

# Knowledge and practices of primary health care physicians regarding updated guidelines of MERS-CoV infection in Abha city

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## ABSTRACT

**Background:** Human coronaviruses (hCoV) usually cause mild to moderate upper respiratory tract illnesses. The novel coronavirus (nCoV), or Middle East respiratory syndrome coronavirus (MERS-CoV), is a particular strain different from any other known hCoV with the possibility of human and also zoonotic transmissions. The aim of the study to assess primary health care (PHC) physicians' knowledge and adherence regarding Saudi Ministry of Health guidelines regarding MERS-CoV. **Materials and Methods:** A cross-sectional study design was followed to include 85 PHC physicians in Abha city. An interview questionnaire has been designed by the researcher that was used to assess knowledge and practices of PHC physicians regarding diagnosis and management of MERS-CoV. It includes personal characteristics, the MERS-CoV knowledge assessment questionnaire, and practices related to adherence toward guidelines regarding MERS-CoV. **Results:** PHC physicians' knowledge gaps regarding MERS-CoV included protected exposure (32.9%), highest seasonal incidence of MERS-CoV in Saudi Arabia (60%), relation between incidence of MERS-CoV and overcrowding (62.4%), case fatality of MERS-CoV cases (63.5%), and collecting specimens from MERS-CoV patients (64.7%). The knowledge of PHC physicians about MERS-CoV was poor among 5.9%, good among 63.5%, and excellent among 30.6%. Personal protective equipment to be used when seeing suspected cases of MERS-CoV infection were mainly the mask (94.1%), gloves (78.8%), the gown (60%), goggles (31.8%), and the cap (22.4%). All participants stated that the most important standard precaution that should be applied when seeing a case of MERS-CoV infection is hand washing, whereas 97.6% stated that the most important respiratory precaution to prevent transmission of respiratory infections in PHC setting when seeing a case of MERS-CoV infection is masking and separation of suspected MERS-CoV patients, and 81.2% stated that upon exit from the room of a MERS-CoV patient, the physician should remove and discard personal protective equipment. PHC physicians' knowledge about MERS-CoV differed significantly according to their nationality ( $P = 0.038$ ), with non-Saudi physicians expressing higher percent of excellent knowledge than Saudi physicians (40% and 20%, respectively). Those who attended continuing medical education (CME) activities had significantly higher percent of excellent knowledge than those who did not attend a CME activity (55.6% and 23.9%, respectively,  $P = 0.011$ ). PHC physicians' knowledge did not differ significantly according to their age, gender, qualification, experience in PHC, and practice-related adherence to guidelines. PHC physicians' practice-related adherence to guidelines about MERS-CoV differed significantly according to their position ( $P = 0.035$ ), with specialists having the highest percent of excellent practice (13%). **Conclusions:** There are knowledge gaps among PHC physicians in Abha city, and their practice is suboptimal regarding MERS-CoV infection. Less than one-fourth of PHC physicians attend CME activities about MERS-CoV infection. However, significantly less practice-related adherence to guidelines are associated with Saudi PHC physicians, those who did not attend a related CME activity, and MBBS qualified physicians' general practitioners. To increase awareness, more CME activities related to MERS-CoV infection management needs to be organized.

**Keywords:** Continuous medical education, General physician and Primary Health Center, Middle East respiratory syndrome coronavirus

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## Introduction

Coronaviruses are common viruses that may infect some people and animals. Human coronaviruses (hCoV) usually cause mild to moderate upper respiratory tract illnesses. The novel coronavirus (nCoV), or Middle East respiratory syndrome coronavirus (MERS-CoV), is a particular strain different from any other known hCoV with the possibility of human and also zoonotic transmissions. Investigations are being done to figure out the reservoir and source of infection, route of transmission to humans, severity, and clinical impact with gradually increasing number of reported cases.<sup>[1]</sup>

The MERS-CoV belongs to the genus “Betacoronavirus.” It appears to replicate efficiently in human respiratory tissues targeting alveolar epithelial cells and the endothelium of blood vessels in the lungs, indicating a potential for spreading beyond the respiratory tract.<sup>[2]</sup> In September 2012, MERS-CoV was first isolated in two Saudi patients who presented with severe pneumonia.<sup>[3]</sup>

The transmission of MERS-CoV was through a hospital cluster, suggesting that the virus can be spread through contact and in the form of droplets. The common symptoms and signs of infection include pyrexia with chills/rigors, cough, dyspnea, myalgia, and gastrointestinal problems (diarrhea, vomiting, and abdominal pain). Abnormal findings of chest radiograph are very common in MERS-CoV patients, and laboratory reports have shown thrombocytopenia, lymphopenia, and raised concentrations of lactate dehydrogenase and aspartate aminotransferase.<sup>[4]</sup>

It has been reported that MERS-CoV outbreak was a result of multiple isolated transmission events, in addition to some human-to-human transmission.<sup>[5]</sup>

The discovery of MERS-CoV requires that the countries of the region to demonstrate to rest of the world the extent of their preparedness to prevent the international spread of a new infection and protect both global health and the well-being of their own citizens. Moreover, the countries of the region need to be also watchful and put in place enhanced public health surveillance plans to identify suspected cases using the World Health Organization’s recommended case definition and investigation protocol.<sup>[6]</sup>

The Ministry of Health (MOH) in Saudi Arabia reported that the total number of infected cases with MERS-CoV infection during the period from June 2012 to April 20 2015 were 981, accounting for 89% of all reported cases worldwide. The case fatality for those discovered in Saudi Arabia was high (43.6%), accounting for about 93.8% of total global deaths (CCC, 2015).

The eastern region of Saudi Arabia was affected by MERS-CoV. However, the virus could proceed throughout the country.<sup>[7]</sup>

Travel from Saudi Arabia has led to additional cases in over a dozen countries. Furthermore, five of the highest travelled

airports in the world are located in countries where MERS-CoV has been transmitted, indicating the high possibility of a pandemic.<sup>[8]</sup>

The Kingdom of Saudi Arabia (KSA) has been battling against MERS-CoV infection. A great concern has been taken at both the governmental and public levels as it led to a number of human infections and deaths (CCC, 2015).

Multiple sources of transmission of MERS-CoV were identified in Hafr Al-Batin outbreak with camels suggested to be the most likely source.<sup>[8]</sup> It was a challenge to identify MERS-CoV in Saudi Arabia around the period of Umrah and Haj during 2012 and 2013.<sup>[9]</sup> However, no cases were reported in returning pilgrims during either year added that active surveillance of symptomatic pilgrims in 2012 and 2013 failed to detect MERS-CoV infections. In addition, no cases were reported by pilgrims, who travelled to Saudi Arabia to perform Umrah during July and August 2013.<sup>[10]</sup>

The problem of MERS-CoV infection becomes more complicated so long as there are no prophylactic vaccines, curative treatment, and the lack of experience among physicians regarding control measures.<sup>[11]</sup> If the required infection control actions were not taken promptly by health authorities, a significant disease burden may occur in the community that would result in a number of unnecessary human deaths.<sup>[8]</sup>

Asymptomatic and subclinical cases of MERS-CoV in the community or in healthcare settings may constitute a huge threat to public health. Therefore, health care workers can be at great risk of acquiring infection or become a source of transmission to patients or their colleagues. Therefore, the presence of MERS-CoV among health care workers underlines the importance of continuing educational programs for physicians on infection control measures to upgrade the knowledge and practice regarding diagnosis and control of MERS-CoV infections and to cut down the rate of its spread.<sup>[4]</sup>

Primary health care (PHC) physicians are expected to play an important role in detecting and management of cases of MERS-CoV and adhere to guidelines for prevention. Therefore, the researcher felt that it is necessary to conduct this study to target primary care physicians by assessing their knowledge and adherence toward MERS-CoV updated MOH guidelines.

## Materials and Methods

A cross-sectional study was conducted in Abha city, KSA. There were 85 PHC physicians in Abha city, who provide both preventive and curative services (Aseer Directorate of Health, Personal Communication, 2017). All physicians at PHC centers within Abha city will constitute the study population and be invited to participate in this study. The inclusion criteria include PHC physicians in Abha city who have been working at PHC centers for at least 1 year. There are no exclusion criteria.

An interview questionnaire has been designed by the researcher. It was used to assess knowledge, attitude, and practices of PHC physicians regarding diagnosis and management of MERS-CoV included demographic information such as age, gender, nationality, qualification, position, experience in PHC, etc., and another part of questionnaire to assess the MERS-CoV knowledge about diagnosis and management of MERS-CoV as per MOH guidelines (2017) that comprises True/False 20 items about assessment and management of MERS-CoV infection. Practices related to adherence toward guidelines regarding MERS-CoV included participants' practices about diagnosis and adherence to MERS-CoV guidelines will be assessed through 10 statements. Regarding the scoring, the total knowledge score ranged from 0 to 20. Those who obtain >60% of the total scores were considered as "knowledgeable," whereas those who obtain <60% of the total scores were considered as "not knowledgeable."

The Statistical Package for Social Sciences (IBM SPSS) version 23.0 was used for data entry and analysis. Descriptive statistics (i.e., frequency, percentage, mean, and standard deviation) were calculated, and the appropriate test of significance (e.g.,  $\chi^2$ ) was applied. A statistically significant findings considered if  $P < 0.05$ .

## Results

Table 1 shows that about half of participants (49.4%) aged 30–40 years, 37.6% aged <30 years, and 12.9% aged more than 40 years. Approximately, two-third of participants (61.2%) were males. Less than half of participants were Saudi (47.1%). Approximately, one-fifth of participants (21.2%) were Doctorate/Fellowship qualified, 18.8% had a Master Degree, 17.6% had Diploma, and 42.4% had MBBS Degree. Approximately, two-third (62.4%) were general practitioners, 27.1% were specialists, and 10.6% were consultants. Approximately, half of participants (49.4) had less than 5 years' experience in primary care, whereas the experience of 50.6% was 5 years or more. Only 21.2% of participants attended continuing medical education (CME) courses on MERS-CoV. The main sources of knowledge about MERS-CoV were the internet websites (55.3%) and lectures (30.6%), followed by medical journals (24.7%) and textbooks (5.9%).

Table 2 shows that main identified knowledge gaps, with least correct answers, among primary care physicians regarding MERS-CoV were about protected exposure (32.9%), highest seasonal incidence of MERS-CoV in Saudi Arabia (60%), relation between incidence of MERS-CoV and overcrowding (62.4%), case fatality of MERS-CoV cases (63.5%), and collecting specimens from MERS-CoV patients (64.7%).

Study findings also show that knowledge of primary care physicians about MERS-CoV was poor among 5.9%, good among 63.5%, and excellent among 30.6%.

Table 3 shows that only 34.1% of participants read guidelines about MERS-CoV infection assessment and management. Seeing,

**Table 1: Personal characteristics of study sample**

Personal characteristics	No.	Percentage
Age groups		
<30 years	32	37.6
30-40 years	42	49.4
>40 years	11	12.9
Gender		
Male	52	61.2
Female	33	38.8
Nationality		
Saudi	40	47.1
Non-Saudi	45	52.9
Qualification		
MBBS	36	42.4
Diploma	15	17.6
Master	16	18.8
Doctorate/Fellowship	18	21.2
Position		
General practitioner	53	62.4
Specialist	23	27.1
Consultant	9	10.6
Experience in primary care		
<5 years	42	49.4
5+ years	43	50.6
Attending CME on MERS-CoV		
Yes	18	21.2
No	67	78.8
Sources of knowledge about MERS-CoV		
Textbooks	5	5.9
Internet websites	47	55.3
Lectures	26	30.6
Journals	21	24.7

diagnosing, treating, and referring cases of MERS-CoV infection were practiced by 29.4%, 10.6%, 18.8%, and 25.9%, respectively. Personal protective equipment to be used when seeing suspected cases of MERS-CoV infection were mainly the mask (94.1%), gloves (78.8%), the gown (60%), goggles (31.8%), and the cap (22.4%). All participants stated that the most important standard precaution that should be applied when seeing a case of MERS-CoV infection is hand washing, whereas 97.6% stated that the most important respiratory precaution to prevent transmission of respiratory infections in PHC setting when seeing a case of MERS-CoV infection is masking and separation of suspected MERS-CoV patients, and 81.2% stated that upon exit from the room of a MERS-CoV patient, the physician should remove and discard personal protective equipment. All participants stated that after discharge of a MERS-CoV patient, cleaning and disinfecting all surfaces that were in contact with the patient or may have become contaminated during patient care, whereas 52.9% stated that privacy curtains should be removed, placed in a bag in the room, and then transported to be laundered, and 14.1% mentioned burning all patients' clothes, curtains, and bed coverings. Other findings reveal that practice-related adherence of primary care physicians about MERS-CoV was poor among 43.5%, good among 50.6%, and excellent among 5.9%.

**Table 2: Participants' correct responses regarding knowledge statements about MERS-CoV**

Statement	No.	Percentage
The highest incidence for cases of MERS-CoV is in Africa	63	74.1
MERS-CoV does not infect animals	64	75.3
In Saudi Arabia, most cases of MERS-CoV infection were diagnosed during the Hajj season	51	60.0
Many of the outbreaks of MERS-CoV have been linked to overcrowding	53	62.4
A case of MERS-CoV infection can be suspected when having unexplained febrile illness with recent exposure to camels or camel products	82	96.5
Camels are the most likely reservoir for MERS-CoV infection	82	96.5
Suspected cases of MERS-CoV should have nasopharyngeal swabs or sputum	85	100.0
Protected exposure is the contact within 15 m with a patient even without wearing any personal protective equipment	28	32.9
Vaccination is the most important available strategy to prevent MERS-CoV infection	62	72.9
Broad spectrum antibiotics can be administered to protect against MERS-CoV infection	72	84.7
Hand hygiene is an important standard precaution for general infection prevention and control	79	92.9
Personal protective equipment should be worn by health care workers upon entry into patient rooms or care areas	76	89.4
Common symptoms of MERS-CoV infection include fever, cough, and dyspnea	83	97.6
Presence of gastrointestinal symptoms excludes MERS-CoV infection	70	82.4
It is not generally recommended to examine asymptomatic contacts	76	89.4
Leukopenia and thrombocytopenia are common laboratory findings among cases of MERS-CoV infection	76	89.4
MERS-CoV has been commonly reported among children	66	77.6
It is not useful to collect specimens other than nasopharyngeal swabs from MERS-CoV patients	55	64.7
MERS-CoV patients should be placed in single patient rooms	79	92.9
Case fatality among patients with MERS-CoV infection is less than 10%	54	63.5

Table 4 shows that primary care physicians' knowledge about MERS-CoV differed significantly according to their nationality ( $P = 0.038$ ), with non-Saudi physicians expressing higher percent of excellent knowledge than Saudi physicians (40% and 20%, respectively). Their knowledge also differed significantly according to their position ( $P = 0.047$ ), with general practitioners having the highest percent of excellent knowledge (37.7%). Those who attended CME activities had significantly higher percent of excellent knowledge than those who did not attend a CME activity (55.6% and 23.9%, respectively,  $P = 0.011$ ). Participants who had lectures as a source of knowledge about MERS-CoV had the highest percent of excellent knowledge (50%,  $P = 0.017$ ). However, primary care

**Table 3: Participants' correct responses regarding practice actions about MERS-CoV**

Actions	No.	Percentage
Reading guidelines about MERS-CoV infection assessment and management	29	34.1
Have you ever seen a case of MERS-CoV infection?	25	29.4
Have you ever diagnosed a case of MERS-CoV infection?	9	10.6
Have you ever treated a case of MERS-CoV infection?	16	18.8
Have you ever referred a case of MERS-CoV infection?	22	25.9
Personal protective equipment to be used when seeing suspected cases of MERS-CoV infection		
Gown	51	60.0
Mask	80	94.1
Gloves	67	78.8
Goggles	27	31.8
Cap	19	22.4
Most important standard precaution that should be applied when seeing a case of MERS-CoV infection		
Taking antibiotics	0	0.0
Hand washing	85	100.0
Most important respiratory precaution to prevent transmission of respiratory infections in PHC setting when seeing a case of MERS-CoV infection		
Masking and separation of suspected MERS-CoV patients	83	97.6
Using gloves	2	2.4
What to do upon exit from the room of a MERS-CoV patient?		
Remove and discard personal protective equipment	69	81.2
Make sure to keep personal protective equipment	16	18.8
What should be done after discharge of a MERS-CoV patient?		
Cleaning and disinfecting all surfaces that were in contact with the patient or may have become contaminated during patient care	85	100.0
Privacy curtains should be removed, placed in a bag in the room, and then transported to be laundered	45	52.9
Burning all patients' clothes, curtains, and bed coverings	12	14.1

Significance ( $P < 0.05$ )

physicians' knowledge did not differ significantly according to their age, gender, qualification, experience in primary care, and practice-related adherence to guidelines.

Table 5 shows that primary care physicians' practice-related adherence to guidelines about MERS-CoV differed significantly according to their position ( $P = 0.035$ ), with specialists having the highest percent of excellent practice (13%). Those who attended CME activities had significantly higher percent of excellent practice than those who did not attend a CME activity (11.1% and 1.5%, respectively,  $P = 0.002$ ). Participants who had textbooks as a source of knowledge about MERS-CoV had the highest percent of excellent practice (40%,  $P < 0.001$ ). However, primary care physicians' knowledge did not differ significantly according to their age, gender, qualification, experience in primary care, and practice-related adherence to guidelines. However, primary care

**Table 4: Participants knowledge grades about MERS-CoV according to their personal characteristics**

Personal characteristics	Poor		Good		Excellent		P
	No.	Percentage	No.	Percentage	No.	Percentage	
Age groups							
<30 years	3	9.4	24	75.0	5	15.6	
30-40 years	2	4.8	23	54.8	17	40.5	
>40 years	0	0.0	7	63.6	4	36.4	0.173
Gender							
Male	2	3.8	36	69.2	14	26.9	
Female	3	9.1	18	54.5	12	36.4	0.330
Nationality							
Saudi	1	2.5	31	77.5	8	20.0	
Non-Saudi	4	8.9	23	51.1	18	40.0	0.038
Qualification							
MBBS	2	5.6	21	58.3	13	36.1	
Diploma	1	6.7	9	60.0	5	33.3	
Master	1	6.3	11	68.8	4	25.0	
Doctorate/Fellowship	1	5.6	13	72.2	4	22.2	0.962
Position							
General practitioner	3	5.7	30	56.6	20	37.7	
Specialist	0	0.0	19	82.6	4	17.4	
Consultant	2	22.2	5	55.6	2	22.2	0.047
Experience in primary care							
<5 years	3	7.1	30	71.4	9	21.4	
5+ years	2	4.7	24	55.8	17	39.5	0.190
Attending CME							
Yes	2	11.1	6	33.3	10	55.6	
No	3	4.5	48	71.6	16	23.9	0.011
Sources of knowledge							
Textbooks	1	20.0	4	80.0	0	0.0	
Internet websites	2	4.3	32	68.1	13	27.7	
Lectures	1	3.8	12	46.2	13	50.0	
Journals	4	19.0	15	71.4	2	9.5	0.017

Significance ( $P < 0.05$ )

physicians' knowledge did not differ significantly according to their age, gender, nationality, qualification, and experience in primary care.

## Discussion

Health care facilities are expected to play a major role during a pandemic when health care workers are at a high risk of exposure and infection.<sup>[12]</sup>

To the best of the researcher's knowledge, this study is the first to be conducted in Abha city to assess PHC physicians' knowledge and adherence regarding Saudi MOH guidelines about MERS-CoV.

In general, primary care physicians in Abha city expressed suboptimal grades of knowledge and practice-related adherence regarding Saudi MOH guidelines. Less than one-third of primary care physicians had excellent knowledge, whereas only 3.5% had excellent practice-related adherence to guidelines. Moreover, the main identified knowledge gaps among primary care physicians regarding MERS-CoV were related to protected

exposure, seasonal incidence of MERS-CoV in Saudi Arabia, relation between incidence of MERS-CoV and overcrowding, case fatality of MERS-CoV cases, and collecting specimens from MERS-CoV patients.

In Al-Qassim region, Saudi Arabia, Khan *et al.* (2014) reported good knowledge level among healthcare workers regarding MERS-CoV infection.

The present study revealed that the main sources of knowledge about MERS-CoV for primary care physicians in Abha city were the internet websites and lectures, followed by medical journals and lastly textbooks.

This finding is in accordance with that of Nour *et al.*<sup>[13]</sup> who reported that the internet was the main source of knowledge about MERS-CoV among the majority of health care providers in Makkah hospitals. However, the scientific study (Erdem E. *et al.*, 2011)<sup>[14]</sup> supporting that, the television had been reported to be the main source of knowledge about such kind of virus and plays a significant role in gaining knowledge by healthcare workers.

**Table 5: Participants practice grades about MERS-CoV according to their personal characteristics**

Personal characteristics	Poor		Good		Excellent		P
	No.	Percentage	No.	Percentage	No.	Percentage	
Age groups							
<30 years	15	46.9	15	46.9	2	6.3	
30-40 years	16	38.1	23	54.8	3	7.1	
>40 years	6	54.5	5	45.5	0	0.0	0.785
Gender							
Male	19	36.5	30	57.7	3	5.8	
Female	18	54.5	13	39.4	2	6.1	0.241
Nationality							
Saudi	17	42.5	18	45.0	5	12.5	
Non-Saudi	20	44.4	25	55.6	0	0.0	0.047
Qualification							
MBBS	11	30.6	25	69.4	0	0.0	
Diploma	7	46.7	7	46.7	1	6.7	
Master	7	43.8	7	43.8	2	12.5	
Doctorate/Fellowship	12	66.7	4	22.2	2	11.1	0.037
Position							
General practitioner	20	37.7	32	60.4	1	1.9	
Specialist	10	43.5	10	43.5	3	13.0	
Consultant	7	77.8	1	11.1	1	11.1	0.030
Experience in primary care							
<5 years	22	52.4	18	42.9	2	4.8	
5+ years	15	34.9	25	58.1	3	7.0	0.265
Attending CME							
Yes	3	16.7	13	72.2	2	11.1	
No	34	50.7	30	44.8	3	4.5	0.031
Sources of knowledge							
Textbooks	1	20.0	2	40.0	2	40.0	
Internet websites	20	42.6	27	57.4	0	0.0	
Academic lectures	5	19.2	18	69.2	3	11.5	
Journals	11	52.4	8	38.1	2	9.5	0.006
Grades of practice							
Poor	4	80.0	1	20.0	0	0.0	
Good	26	48.1	23	42.6	5	9.3	
Excellent	7	26.9	19	73.1	0	0.0	0.033

Significance ( $P<0.05$ )

These variations in reported sources of physicians' knowledge can be explained by the recent advancement in internet technologies, and most of the educational materials and health messages on MERS-CoV, nowadays, are posted online by the Saudi MOH, which may have encouraged primary care physicians to use the widely available internet technology to gain access to this subject.

This assumption is further supported by other previously conducted research that observed how this way of communicating information has an important impact on healthcare workers' knowledge (Arda *et al.*, 2011; Chor *et al.*, 2011).<sup>[15,16]</sup>

Therefore, it is recommended that primary care physicians should be encouraged to visit official websites to obtain up-to-date information on important health-related issues, and the MOH website should also be kept updated regularly.

Findings of the present study show that only 34.1% of participants read guidelines about MERS-CoV infection assessment and

management. Personal protective equipment to be used when seeing suspected cases of MERS-CoV infection were mainly the mask and gloves. All participants stated that the most important standard precaution that should be applied when seeing a case of MERS-CoV infection is hand washing, whereas the majority stated that the most important respiratory precaution to prevent transmission of respiratory infections in PHC setting when seeing a case of MERS-CoV infection is masking and separation of suspected MERS-CoV patients, and most of them stated that upon exit from the room of a MERS-CoV patient, the physician should remove and discard personal protective equipment.

These findings can be considered encouraging and of particular concern as adherence to such procedures can successfully lead to decreased morbidity and mortality related to MERS-CoV infection.

Similarly, Nour *et al.*<sup>[13]</sup> reported that health care providers use personal protective equipment and keep healthy lifestyle to

prevent MERS-CoV infection. However, Thu *et al.*<sup>[17]</sup> reported limited numbers of correct responses regarding items about hand washing and the use of personal protective equipment.

Results of the present study showed that some personal characteristics were significantly associated with primary care physicians' knowledge and practice, (e.g., nationality and attending CME), with higher percentages of excellent grades among non-Saudi and those who attended CME activities. However, knowledge and practice of primary care physicians did not differ significantly according to some other personal characteristics, (e.g., age and gender).

Similar results were reported by Joukar *et al.*<sup>[18]</sup> Nevertheless, there is a pressing necessity to improve knowledge of all primary care physicians toward MERS-CoV. Moreover, the lack of significant associations with age and gender were supported by some reports (Apisarnthanarak *et al.*, 2008).<sup>[19]</sup> Similarly, Nour *et al.* (2015)<sup>[3]</sup> reported that gender did not differ significantly with knowledge scores of health care providers.

## Conclusions

From the findings of the present study, it can be concluded that there are knowledge gaps among primary care physicians in Abha city, and their practice is suboptimal regarding MERS-CoV infection. Less than one-fourth of primary care physicians attend CME activities about MERS-CoV infection, and about one-third of them read about its management guidelines. Significantly, less knowledge regarding MERS-CoV infection is associated with Saudi primary care physicians, and those who did not attend a related CME activity and those who depend on textbooks or medical journals to obtain their knowledge. However, significantly less practice-related adherence to guidelines are associated with Saudi primary care physicians, those who did not attend a related CME activity, and MBBS qualified general physicians.

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## Conflicts of interest

There are no conflicts of interest.

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