male 50 (20%) Female 207 (80%)
Nationality N (%)	Saudi 218 (85%) Non-Saudi 39 (15%)
Country of residence N (%)	Saudi 245 (95%) Other 12 (5%)
Living arrangements N (%)	Alone 12 (5%) With others 245 (95%)
Education N (%)	>High school or 10th grade 183 (71%) $\leq$ High school or 10th grade 74 (29%)
Employment N (%)	Employed (i.e., full time, part time or self-employed) 110 (43%) Unemployed 37 (14%) Out of the labour force (i.e., homemaker, retired, students) 110 (43%)
Current health status N (%)	Good 251 (97%) Neither good or bad 5 (2%) Bad 1 (0.4%)

Fig. 1 illustrates the responses to the knowledge questions (KQ) 1–9. Seventy-seven percent (198/257) of participants incorrectly believed that stomach cramps, loss of appetite, nausea and vomiting are mark symptoms of coronavirus. A majority of Hajj pilgrims (67%, 173/257) held misconceptions that antibiotics can be used to treat coronavirus. In terms of knowledge regarding the incubation period of coronavirus, most participants (55%, 142/257) did not know that the incubation period or the period between exposure to coronavirus infection and the appearance of the first symptoms is from two to 14 days, and fewer than half of the participants (45%, 115/257) did not know that people with comorbidity (e.g., diabetes, cardiovascular diseases, cancer and other chronic diseases) are more likely to be infected with coronavirus. Meanwhile, fewer than half of Hajj pilgrims were not aware that there is no vaccine available in the market to protect against coronavirus (42%, 109/257). Ninety-seven (38%) participants incorrectly believed that the main source of coronavirus is a plant.

#### 3.3. Attitude and beliefs

In the attitude and beliefs section, the median score was 6 (IQR: 5–7) from a maximum of 9. This demonstrated an intermediate belief regarding coronavirus. The results of the difference in the median attitude score based on participants' characteristics revealed that there were significant differences in terms of gender ( $P < 0.009$ ; Mann–Whitney test), as illustrated in Table 2. The overall attitude of female pilgrims about coronavirus was positive compared to that of male pilgrims.

Fig. 2 illustrates the responses to attitude questions (AQ) 1–9. More than 80% (211/257) of Hajj pilgrims incorrectly believed that taking antibiotics can treat coronavirus. Almost 75% (188/257) of participants agreed that taking pain and fever medications cannot relieve coronavirus symptoms. The numbers of Muslims pilgrims who declared that avoiding undercooked meat or food prepared under unsanitary conditions and contact with live animals such as camels cannot prevent transmission of disease were 99 (39%) and 89 (35%) respectively. Seventy-eight (30%) participants incorrectly believed that there is no risk of catching coronavirus infection during the Hajj period.

#### 3.4. Practice

The median practice score of 8 (IQR: 6–9) was obtained from a potential maximum of 9. This demonstrated that participants were compliant with the practices required to prevent the spread of infection during the pilgrimage. Evaluating the difference in the median practice score based on participants' characteristics showed that there was a significant difference in age only ( $P < 0.006$ ; Mann–Whitney test) (Table 2). People aged >35 had significantly better practice regarding coronavirus than those aged  $\leq 35$ .

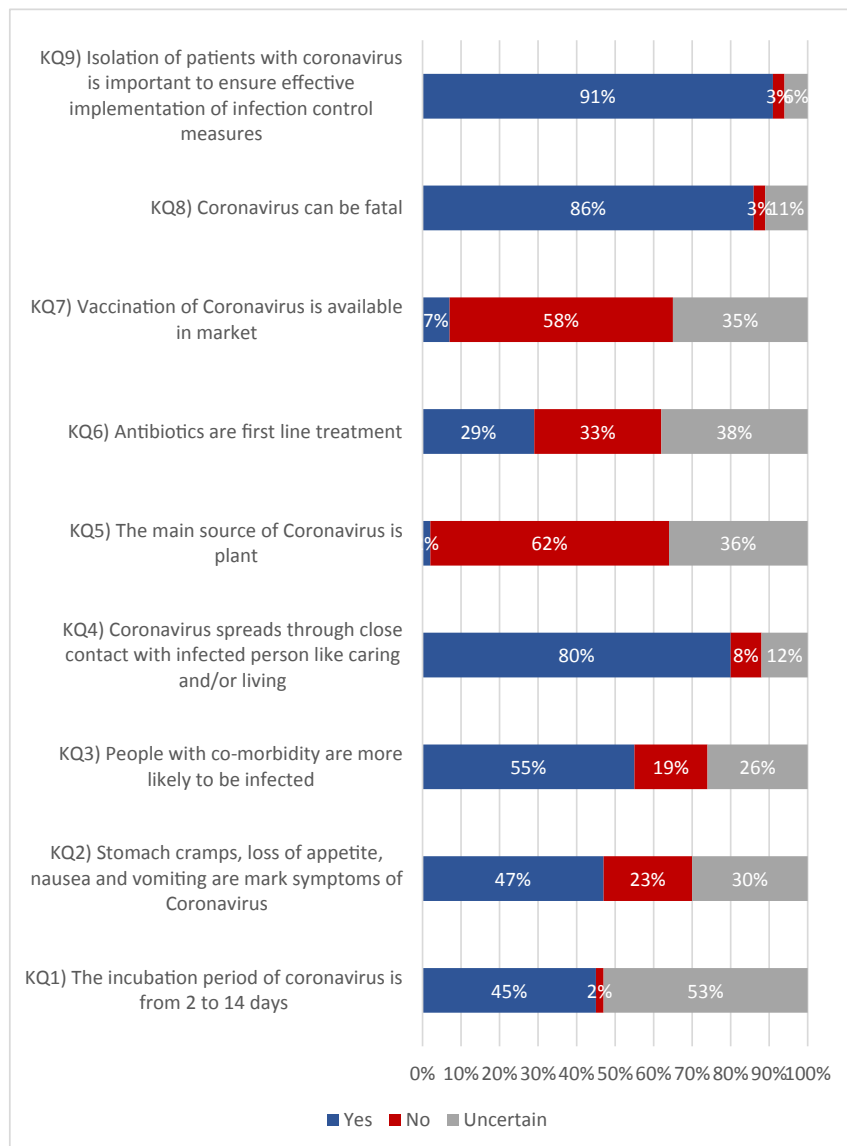
Fig. 3 illustrates the responses to practices questions (PQ) 1–9. Ninety-four (37%) participants reported they were unable to avoid direct hand contact with eyes, nose and mouth during the Hajj. Nearly 30% (75/257) of pilgrims did not wash their hands with soap and water or disinfectant after sneezing/coughing during the Hajj season. Sixty-five (25%) participants reported that they did not wear a face mask in heavily crowded areas while performing their Hajj. Nearly 20% (53/257) declared that they did not consult a healthcare worker if they had a fever or cough or difficulty breathing.

#### 3.5. Relationship between pilgrims' knowledge and attitude regarding coronavirus and their practices

The participants' knowledge and attitude about coronavirus correlate at a significant level with their practices (multiple

**Table 2**  
Median knowledge, attitude, practice and total score based on participants' characteristics.

Participants' characteristics		Total score Median (IQR)	P value	Knowledge score Median (IQR)	P value	Attitude score Median (IQR)	P value	Practice score Median (IQR)	P value
Age	>35	19 (17–22)	0.399	5 (4–7)	0.905	6 (5–7)	0.519	8 (6–9)	0.006
	≤35	19 (16–21)		5 (4–7)		6 (5–7)			
Gender	Male	18 (15–21)	0.113	5 (4–7)	0.413	5 (4–7)	0.009	8 (6–9)	0.725
	Female	19 (17–21)		5 (4–7)		6 (5–7)			
Nationality	Saudi	19 (16–21)	0.579	5 (4–7)	0.594	6 (5–7)	0.092	8 (6–9)	0.073
	Non-Saudi	19 (17–20)		5 (4–7)		7 (5–7)			
Country of residence	Saudi	19 (17–21)	0.172	5 (4–7)	0.090	6 (5–7)	0.296	8 (6–9)	0.099
	Other	18 (14–20)		5 (2–6)		7 (5–7)			
	Living arrangements	Alone		19 (16–20)		6 (5–6)		6 (4–7)	
Education	>High school or 10th grade	19 (17–22)	0.148	6 (4–7)	0.045	6 (5–7)	0.104	8 (6–9)	0.382
	≤High school or 10th grade	19 (16–21)		5 (4–7)		6 (5–7)			
Employment	Employed (i.e., full time, part time or self-employed)	19 (17–22)	0.163	6 (5–7)	0.034	6 (5–7)	0.811	8 (7–9)	0.417
	Unemployed	19 (16–21)		5 (4–6)		6 (5–7)			
	Out of the labour force (i.e., homemaker, retired, students)	19 (16–21)		5 (4–7)		6 (5–7)		8 (6–9)	



**Fig. 1.** Hajj pilgrims' responses (%) to questions related to knowledge (KQ1–KQ9).

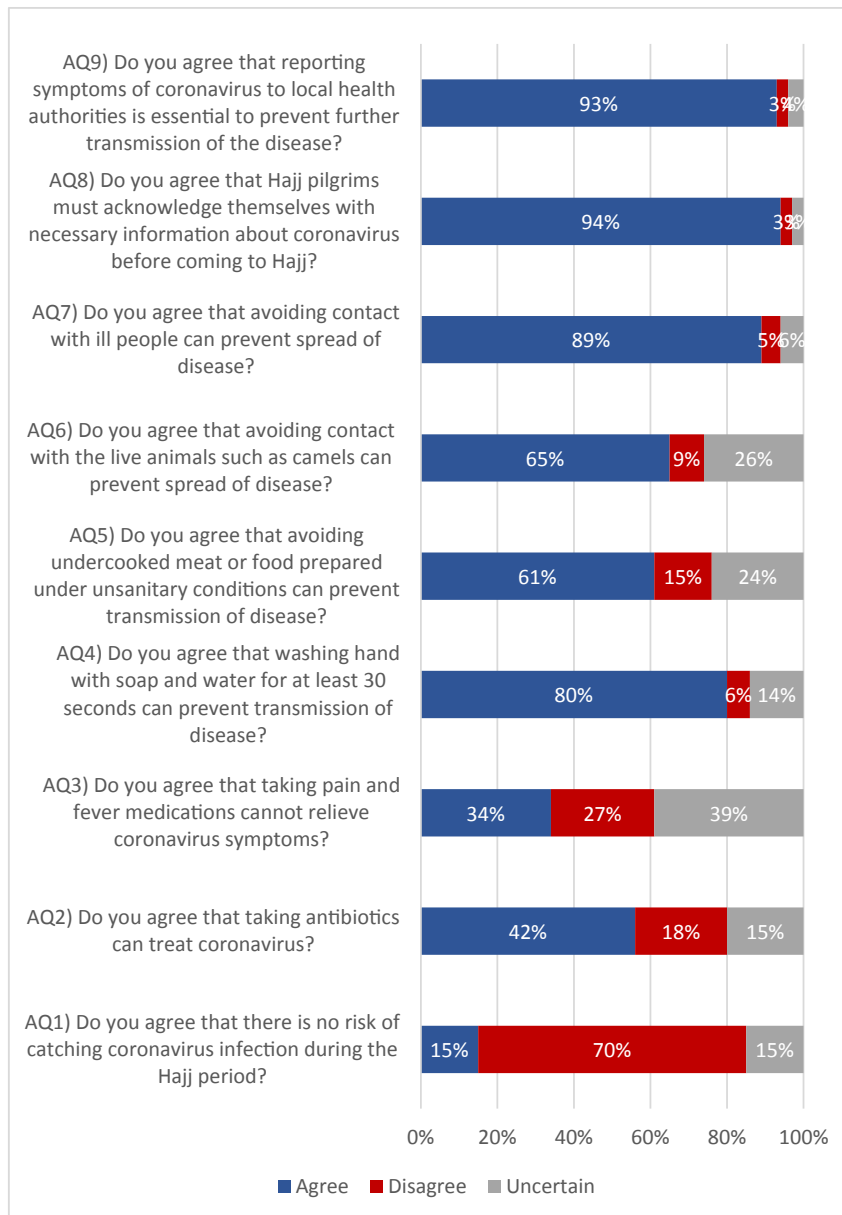


Fig. 2. Hajj pilgrims' responses (%) to questions related to attitude (AQ1–AQ9).

correlation coefficient  $R = 0.207^a$ ; ANOVA<sup>b</sup>  $P = 0.004$ ). By building a linear regression model for prediction of pilgrims' practices, knowledge about coronavirus was found to be the significant predictor ( $P = 0.005$ ) compared to pilgrims' attitude ( $P = 0.585$ ). For each unit increase in knowledge score the practice score increases by 0.16 units, and for each unit increase in attitude score the practice score increases by 0.04 units. This indicates that higher knowledge was translated into higher compliance with precautionary recommendations.

#### 4. Discussion

This descriptive, quantitative study, which is believed to be the first of its kind conducted among Hajj pilgrims in Mecca, Saudi Arabia, focused on the knowledge, attitudes and practices regarding MERS-CoV. The overall lack of knowledge and negative attitude regarding MERS-CoV among pilgrims at Hajj in the current study corroborates results obtained from a survey of Australian

pilgrims [16]; a similar lack of knowledge about MERS-CoV was also found among French pilgrims [8], which was also comparable to the Turkish data [9]. Approximately 65% of the French [8], 45% of the Turkish [9], and only 35% of the Australian [16] pilgrims were aware of the MERS-CoV epidemic in Saudi Arabia. However, according to the French study [8], the French pilgrims were more serious about taking the protective measures. Most French pilgrims (90%) used hand sensitizers and wore masks in comparison to 70% of our study participants who used hand sensitizers and only wore masks in crowded places.

One may conclude from this study that knowledge and attitude toward MERS-CoV among the Hajj pilgrims are generally less satisfactory compared to their practices toward protective measures. Employed and more educated people were significantly more knowledgeable about the disease. However, some false beliefs about treatment were common, as demonstrated by the fact that only 33% of participants recognised that antibiotics cannot treat the infection and 58% knew that doctors do not have an antiviral drug

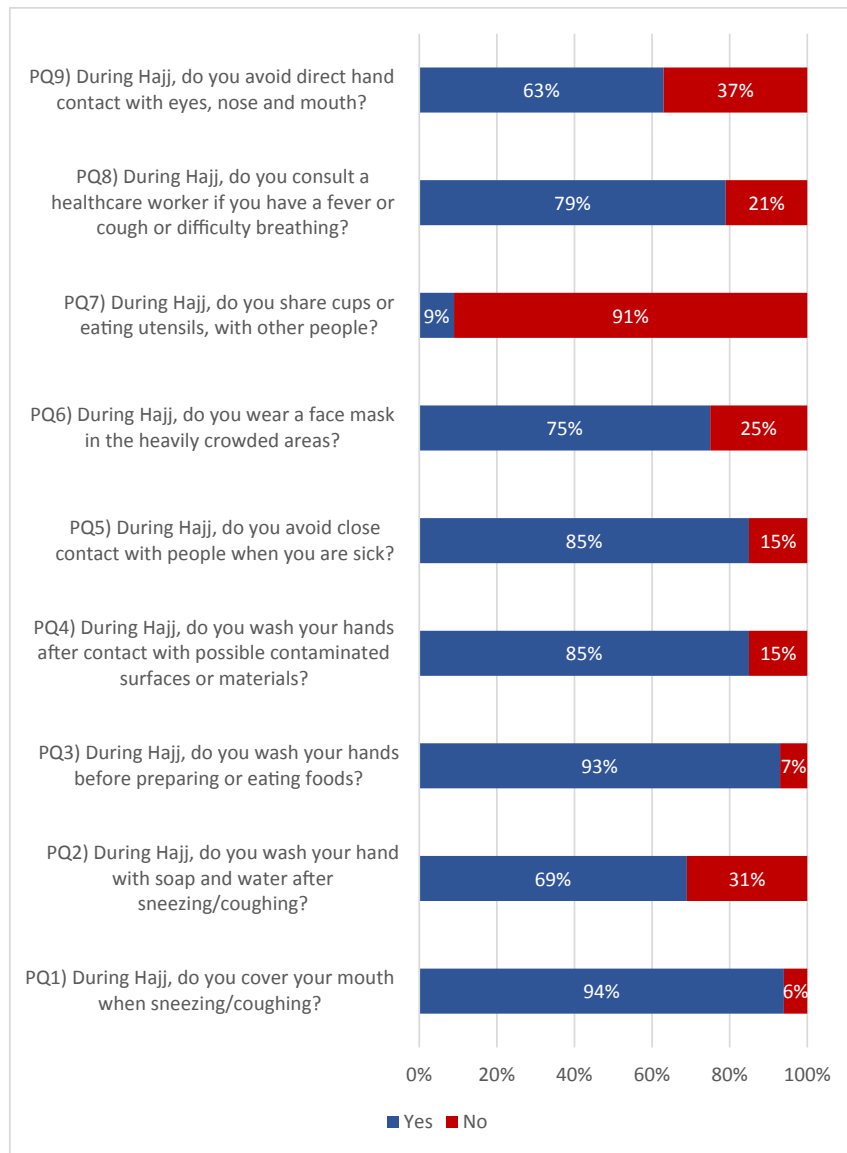


Fig. 3. Hajj pilgrims' responses (%) to questions related to practices (PQ1–PQ9).

for MERS-CoV, which are consistent with a previous study among Saudi general public [17]. In addition, 70% of participants did not recognise hallmark symptoms of MERS-CoV and 45% did not know that people with comorbidities are more likely to be infected. Lack of information about the source of the virus was also noticed, with 38% of participants remaining unaware that bats and camels are the most suspected source of the virus.

Female and older participants had significantly better attitude and practices toward MERS-CoV respectively. However, some participants (40%) showed a negative attitude towards the use of protective measures such as avoiding food prepared under unsanitary conditions and contact with live animals. Other participants (30%) were unable to comply with hygiene practices, particularly washing hands with soap and water or disinfectant after sneezing/coughing and wearing a face mask in crowded areas.

To limit the spread of the infection, the health authorities in Saudi Arabia and the pilgrims' countries of origin should take a more active role and use all practical and effective means to disseminate the health information and recommendations to travellers either during pre-travel counselling or at the entry point

to the KSA [16]. The MoH, for example, launched one of the largest public awareness campaigns in Saudi Arabia to educate the community regarding the possible modes of transmission of MERS-CoV [17]. It included television advertisements that introduced virus to the public and discussed ways to avoid infection transmission. It also used text messages to update the public on new development; these sent via mobile phones and different social media platforms. However, based on the current findings, a more rigorous public health educational method is recommended to correct misconceptions. This can be done by addressing the public through utilising media and social media resources [17]. The establishment of a telephone helpline to provide further information and educational support to Hajj pilgrims would also be a useful option. Alternatively, formation of community organisations and pre-hajj educational campaigns carried out in schools, colleges and shopping malls may also educate the public.

Healthcare professionals and imams should also take an active role in informing pilgrims about MERS-CoV when they visit health centres for immunisation or mosques for religious rituals. Travel agents should also be equipped with health information integrated

into their information sessions for their clients to address this information gap. For example, showing health education videos on aircrafts and ships bringing pilgrims to Mecca is an option. Providing verbal, written, pictorial and recorded information in various languages is essential to educate and empower pilgrims from different educational backgrounds and ethnic groups with the information needed to manage their health, reduce the risk of MERS-CoV transmission and meet their needs during the Hajj.

Countries around the globe need to develop a compelling vision for what pilgrims need to know about MERS-CoV, when they need to know it, who is the appropriate person, what is the suitable method and language to deliver the information. Synthesizing current knowledge about people's understanding, attitudes and practices about coronavirus is essential. Developing a research agenda to provide the intellectual foundation and guide future practice in teaching and learning about MERS-CoV is also crucial. For example, piloting future public health campaigns to test knowledge before implementation is essential. Fostering the implementation, assessment documentation and dissemination of innovative and effective practices for teaching about MERS-CoV is also important.

#### 4.1. Strengths and limitations

The strength of this study is that it addresses a major health problem in Saudi Arabia. It has highlighted the area where very little research has been conducted. However, the present study has some limitations. A convenience sampling technique was used in this study, so the study population may not represent the true nature of all hajjies. For example, the study had a higher proportion of Saudi pilgrims compared to non-Saudi ones (85% vs 15%) and the majority of participants were female (80%). A future study can target pilgrims in streets and mosques rather than a Hajj campaign to get a more represented sample.

#### 4.2. Recommendations for future research

Findings can help inform the design of interventions targeted at improving pilgrims' knowledge and attitudes regarding coronavirus. The impact of such interventions on adherence to precautionary measures could then be assessed. Future work needs to establish whether the lack of knowledge and the poor attitudes and practices about coronavirus are more widespread in the general population.

### 5. Conclusions

The findings of this study will provide insight when designing future interventions to promote specific messages to enhance knowledge, change attitude and improve practice regarding MERS-CoV.

### Ethical approval

No ethical approval required.

### Funding

None.

### Conflict of interest

The authors declare that they have no competing interests.

### References

- [1] Samir B, Philippe B, Philippe G. Non-pharmaceutical interventions for the prevention of respiratory tract infections during Hajj pilgrimage. *Travel Med Infect Dis* 2014;12:429–42.
- [2] Memish ZA, Stephens GM, Steffen R, Ahmed QA. Emergence of medicine for mass gatherings: lessons from the Hajj. *Lancet Infect Dis* 2012;12:56–65.
- [3] Memish ZA, Zumla A, Alhakeem RF, Assiri A, Turkestani A, Alharby K, et al. Hajj: infectious disease surveillance and control. *Lancet* 2014;383:2073–82.
- [4] World Health Organization. Middle East Respiratory Syndrome Coronavirus (MERS-CoV): summary of current situation, literature update and risk assessment-as of 5th. Geneva: WHO; February 2015.
- [5] Assiri A, McGeer A, Perl TM, Price C, Al Rabeeah A, Cummings D, et al. Hospital outbreak of Middle East respiratory syndrome coronavirus. *N. Engl J Med* 2013;369:407–16.
- [6] The Saudi Arabia Ministry of Health (MoH). Health requirements and recommendations for Hajj and Umrah performers and those working in Hajj area. Riyadh: The Saudi Arabia MoH; 2015. English.
- [7] World Health Organization (WHO). World – travel advice on MERS-CoV for pilgrimages. Geneva: WHO; 2014.
- [8] Gautret P, Charrel R, Benkouiten S, Belhouchat K, Nougairede A, Drali T. Lack of MERS coronavirus but prevalence of influenza virus in French pilgrims after 2013 Hajj. *Emerg Infect Dis* 2014;20:728–30.
- [9] Sahin MK, Aker S, Kaynar Tuncel E. Knowledge, attitudes and practices concerning Middle East respiratory syndrome among Umrah and Hajj pilgrims in Samsun, Turkey, 2015. *Euro Surveill* 2015;20. <http://dx.doi.org/10.2807/1560-7917.ES.2015.20.38.30023>. pii=30023.
- [10] Centers for Disease Control and Prevention (CDC). Middle East Respiratory Syndrome (MERS). Atlanta: CDC; 2014.
- [11] Khan M, Shah S, Ahmad A, Fatokun O. Knowledge and attitude of healthcare workers about middle east respiratory syndrome in multispecialty hospitals of Qassim, Saudi Arabia. *BMC Public Health* 2014;14:1281. <http://dx.doi.org/10.1186/1471-2458-14-1281>. pmid:25510239.
- [12] Almutairi K, Alhelih E, Moussa M, Boshaiqah A, Alajilan A, Vinluan J, et al. Awareness, attitudes, and practices related to coronavirus pandemic among public in Saudi Arabia. *Fam Community Health* 2015;38:332–40.
- [13] Sawalha AF. A descriptive study of self-medication practices among Palestinian medical and nonmedical university students. *Res Soc Adm Pharm* 2008;4:164–72.
- [14] Lv B, Zhou Z, Xu G, Yang D, Wu L, Shen Q, et al. Knowledge, attitudes and practices concerning self-medication with antibiotics among university students in western China. *Trop Med Int Health* 2014;19:769–79.
- [15] Beaton D, Bombardier C, Guillemin F, Ferraz M. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine* 2000;25:3186–91.
- [16] Turkestani A, Balahmar M, Ibrahim A, Moqbel E, Memish ZA. Using health educators to improve knowledge of healthy behaviour among Hajj 1432 (2011) pilgrims. *East Mediterr Health J* 2013;19(Suppl. 2):S9–12.
- [17] Al-Mohrej OA, Al-Shirian SD, Al-Otaibi SK, Tamim HM, Masuadi EM, Fakhoury HM. Is the Saudi public aware of Middle East respiratory syndrome? *J Infect Public Health* 2016;9:259–66.