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RAISING HEALTHCARE PROVIDERS' AWARENESS OF MERS-CoV INFECTION IN MAKKAH HOSPITALS, KSA

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ABSTRACT

We aimed to assess knowledge, attitude and practices (KAP) of healthcare providers in Makkah hospitals regarding MERS-CoV infection and to measure effectiveness of the health education intervention used. The pretest data included 281 participants using self-administered questionnaire. Health education intervention using a combination of methods was conducted. After 3 months gap, a total of 188 participants responded to the post-intervention evaluation. Results showed significant post intervention improvement in their median scores for knowledge; (21 out of 28, P<0.001), attitude (6 out of 11, P=0.022) and cumulative KAP (34 out of 47, P<0.001) compared to the median scores obtained in the pre-test (18, 5.5 and 31 respectively). However; improvement in the median practice score after intervention was not significant. Continuous education and in-service training program on prevention of MERS-CoV are essential to improve healthcare providers' knowledge, change their attitudes and reduce the hazards attached with MERS-CoV infection.

KEYWORDS: Knowledge, Attitude, Practices, Healthcare providers, Health education intervention, MERS-CoV.

INTRODUCTION

Novel coronavirus, described as MERS-CoV, is a particular strain different from any other known human coronavirus and is known to cause severe acute respiratory illness in humans with possibility of zoonotic transmission.[1]

As of February2, 2016; 1638 laboratory-confirmed cases have been reported to WHO including cases from 26 different countries with 587 related deaths.[2,3]

At this point and with gradually increasing number of reported cases, international concern about infection is high with possibility for this virus to move around the world. Consequently, all countries in the world need to ensure that their healthcare workers (HCWs) are aware of the virus and the disease it can cause and all countries in this Region need to demonstrate to rest of the world how vigilant and prepared they are to develop mitigation measures to prevent international spread of infection and to support the timely release of research findings as well as put in place enhanced public health surveillance plan for identifying suspected cases using WHO's recommended case definition and investigation protocol to protect both global health and wellbeing of local community.[4,5]

In Saudi Arabia, MERS-CoV infection is also taking a great concern at governmental and public levels because the number of infected individuals and deaths is increasing although extensive work has been done and is ongoing covering a wide range of interventions including prevention and control procedures; research studies; special consideration for people working with animals; risk communications and community engagement; and national, ministerial, and international coordination in the process of investigation and management of cases in Saudi Arabia.[5]

Since June 2012 to February 23, 2016; Ministry of Health has reported a total of 1297 confirmed cases with MERS-CoV infection accounting for about 79% of global cases of which 554 cases have died (43%) accounting for about 94% of total global deaths. Patients acquired infections in healthcare setting represents 32% while 12% of infected cases were healthcare workers.[6]

Based on the available data and WHO's risk assessment, no sustained human-to-human transmission in

communities has been documented and no evidence of airborne transmission. However, MERS-CoV is a relatively new disease and large gaps in our knowledge are considerable including epidemiological pattern, characteristic of virus and clinical features.[5]

Careful monitoring of current situation is crucial particularly with absence of any prophylactic vaccines, curative treatment and lack of experience in control measures. There is a great fear from increased number of human infections and deaths in seasons of Hajj and Umrah where about two million pilgrims come together on the Holy Places in Saudi Arabia (Makkah and Madinah) during the annual Hajj and about six million pilgrims arrive throughout the year-round Umrah. Till now, little is known about severity and transmission of this virus in mass gatherings although no cases have been confirmed during and after Hajj. However, special measures need to be done for returning home pilgrims. In the other hand, in Umrah, several cases have been detected and one of the risk factors was a history of visiting healthcare setting in Makkah.[7]

Healthcare providers in Makkah hospitals are at risk of infection through occupational exposure to suspected cases during Umrah and Hajj season and expected to have an essential participation in health education activities towards infection particularly if they have relevant information which can be transferred to patients and through them to their families and members of the community. We investigated whether trained healthcare providers had better KAP towards MERS-CoV in comparison with the same group before intervention.

MATERIALS AND METHODS

Study design

It is an intervention study conducted in Makkah public hospitals: King Abdul Aziz, King Faisal, Al-Nour Specialist, Agiad, and Hera during the period from September 2014 to October 2015. It was a continuation of a project with previously published descriptive date.[8]

Subjects & inclusion criteria

The target study population included all healthcare providers (physicians, specialists, technicians and nurses) in emergency departments in Makkah public hospitals. They were contacted and requested to participate according to the below mentioned criteria regardless of age, gender or type of their work:

- willing to be involved in the study and complete the questionnaire;
- in direct contact with patients;
- working only in emergency departments;

Sample size

It was calculated by Raosoft sample size calculator.[9] Based on estimated population 613 (according to statistical office in each hospital) and anticipated response 50%, the required sample size was 188 with a confidence level of 90% and a 5% margin of error. In the pre-test, we used convenience sampling to find respondents with distribution of a total of 500 questionnaires, putting into consideration drop-outs in the post-test. Each questionnaire, in both pre- and post-tests, was evaluated for missing data at the time of submission and corrected in presence of respondent to make sure each question is answered. In the pre-test, the total response rate was 56% representing 281 out of 500 distributed questionnaires. Among participants who completed the intervention, only 188 out of 281 (response rate of 66.9%) underwent post intervention evaluation.

Study instrument

The study passed through the following steps:

Pre-test evaluation: Construction, contents and scoring of self-administered questionnaire were explained in details in previously published descriptive date. [8] In short, it included 21 questions for knowledge with overall score of 28 (ranged from 0 to 28) that dichotomized to good knowledge (score $\geq$ 21) or poor knowledge (score < 21), 11 questions for attitude with overall score of 11 (ranged from 0 to 11) that considered as positive attitude (score $\geq$ 8) or negative attitude (score < 8) and 8 questions for practices with overall score of 8 (ranged from 0 to 8) that dichotomized to good practice (score $\geq$ 6) or poor practice (score < 6).

The cumulative KAP score represent the sum of the three scores (i.e. 47 points ranged from 0 – 47) that dichotomized to good cumulative KAP (score $\geq$ 35) or poor cumulative KAP (score < 35). All scores were categorized into good/positive or poor/negative based on 75% cut-off point out of the total expected score for each.

Analysis of pre intervention data was done[8] and we identified certain areas where participants had less knowledge, negative attitude and/or poor practice to be covered during health education intervention.

Health education intervention: Coordinating with training & education center in each hospital, all available participants were given the first health education session addressing epidemiology of MERS-CoV infection and the second session was held after one week addressing prevention & control measures. Both sessions (60 minutes each) were based on the most recent available data with a summary take-home message to protect yourself against infection. The session manner varied by presentation, brainstorming, interactive discussion and was supported by a short video. For provision of knowledge and reinforce their attitudes by feedback on pretest observations, we developed five large banners and distributed posters, brochures and pamphlets both in Arabic and English addressing different epidemiological aspects and prevention & control measures gathered and prepared from WHO, CDC and Saudi's Ministry of Health media website. As commitment to proper

infection prevention and control measures would result in decrease in risk of occupational exposure to infection, we emphasized the infection control measures through hands-on practicum demonstration on proper hand washing technique, cough etiquette, use of personnel protective equipment and safe disposal of contaminated objects with the help of infection control unit in each hospital. In addition, with the help of the training & education center in each hospital and under complete support & supervision of local health authorities, reminder services were given through short health education messages that were sent regularly on their mobiles using WhatsApp application for 2 months after intervention and also the contents of the banners, posters, brochures and educational videos were continuously presented in display screens distributed in different parts within each hospital. These services were applied to the whole hospital team and not to the target group only as requested by the health authorities.

Post-test evaluation: We measured the change in their KAP using the same self-administered questionnaire of pre-test about 3 months after the intervention.

Ethical consideration

Consent from the bioethics committee at Umm Al-Qura University (project # 43409062) and from the research ethical committee at Al-Noor Specialist Hospital (No. 512267\302\47) was done as well as from Directorate of Health Affairs. Furthermore, oral consent was obtained from respondents before participation in the study with brief explanation on the objectives and paybacks of the study with emphasis confidentiality.

Statistical analysis

SPSS computer package version 19.0 was used for data analysis. The Chi-square or Fisher's Exact tests were applied to compare qualitative variables. The samples were not following a normal distribution and accordingly median and non-parametric tests were used; Mann–Whitney test for dichotomous variables and Kruskal Wallis test when there was more than two subgroups of respondents. All p-values were two-tailed, assuming a significance level of $p<0.05$ and a highly significant level of $p<0.001$.

RESULTS

Pre & post intervention KAP scores

A total of 188 healthcare providers were evaluated for changes in their KAP scores before and after intervention. Our results showed post intervention improvement in their good knowledge score ($p<0.001$), positive attitude score ($p=0.008$) and good cumulative KAP score ($p=0.001$). An increase in self-reported good practice score ($p=0.168$) by about 4% was observed "Fig. 1". In other words, the intervention resulted in considerable positive improvement in knowledge, attitude and cumulative KAP scores among participants.

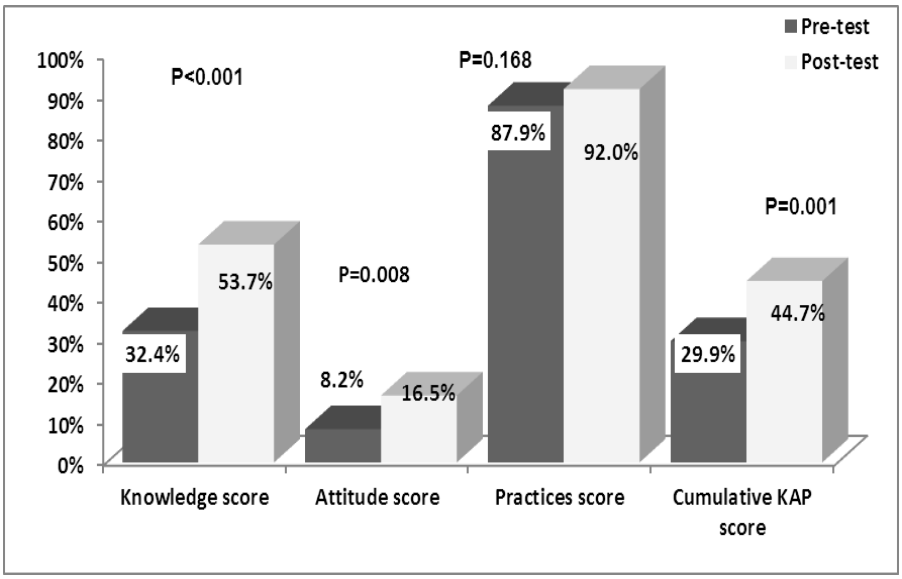

Fig: 1. Overall good/positive KAP scores of healthcare providers about MERS-CoV before and after intervention.

KNOWLEDGE

In general, their right knowledge was improved after intervention in response to questions regarding reservoir of infection, transmission through renal dialysis, disease manifestations in human, availability of vaccine, travel ban to the kingdom, methods of providing healthcare to patients and return to daily activities in case of cure ($p<0.001$), incubation period in human ($p=0.001$), characteristics of Saudi' infected cases ($p=0.002$), protection by seasonal influenza vaccine ($p=0.003$), recommendations when admitting suspected/confirmed case at hospital &recommendations for contact of confirmed case at home ($p=0.006$), methods of transmission of infection to human ($p=0.008$), isolation of suspected cases at emergency department ($p=0.014$) and diagnosis of disease in human ($p=0.018$).(Table 1).

Table: 1. Good knowledge of healthcare providers about MERS-cov infection before and after intervention.

Knowledge (Complete right answer)	Pre-test n=281	Post-test n=188	FET / X^2	P-value
	no. (%)	no. (%)		
Causative agent	264 (94.0)	178 (94.7)	0.11	0.841
Reservoir of infection	142 (50.5)	132 (70.2)	17.9	< 0.001
Source of infection	259 (92.2)	179 (95.2)	1.05	0.335
Transmission from infected person to another	264 (94.0)	180 (95.7)	0.72	0.530
Methods of transmission	194 (69.0)	154 (81.9)	9.78	0.008
Transmission through renal dialysis	116 (41.3)	111 (59.0)	14.23	< 0.001
Characteristics of Saudi' infected cases	180 (64.0)	148 (78.7)	12. 37	0.002
Incubation period in human	166 (59.1)	139 (73.9)	10.94	0.001
Disease manifestations in human	163 (58.0)	149 (79.3)	29.10	< 0.001
Healthcare providers are among high risk groups	259 (92.2)	181 (96.3)	3.27	0.080
Delayed seeking treatment could lead to death	265 (94.3)	179 (95.2)	0.18	0.834
Isolation of suspected cases at emergency department	238 (84.7)	174 (92.6)	6.51	0.014
Recommendations when admitting suspected/confirmed case at hospital	150 (53.4)	128 (68.1)	10.09	0.006
Recommendations for contact of confirmed case at home	202 (71.9)	158 (84.0)	10.08	0.006
Diagnosis of disease in human	213 (75.8)	159 (84.6)	8.01	0.018
Availability of vaccine	208 (74.0)	166 (88.3)	14.21	< 0.001
Protection by seasonal influenza vaccine	167 (59.4)	137 (72.9)	8.93	0.003
Travel ban from WHO to the kingdom	158 (56.2)	137 (72.9)	13.37	< 0.001
Methods of providing healthcare to patients	138 (49.1)	129 (68.6)	17.73	< 0.001
Possible curability from infection	231 (82.2)	165 (87.8)	2.65	0.119
Time to return to daily activities in case of cure	86 (30.6)	122 (64.9)	53.66	< 0.001

Attitude

On average, they expressed an increase in their positive attitudes regarding negative impact of corona infection on KSA economy, afraid to go to common places in order not to get infection (p<0.001), corona infection is preventable, fear from getting infection by one of their family members (p=0.002), treatment of corona infection at home (p=0.005), use of the face mask during working hours, role of health education in disease prevention (p=0.008) and closure of schools and work places in case of epidemic (p=0.031). (Table 2).

Table: 2. Positive attitude of healthcare providers towards MERS-cov infection before and after intervention.

Positive attitude	Pre-test n=281	Post-test n=188	FET	P-value
	no. (%)	no. (%)		
Negative effect of infection on KSA economy	44 (15.7)	83 (44.1)	46.30	< 0.001
Important to report a suspected case to health authorities	265 (94.3)	181 (96.3)	0.94	0.389
Important to use face mask during working hours	208 (74.0)	159 (84.6)	7.37	0.008
Corona infection can be treated at home	185 (65.8)	147 (78.2)	8.32	0.005
Corona infection is preventable	242 (86.1)	179 (95.2)	10.13	0.002
Afraid that one of your family members can get infection	27 (9.6)	37 (19.7)	9.70	0.002
Afraid to go to common places in order not to get infection	78 (27.8)	84 (44.7)	14.27	< 0.001
Closure of schools &work places during corona epidemic	52 (18.5)	51 (27.1)	4.89	0.031
Ability of governmental institutions to control epidemic	170 (60.5)	129 (68.6)	3.21	0.078
Health education has nothing to do with disease prevention	216 (76.9)	163 (86.7)	7.02	0.008
Handling corona infected patient dose not threaten medical and paramedical staff	39 (13.9)	39 (20.7)	3.83	0.058

Practices

Non considerable improvement (p>0.05) was observed in their self-reported infection control practices after intervention. (Table 3).

Table: 3. Good practices of healthcare providers regarding infection control measures before and after intervention.

Good practices	Pre-test n=281	Post-test n=188	FET	P-value
	no. (%)	no. (%)		
Use soap and water to wash my hands continuously	257 (91.5)	176 (93.6)	0.74	0.480
Cover my nose and mouth with a tissue during sneezing or coughing	262 (93.2)	179 (95.2)	0.78	0.431
Throw the used tissue in the trash	268 (95.4)	179 (95.2)	0.01	1.000
Avoid touching my eyes, nose or mouth as far as I can	264 (94.0)	180 (95.7)	0.72	0.530
Use face mask in crowds	234 (83.3)	166 (88.3)	2.27	0.145
Carefully handle suspected patient's belongings	259 (92.2)	177 (94.1)	0.67	0.465
Keep on healthy eating and health styles	253 (90.0)	173 (92.0)	0.53	0.517
Used to educate clients about the disease	219 (77.9)	154 (81.9)	1.10	0.350

Other relations

Comparison of median KAP scores before and after intervention of various subgroups of respondents was shown in Table (4).

Table: 4. Comparison of median KAP scores among different subgroups of healthcare providers before and after intervention.

Characteristics	Knowledge score (Max.=28)			Attitude score (Max.=11)			Practice score (Max.=8)			Cumulative score (Max.=47)		
	Pre-test	Post-test	P-value	Pre-test	Post-test	P-value	Pre-test	Post-test	P-value	Pre-test	Post-test	P-value
Overall	18	21	<0.001	5.5	6	0.022	8	8	0.591	31	34	<0.001
Age* (y)												
< 30 y	17	19	0.040	5	6	0.004	8	8	0.816	31	32	0.046
≥ 30 y	19	22	<0.001	6	6.5	0.009	8	8	0.087	32	35	0.001
Gender*												
Male	19	21.5	<0.001	5	6	0.046	8	8	0.888	32	34.5	<0.001
Female	18	20	<0.001	6	7	0.040	8	8	0.068	31	33	0.006
Occupation†												
Physician	20	21	0.261	5.5	6	0.306	8	8	0.138	33	34	0.291
Nurse	18.5	21	<0.001	5.5	6.5	0.037	8	8	0.227	32	34	0.001
Specialist	17	21	0.015	5	5	0.505	8	8	0.670	29	33	0.001
Technician	17	21	<0.001	6	5.5	0.685	8	8	0.948	31	34	0.002
Years of experience†												
< 5 y	17	22	<0.001	5	6	0.031	8	8	0.390	30	34	<0.001
5 – 10 y	19	21	<0.001	5	6	0.062	8	8	0.057	32	34	0.002
> 10 y	20	21	0.625	6	6	0.514	8	8	0.427	32.5	33	0.929

**Mann–Whitney test (two subgroups).*
†Kruskal Wallis test (more than two subgroups).

Overall

The overall median knowledge (21out of 28), attitude (6out of 11) and cumulative scores (34 out of 47) were improved after intervention (p<0.001, p=0.022 and p<0.001 respectively). However; no improvement observed in their median practice score after intervention (p=0.591).

Knowledge & cumulative KAP

The median knowledge and cumulative KAP scores improved after intervention among different subgroups of participants except for physicians (p=0.261, p=0.291respectively) and those with experience > 10 years (p=0.625, p=0.929 respectively).

Attitude

The median attitude scores changed positively after intervention among different subgroups of participants regarding age, gender, among nurses and among those with experience < 5 years.

Practice

No improvement observed in the median practice scores after intervention among all subgroups of participants.

DISCUSSION

To the best of our knowledge, this is the first intervention study in Western area in KSA to raise awareness of healthcare providers about MERS-CoV via health education intervention.

Knowledge

Conducting health education intervention helps to raise knowledge of participants about reservoir of infection, methods of transmission, incubation period, characteristics of Saudi' infected cases, disease manifestations, diagnosis, role of vaccination, travel ban to the kingdom, recommendations for suspected/confirmed case at hospital & for close contacts at home, isolation of suspected, methods of providing healthcare to patients and returning to daily activities.

Although the present findings were positive overall, some also merited concern. An example is in incubation period (pretest 59%, post-test 74%, p=0.001). Some participants before intervention might have not considered importance of incubation period in infectious disease surveillance &control, in diagnosis if laboratory facilities are unavailable and is clinically relevant in administration of antiviral medications which are most effective when given before or immediately after symptom onset.[10] Findings related to recommendations when dealing with suspected/confirmed case at hospital (pretest 53%, post-test 68%, p=0.006)& recommendations for close contacts at home (pretest 72%, post-test 84%, p=0.006) also gave rise to concern as dealing with suspected/confirmed case is inevitable whether by healthcare providers at hospital or close contacts at home. Well knowledge and commitment to these recommendations helps to avoid transfer of infection.[11, 12]

Attitude

The health education intervention helps to improve their positive attitudes regarding negative impact on KSA economy, preventability of infection, treatment at home, fear to go to common places, fear to catch infection by a family member, fear from epidemic, protection by face mask and role of health education in disease prevention.

Some studies showed different degrees of attitude towards MERS-CoV and other related infections. More than half (55%) of Japanese HCWs were afraid from SARS infection, even in absence of an epidemic, and 92% preferred to avoid the patient.[13] Majority of HCWs in Thailand (90%) accepted occupational risk of caring for H5N1-infectd patients.[14] Closure of schools in case of H1N1 influenza epidemic was accepted by about 78% of Saudi public.[15]

The use of personal protective equipment by HCWs at Al Qassim region was reported to be the most positive attitude when dealing with MERS. [16] In the same context, Thu et al. reported similar positive attitude of HCWs when dealing with healthcare associated infections.[17]

Rahnavardi et al. reported a positive attitude of Iranian HCWs regarding active participation by health education in prevention programs. [18] However, a negative attitude of HCWs at Al Qassim region was observed regarding active participation in infection control program in reducing prevalence of MERS.[16]

The contradict that observed here was that although about 68% of participants after intervention reported good knowledge about recommendations when dealing with suspected/confirmed case at hospital, yet about 80 % believed that they might be threaten when handling corona infected patient. This directly contradicts Green et al. suggestion that increased identifiable knowledge results in increased identifiable attitude.[19]

Practice

Adherence to infection control procedures could lead to decreased morbidity and mortality related to MERS-CoV infection. Generally, their self-reported infection control practices to prevent MERS-CoV infection including hand hygiene and use of personal protective equipment in addition to keeping healthy lifestyle and educating clients about the disease were positive both before &after intervention, (range of individual items was 77.9% - 95.4% pre-test to 81.9% - 95.7% post-test)though this wasn't the ideal way of measuring practice.

These results support finding by Al Saleh et al. who reported high level of healthcare workers compliance to infection control practices with no difference between doctors and nurses[20] and Creedon who reported good compliance of healthcare workers with hand washing guidelines.[21] However, Thu et al. reported small number of correct responses to items about hand hygiene and use of surgical mask with exception of the question about waste management.[17] Also Balkhy et al. found about 60% of Saudi public with low level of self-reported precautionary measures regarding swine flu.[15]

We shouldn't interpret results of this study without caution particularly evaluation of practice of HCW regarding infection control measures was done by self-reporting and not by an observation checklist. Some participants may not express their real thoughts, beliefs and understandings which may be misinterpreted and this may have a direct impact on their responses. [22] In addition, although observation is a more reliable method to measure compliance, the presence of observer will influence behavior and may improve compliance (observer effect).[23]

General characteristics and KAP scores

In general; knowledge, attitude and cumulative KAP scores improved after intervention in relation to age, gender, nurse specialty and less than 5 years of experience. In addition, specialists, technicians and those

with 5–10 years of experience were found to have considerable improvement in knowledge and cumulative KAP scores after intervention.

The association between KAP and age, gender, specialty or experience was supported by some reports [16, 24, 25, 26] while contrasts others.[14]

Some explained more knowledge among physicians compared to other healthcare providers by their greater opportunities of professional development and clinical training.[16] Gender and experience were found to be important predictors of knowledge and attitude of HCWs by some studies[16,24,27,28,29] while other research does not support this association.[30]

It is difficult to determine to what extent the individual strands of intervention (health education sessions, provision of knowledge, feedback of results, hands-on practicum demonstration, reminder services) may have contributed to overall improvement that occurred because of the multifaceted nature of the intervention. This supports the theory that, in order to achieve behavioral change, attention must be paid to all factors that predispose, reinforce and enable behavior and not to any single factor.**[19]**

Some studies have reviewed effects of health education on KAP of HCWs at various time intervals. In India, assessing post-education KAP scores showed that the best scores were achieved in the first post-education assessment conducted 6 months following intervention. However, improvement in answers declined in the second assessment at 12 months and still further dropped in the third assessment after 24 months.[31] On the other hand, other studies found that passing time does not negatively affect KAP and it can even improve KAP if education is continuous and it can over shadow other factors.[32,33] Thus, continuous education, efficient in-service training, monitoring and evaluation of HCW practices play a pivotal role in sustainability of knowledge and application of infection control practices. [34]

It is important to interpret our results in the context of potential study limitations. First, it was conducted only among HCWs present at public hospitals and does not represent the private sector nor other HCWs as patient supporters and cleaners. Second, information was obtained from available healthcare providers who were on duty during the study. Others may have been excluded and information on their characteristics is unknown. In addition, we could not gather all the health team simultaneously for educational intervention due to various constraints. So the number of post intervention participants was markedly decreased. Third, there may be data reporting bias, where participants who received health education intervention may be more likely to report practices consistent with proper infection control procedures (social desirability bias). Fourth, participants could achieve different levels of knowledge through mass media, books, articles, or conferences which consequently influenced the study. Fifth, the 3-month post intervention period was relatively short and the long-term effect of intervention should be investigated. Sixth, the effect of intervention may diminish over time. So, periodic repetition of educational programs may have a booster effect on maintaining healthcare providers' awareness towards MERS-CoV. Finally, to increase power of the study and reduced bias, it was better to design a quasi-experimental study with a control group which did not undergo the educational intervention.

In spite of study limitations, it highlighted a major health problem that challenges healthcare providers in Saudi Arabia especially in Makkah. The positive results of this health education intervention and the extent of current MERS-CoV threat during Hajj and Umrah season support efforts to continuously implement intervention program for healthcare providers especially in Makkah. Rigorous evaluation of these programmes would be of great value.

CONCLUSION

We noted KAP of healthcare providers at Makkah public hospitals regarding MERS-CoV and compared their scores before and after intervention. Yet, using different methods of health education intervention was successful in improving knowledge, attitude and cumulative scores however; the practice score was not considerably improved. Continuous health education and training programs, both educational and motivational, and creating an organizational atmosphere adherent to the recommended prevention and control measures and safety practices regarding MERS-CoV are mandatory in healthcare settings and important to raise awareness of healthcare providers towards the risk of the disease.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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