

Assessment of the Holy Mosque Visitors' Knowledge and Practice Toward Viral Respiratory Tract Infections

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ABSTRACT

Background/Purpose: Hajj and Umrah are one of the most significant and long-standing recurring religious mass gatherings events across the world. The mass gathering in Hajj and Umrah may provide potential environment for transmission of viral respiratory infections. Therefore, rising awareness of the Holy Mosque visitors could be helpful in reducing the risk of infections transmission.

Method: The study was aimed to assess the Holy Mosque visitors' knowledge and practice toward the spread and symptomatic victim of viral respiratory tract infections. A cross-sectional study was conducted on four hundred and forty-eight visitors of Holy Mosque between January and February 2020. The participants were interviewed for various virtual and practicing tools through different ranking scales, used to correlate with the spread of the said viral infection.

Results: The data revealed that most of the study respondents (62.6%) were visitors to Makkah and only 29.7% were residing in Makkah. Regarding awareness of the respondents, to know about the various routes of transmission, a total of 398 (82.7%), 372 (77.3%) and 294 (61.1%) got the information that respiratory viruses may be transmitted through sneezing, coughing and touching mouth and/or nose by contaminated hands. Approximately, 60.7% of the visitors considered that contaminated objects can transmit viral respiratory tract infections. Regarding various precautionary measures used to protect against spread of viral respiratory tract infections, only 53% of the participants used hand sanitizer after sneeze or cough and 43.9% wore a mask in the crowded places.

Conclusion: The Holy Mosque visitors had a good level of general knowledge about the viral respiratory infections and their transmission modes. However, there is lack of good practices among the visitors with regard to the viral respiratory tract infections.

Keywords: Umrah; Knowledge; Self-protection; Makkah; Viral respiratory infections

INTRODUCTION

Hajj and Umrah are religious obligations performed at Holy Mosque in Makkah, Saudi Arabia. They draw enormous numbers of pilgrims and visitors annually. Indeed, the gathering millions of Muslims from all over the world create one of the most significant and most long-standing recurring religious mass gathering events across the world (Shafi et al., 2008). This mass gathering with the diversity of the attendees may lead to increase in the transmission rates of viral and/or bacterial respiratory tract infections among the Holy mosque visitors (Al-Tawfiq et al., 2016; Born et al., 2016; Weissbrich et al., 2006).

Respiratory tract infections (RTIs) are the main reason for human morbidity, usually caused by an extensive spectrum of microbial agents (Weissbrich et al., 2006). Many studies have recognized etiologic agents for respiratory tract infections, including viruses and bacteria. The majority of reported respiratory infections were caused by viruses (Gaynor et al., 2007). However, only 30% of cases were attributed to pathogens other than viruses. This suggest that bacterial pathogens are responsible for the spread of respiratory infections amongst the pilgrims

(Gaynor et al., 2007). Viral respiratory tract infections are one of the most prevalent infections during Hajj and Umrah (Shafi et al., 2008; Gaynor et al., 2007). A previous study, conducted from 2005 to 2014 revealed that 1784 pilgrims were suffering from upper respiratory tract infections (URTIs) and/or lower respiratory tract infections (LRTIs). The most common viruses from symptomatic patients during the Hajj season, were identified as rhinoviruses (3 out of 10 sick pilgrims), influenza viruses (1 out of 10 sick pilgrims) and coronaviruses (1 out of 10 sick pilgrims) respectively. Whereas, the other viruses such as adenoviruses, parainfluenza viruses, hRSV and enteroviruses were comparatively lower in frequency (El-Sheikh et al., 1998). In 2016, Gautret and Benkouiten reported that the most common viruses responsible for the RTI amongst the pilgrims during the Hajj (1436) season were rhinoviruses, influenza and corona viruses, respectively (Gautret et al., 2009).

Knowing the most prevalent viruses and their transmission routes would help to reduce the adverse impacts of these pathogens on pilgrims. Crowded religious mass gatherings such as Hajj and Umrah draw millions of

foreign and national pilgrims, who may put themselves at risk towards these pathogens particularly if they were not familiar with the mode of infectious diseases transmission (Sahin et al., 2009; Blumberg et al., 2016) [9-10]. Hence, a study was arranged to detect the knowledge gaps and raise awareness which might help reduce the risk of transmission of infectious diseases. From this point of view, this study was aimed to assess the Holy mosque visitors' knowledge and practice toward the viral RTI.

MATERIAL AND METHODS

Study design and population: This cross-sectional survey was conducted during January and February 2020, to assess the knowledge about modes of transmissions of viral respiratory tract infections during Hajj and Umrah in Makkah, Saudi Arabia. The study was performed in the Holy Mosque central area, targeting its visitors. Participants were randomly selected, and we included all participants except those "non-Arabic, English, or Urdu" speakers, younger than 10 years old, and Al-Haram employees. Sample size was calculated based on the margin error of 2.5%, a confidence interval of 95%, and a total population visiting the Holy mosque. It was expected to have 50% response proportion.

Questionnaire and scoring: The questionnaire was designed on the base of literature review about modes of transmission of viral RTI. It included three main parts as demography, knowledge, and practice. Questions were divided into knowledge questions "10" (Table 1) and practice questions "6" as mentioned in (Table 2). The pilot study was conducted on 24 visitors to confirm the validity and efficacy of the questionnaire. Each individual took about 5-10 min to complete the questionnaire. Questions were based on Yes/No, with additional "I don't know" options. The correct answer was given one score and incorrect answer was given zero score. The total knowledge score ranged from 0-9, with high score reflects better knowledge. The total practice score ranged from 0-6, with high score reflects better practice against the transmission of viral RTI.

Statistical analysis: Frequencies of the correct answers were described with different options for all knowledge and practice questions. We compared demographic variables with knowledge and practice scores using chi-square or independent samples t-test as appropriate. Number of participants, knowledge and practice scores \pm standard deviation (SD), and p-value were reported. Logistic regression was performed to identify all demographic variables associated with the knowledge and practice scores. Odds Ratios (ORs) and the confidence intervals (CIs) were also reported. Data analysis was conducted using SPSS version 25. The statistical significance level was set at ($P < 0.05$) (two-sided).

Ethical statement: The Institutional Review Board (IRB) at the faculty of Applied Medical Sciences College at the Umm Al-Qura University approved the study protocol and procedure of the informed consent. All participants were informed about the confidentiality of their identity and answer through an informed consent at the beginning of the questionnaire.

RESULTS

Demographics and characteristics of the study population:

The results obtained from this study revealed that out of 480 interviewed participants, 443 completed the questionnaire and were included in this analysis. Those participants who were under the permissible age, did not complete the questionnaire, or denied participating in the study were excluded for consideration regarding data analysis. Knowledge and practice questions with correct answers were reported in the Table 1 and 2. We calculated the correct response rate for all questions and the range was 47.2 - 95.9%. Characteristics of participants are presented in Table 3. Regarding the gender distribution amongst the study participants, there were 217 (49%) males and 226 (51%) females. Most of the participants fell into three age groups and were distributed as 30-49 years old (42.2%), followed by 20-29 years old (28.2%), and 50-59 years old (14.2%). Amongst the study participants, most "visitors" were from Egypt (18.5%), Saudi Arabia (17.4%) and Pakistan (16%). The majority of the study participants, such as 48.3% hold Bachelors' degree, followed by those with High school level of education were 21.7%, and finally Master's degree holders with 11.1%.

Table 1: Questionnaire of knowledge towards Viral Respiratory Infection and correct answer percentage.

Questions	Yes	No	I don't Know
K1- Do you have any idea about respiratory infections?	60.5	39.5	0
K2- Do you think fever, sore throat and/or running nose are related to respiratory infection?	75.6	15.1	9.3
K3- Do you have any idea about viral respiratory infection?	54	46	0
K4- Do you think there is a difference between viral and bacterial respiratory infections?	63	16.5	20.5
K5- Do you think sneeze is considered as a way to transmit viral respiratory infection?	89.2	6.1	4.7
K6- Do you think cough is considered as a way to transmit viral respiratory infection?	83.5	11.3	5.2
K7- Do you think respiratory viruses can be transmitted indirectly by touching contaminated objects (as doorknob and carpet)?	65	23.9	11.1
K8- Do you think breath of an infected person (with viral respiratory infection) during sneezing and/or coughing can transmit infection?	83.1	10.8	6.1
K9- Do you think that respiratory viruses can be transmitted by shaking hands with infected person?	52.1	39.7	8.1
K10- Do you think crowded places may increase susceptibility of transmission of viral respiratory infections?	91.9	4.7	3.4
K11- If you are an infected person, do you think that touching your mouth and/or nose with hands during sneezing or coughing would transmit viral respiratory infection to others?	65.5	29.1	5.4
K12- Do you think using hand sanitizer may reduced the respiratory viruses transmission?	83.3	12.6	4.1
(K; Knowledge)			

Table 2: Questionnaire of practice towards Viral Respiratory Infection and correct answer percentage.

Questions	Yes	No
P1- Do you use hand sanitizer after sneeze or cough?	56.9	43.1
P2- Do you wash your hands before eating?	95.9	4.1
P3- Do you wash your hands after touching any suspected contaminated object?	81	19
P4- Do you cover your mouth and/or nose by tissue when you sneeze or cough?	88.3	11.7
P5- If you do not have a tissue, do you use your elbow when you sneeze or cough?	58.5	41.5
P6- Do you wear a mask in crowded places? (Linked with K10)	47.2	52.8
(P; Practice)		

Table 3: Baseline characteristics of the participants.

Variable	Variable details	Number of Participants	Percent age (%)
Age	10-19 years old	23	5.2
	20-29 years old	125	28.2
	30-49 years old	187	42.2
	50-59 years old	63	14.2
	More than 60 years old	45	10.2
Gender	Male	217	49
	Female	226	51
Nationality	Egypt	82	18.5
	Saudi Arabia	77	17.4
	Pakistan	71	16
	Sudan	25	5.6
	Yemen	25	5.6
	Jordan	23	5.2
	India	16	3.6
	Others	123	27.9
Identity	Resident	146	33
	Visitor	297	67
Education	Non educated	14	3.2
	Primary school	28	6.3
	Middle / secondary school	29	6.5
	High school	96	21.7
	University/Bachelors degree	214	48.3
	Master's degree	49	11.1
	Doctorate degree	13	2.9

Participants knowledge related to viral RTI: The mean of correct answers score about viral respiratory infections knowledge was 6.69 (SD: 1.84, range 0-9), with an overall 74.3% correct responses of knowledge questions. The question “Do you think crowded places may increase the susceptibility of viral respiratory infections transmission (K10)” reported the highest correct response rate with 91.9%. For the question “Do you think sneeze is considered as a way to transmit viral respiratory infection (K5)”, the correct responses acquired were 89.2%, and question “Do you think cough is considered as a way to transmit viral respiratory infection (K6)” with 83.5% correct response rate (Table 1). While the questions of “Do you think that respiratory viruses can be transmitted by shaking hands with infected person (K7)” reported the lowest correct response rate with 52.1%. This was followed by the question “Do you think there is a difference between viral and bacterial respiratory infections (K4)” with 63% correct

responses, and for the question “Do you think respiratory viruses can be transmitted indirectly by using contaminated objects such as doorknob and carpets to others (K9)” with 65% correct response rate (Table 1). Participant knowledge score was significantly different amongst the different age and gender groups with P-value = 0.018 and 0.000, respectively. No significant difference in knowledge score was reported among participants' nationality, identity, or level of education (Table 4). Moreover, in multiple logistic regression analysis of the association between factors and good knowledge about the viral respiratory infection, we reported that participants in older age group was approximately 1.46 times higher to have better knowledge than those of participants in the younger age groups (P-value=0.02). In addition, the study revealed that female participants have approximately 2.87 times better knowledge about viral respiratory infections in comparison to the male participants (P-value=0.00) as shown in the Table 5.

Table 4: Demographic characteristics of participants and knowledge score of Viral Respiratory Infection by demographic variables.

Variable	Variable Details	No. of Participants	Knowledge Score (mean±SD)	P-value
Age	10-19years old	23	6.30±(1.7)	0.018
	20-29years old	125	6.52±(1.8)	
	30-49years old	187	6.67±(1.9)	
	50-59years old	63	6.88±(1.8)	
	More than 60 years old	45	7.16±(1.7)	
Gender	Male	217	6.45±(1.9)	0.000
	Female	226	6.92±(1.6)	
Nationality	Egypt	82	7.12±(1.5)	0.744
	Saudi Arabia	77	6.40±(1.9)	
	Pakistan	71	6.48±(2.1)	
	Sudan	25	6.92±(1.6)	
	Yemen	25	6.40±(1.8)	
	Jordan	23	7.52±(1.5)	
	India	16	5.93±(2.6)	
	Other	123	6.69±(1.8)	
Identity	Resident	146	6.78±(1.7)	0.593
	Visitor	297	6.64±(1.8)	
Education	Non Educated	14	6.14±(1.5)	0.121
	Primary School	28	6.57±(2.0)	
	Middle/Secondary School	29	6.17±(2.2)	
	High School	96	6.93±(1.8)	
	University/Bachelor's Degree	214	6.63±(1.8)	
	Master's Degree	49	6.82±(1.6)	
	Doctorate Degree	13	7.46±(1.8)	

Table 5: Multiple logistic regression analysis of the association between factors and good knowledge about Viral Respiratory Infection.

Variable	OR (95%CI)	P-value
Age	1.46 (1.15-1.87)	0.002
Gender (Male, ref.)	2.87 (1.74-4.73)	0.000
Nationality	0.99 (0.97-1.02)	0.616
Identity (visitor, ref.)	1.62 (0.95-2.76)	0.074
Educational Level	1.19 (0.98-1.45)	0.076

OR; odds ratio, CI; confidence interval

Table 6. Demographic characteristics of participants and practice score of Viral Respiratory Infection by demographic variables.

Variable	Variable details	No. of Participants	Knowledge Score (mean±SD)	P-value
Age	10-19 years old	23	4.30±(1.6)	0.859
	20-29 years old	125	4.35±(1.3)	
	30-49 years old	187	4.16±(1.4)	
	50-59 years old	63	4.41±(1.2)	
	More than 60 years old	45	4.36±(1.2)	
Gender	Male	217	4.05±(1.4)	0.000
	Female	226	4.49±(1.2)	
Nationality	Egypt	82	4.11±(1.3)	0.832
	Saudi Arabia	77	4.44±(1.3)	
	Pakistan	71	4.00±(1.4)	
	Sudan	25	4.60±(1.2)	
	Yemen	25	4.20±(1.7)	
	Jordan	23	4.65±(0.9)	
	India	16	4.13±(1.6)	
	Other	123	4.28±(1.3)	
Identity	Resident	146	4.21±(1.3)	0.511
	Visitor	297	4.31±(1.3)	
Education	Non Educated	14	4.50±(1.2)	0.856
	Primary School	28	4.07±(1.3)	
	Middle/Secondary School	29	4.34±(1.4)	
	High School	96	4.30±(1.3)	
	University/Bachelor's Degree	214	4.29±(1.3)	
	Master's Degree	49	4.16±(1.1)	
	Doctorate Degree	13	4.31±(1.4)	

SD; standard deviation

Table 7: Multiple logistic regression analysis of the association between factors and proper practice toward Viral Respiratory Infection.

Variable	OR (95%CI)	P-value
Age	1.04 (0.83-1.29)	0.712
Gender (Male, ref.)	1.72 (1.11-2.67)	0.015
Nationality	1.00 (0.98-1.02)	0.928
Identity (visitor, ref.)	0.96 (0.60-1.53)	0.866
Educational Level	0.95 (0.79-1.13)	0.533

OR; odds ratio, CI; confidence interval

Practice related to viral respiratory infections: The mean of correct answers score about the practice of knowledge toward the viral respiratory infections was 4.27 (SD: 1.31, range 0-6), with an overall 71.2% correct responses of practice questions. The question "Do you wash your hands before eating (P2)" reported the highest correct response rate of 95.9%. This was followed by the question "Do you cover your mouth and/or nose by tissue when you sneeze or cough (P4)" with 88.3% correct responses, and for the question "Do you wash your hands after touching any suspected contaminated object (P3)", 81% correct response rate was acquired and are shown in Table 2. A lowest correct response rate of 47.2% was acquired for the questions "Do you wear a mask in crowded places", followed by the question "Do you use hand sanitizer after sneeze or cough (P6)" with 56.9% correct responses. Finally, for the question "If you do not have a tissue, do you use your elbow when you sneeze or cough (P5)", 58.5% correct response rate was acquired (Table 2). Participants' practice score was significantly different

amongst the different gender groups with P-value=0.000. While no significant difference in knowledge score was reported among participants' age, nationality, identity, or level of education as shown in Table 6. Moreover, in multiple logistic regression analysis of the association between factors and proper practice toward viral respiratory infection, our results revealed that females observed 1.72 times better precautionary practice toward viral respiratory infections in comparison to the males male participants (P-value=0.00) and is shown in Table 7.

DISCUSSION

Viral respiratory tract infections are considered as one of the most prevalent infections during Hajj and Umrah [1]. As in mass gatherings, the prevalence of viral respiratory tract infections usually increases; there is a strong need to focus on education, prevention and control, and raising awareness toward the transmission modes of these infections. Since mass gatherings may increase the susceptibility of viral RTI transmission, this study was conducted among the Holy mosque visitors to assess their knowledge and practices towards the said infectious disease [9].

In this study, it was found that around 74% of the participants responded correctly to the modes of transmission questions. These findings were nearly similar to those that were observed by Ahmed et al., who reported that 79.2% of the study participants, mostly healthcare professionals, were aware of the transmission modes of SARS-CoV-2 infection [11]. We found that around 92% of the Holy mosque visitors were aware of the fact that risk of transmission of infections may increase in the crowded places without following the precautionary measures. Similarly, Haque et al. found that 87.97% of Bangladeshi preferred to avoid mass gatherings in order to prevent SARS-CoV-2 infection [12]. However, in 2016 a study conducted by Alqahtani et al found that only 29% of the Hajj pilgrims avoided being at crowded places because the studies had revealed that it may be ignorance of precautionary measure rather attending crowded places, that may contribute in its spread [13].

Since viral respiratory infections are known to be transmitted from person to person through either direct or indirect ways. The present study indicated that 89 and 83% of the Holy mosque visitors knew that sneezing and coughing were considered as ways of direct transmission of viral RTIs. Another study assessed the MERS-CoV knowledge among Saudi's showed that most participants (99%) knew that MERS-CoV could be transmitted through coughing [14]. Similarly, Balkhy et al found that 95.5% of the Saudi population responded correctly towards the swine influenza transmission through sneezing and coughing [15].

In this study, it was found that around 76% of the respondents were familiar with the symptoms related to RTI, such as fever, sore throat, and/or running nose. The reason behind this good level of knowledge might be due to the availability of information about the respiratory diseases. Saudi service providers usually distribute a lot of recommendations about different aspects, including health education and security; as well as access to the healthcare systems. It has been observed that there are health

education messages distributed through many channels such as, mobile text messages, emails, and mega advertisement screens that are available around different areas within the Holy mosque central area.

It's well known that respiratory viruses can be transmitted from person to person, indirectly, through contaminated surfaces. However, this study found that half of the participants misunderstood the definition of contaminated objects. Although, around 65% of the visitors knew that respiratory viruses can be transmitted indirectly by using contaminated objects such as doorknob and carpets and about half of the participants were unaware that shaking contaminated hands of the infected person, might be a source of infection.

In this study, it was found that only 47.2% of the visitors used to wear mask in the crowded places only. This inappropriate practice could be explained by the weakness of financial position and differences in believes of some visitors. These results are in line with the findings of previous studies that assessed the protective practices toward respiratory illness. In 2016, Alqahtani et al revealed that 53% of the Australian pilgrims were used to wear face masks to protect themselves from infectious diseases during Hajj season [13]. Another study in Malaysia reported results similar to our current study, showing that 51.2% of the Malaysian participants used to wear face mask to protect themselves from COVID-19 infection in mass gatherings [16]. Contrary to our findings, several studies reported good practice scores and higher percentages regarding wearing masks in crowded areas. Dauda Goni et al., Nour et al., Haque et al. and Balaban et al. reported that 90.7, 83.3, 75.5 and 62.8% of the participants had a good practice toward wearing face masks in mass gatherings, respectively [12, 17-19].

In this study, around 56.9% of the participants used hand sanitizer after sneeze and/or cough. More or less, similar results were observed by Dauda et al. too who found that 68% of the study participants used a hand sanitizer to prevent infection transmission [18]. However in contrast to our findings, Gautret et al. reported that 98.1% of French pilgrims used hand sanitizer [8]. This study also showed that most of the Holy mosque visitors (95.9%) knew the importance of hands wash before eating as per the guidance of prophet Mohammed (peace be upon him) guidance, where he always urged Muslims to wash their hands before and after meals to protect themselves from infections. This study also showed that 81% of the visitors used to wash their hands with soap and water after touching any suspected contaminated object. This percentage is actually lower than the reports of Gautret et al. and Balaban et al. who found that 92.8% of the French pilgrims and 86.2% of American pilgrims washed their hands frequently during pilgrimage, respectively [8, 17]. Recently in 2020, Haque et al. conducted a study amongst the Bangladeshi population, where they demonstrated that 95.4% of the respondents were used to wash their hands frequently during COVID-19 pandemic [12].

In this study, around 88.3% of the participants used to cover their mouth and/or nose by tissue during sneezing and/or coughing. This high percentage of appropriate practice could be explained by the good knowledge that was observed among Holy mosque visitors, where 89 and

83% of them knew that sneezing and coughing could transmit viral respiratory infections, respectively. Interestingly, this practice finding was higher than what Alhazmi et al. observed (63.5%) among a sample of the urban population of Riyadh, Saudi Arabia [20]. With regard to other visitors' practices, it was found that about 58.5% of the participants used their elbow when a tissue is not available during sneezing and/or coughing. In contrast, Jones et al. reported that only 20.6% of the study participants used the fold of their elbow during coughing and/or sneezing [21].

CONCLUSIONS

This study was conducted to assess the knowledge and practice of the Holy mosque visitors toward viral respiratory infections. The majority of the Holy Mosque visitors had a good level of general knowledge about viral respiratory tract infections and their transmission modes. There is still a gap that needs to be filled since most of the visitors were not knowledgeable enough about different modes of transmission and how to protect themselves from being infected. In addition, malpractices were reported such as no use of elbows while coughing or sneezing, hand sanitizers (for cleaning), and not wearing masks in crowded places as personal protection. Therefore, continuous evaluation of the Holy mosque visitors is needed to ensure their knowledge and practices levels. Thus, education might be the area that needs improvement to increase visitors' knowledge and good practices. This can be done through different ways including posts, video, and media contents, as well as distributing flyers/handouts that contain all information with translation into different languages is also recommended.

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