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Awareness of middle east respiratory syndrome coronavirus (Mers-Cov) among patients attending a primary care center in Riyadh, Saudi Arabia

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Abstract
Background: Although Middle East respiratory syndrome coronavirus (MERS-CoV) has been continuously seen in Saudi Arabia for more than 5 years, little is known about the awareness and behaviors of Saudi patients and public towards MERS-CoV. Additionally, the few studies that examined the MERS-CoV awareness among public and patients suffered from methodological limitations, with none targeted patients attending primary health care services. Additionally, the influencing factors of awareness and practices have never been comprehensively examined. This study aimed to assess the levels of knowledge, attitude, and practices related to MERS-CoV. and their influencing factors among a sample of patients at a primary care settings.
Methods: A cross-sectional design was used to examine patients attending Al-Wazarat health care center in Riyadh between May and June 2018. Data were collected using a structured study questionnaire, which includes data on socio-demographic and clinical characteristics of the participants as well as knowledge, attitude, and practices related to MERS- CoV. Scores were calculated for knowledge, attitude, and practices of MERS-CoV and were transformed to 100-point scale for easy interpretation.
Results: The current analysis included 181 participants. The average age was 35.3±11.0 years and 51.1% was males. The majority (59.2%) of participants were married and 43.9% of the participants had college or higher education. The overall awareness level was 64.7% (including 57.2% for knowledge and 76.5% for attitude) and the level of appropriate preventive practices was 85.6%. The scores of both awareness and practices were positively and significantly correlated (correlation coefficient=0.232, p=0.002). In addition to awareness, appropriate preventive practices were independently associated with non-employment status and small number of visits to primary care during last year. The current finding pointed to some important misconceptions related to MERS-CoV such as incubation period, animal reservoir, the use of vaccine for prevention, and the use of antibiotics for treatment. Internet and social media were the main sources used to get information about MERS-CoV (66.9%), followed by doctors, TV, friends & neighbors, newspapers, and others.
Conclusions: We are reporting fair awareness and good practices regarding MERS-CoV among a sample of patients at a primary care setting. The current finding indicated the need for improving awareness and understanding of these patients. Additionally, it calls for using internet and social media as an important platform in any future educational program. There is a need for a future intervention study that examines the impact of educational program that consider the above misconceptions on the awareness and practices levels of patients attending primary care services.

Keywords: corona virus, MERS CoV, awareness

Introduction
Middle East respiratory syndrome (MERS) is a viral illness caused by a novel human coronavirus called MERS coronavirus (MERS-CoV). The first case was reported in 2012 from Saudi male presenting with atypical pneumonia [1]. Since the first diagnosis of MERS-CoV in 2012 a total 1,782 laboratory-confirmed cases have been reported in Saudi Arabia as of January. 2018, including at least 726 related deaths equating to a case fatality of 40.7% [2]. According to the Saudi Ministry of Health (MOH), the reported cases were classified as primary community cases (49%), household cases (11%), and healthcare-acquired infections either among patients or healthcare workers (40%) [2].

MERS-CoV can be transmitted from infected patients and camels, mainly through respiratory and oral secretions [3]. Spread can happen at family level, community level, and healthcare level [3]. While MERS-CoV generally causes asymptomatic or mild disease, infection can cause serious disease with life-threatening outcomes with a high case fatality rate, including acute respiratory distress syndrome and multi-organ failure [4]. Although MERS-CoV has been continuously seen in Saudi Arabia for more than 5 years, little is known about the awareness and behaviors of Saud public and patients towards MERS-CoV [5]. Patient awareness is critical as 40% of MERS-CoV cases are acquired at healthcare facilities. Additionally, adequate infection control measures which require strict patient compliance are considered the most important preventive measure for hospital transmission and outbreaks [3]. The lack of vaccine to protect against the disease and the major knowledge gaps about the epidemiology and spread, forced the health authorities to focus on surveillance, education, and prevention [6, 7].

The first MERS-CoV case was identified in a Saudi male presenting with fatal atypical pneumonia in September 2012 [1]. Retrospectively, another earlier case was identified in Jordan in April 2012 [8]. Although MERS-CoV is considered an emerging human disease, serological evidence of MERS-CoV infection in camels has been confirmed in samples collected from Eastern Africa more than 30 years ago [9]. This may explain the endemic nature of MERS-CoV in camels in Saudi Arabia that are usually imported from Eastern Africa [4]. Accumulating epidemiological, genetic, and phenotypic evidence now confirms the link between dromedary camels infection and human MERS-CoV infection [10]. Although a similar corona virus has been isolated from bats, epidemiological link between bat infection and human MERS-CoV infection has not been confirmed [11].

Over the last 5 years, MERS-CoV spread from Saudi Arabia to several countries around the world. According to the World Health Organization (WHO) reports, a total 2040 laboratory- confirmed MERS-CoV cases have been reported from 27 countries in the Middle East, North Africa, Europe, the United States of America, and Asia [12]. However, the reported cases from Saudi Arabia represented 82% of the total number of reported MERS-CoV cases worldwide [12]. The major outbreak that happened in Korea in 2015 is the first large outbreak to happen outside Saudi Arabia [13]. As the Korean outbreak was initiated by human-to-human 'superspreading' of MERS-CoV, it has raised a major global health concern [14].

The current epidemiology of MERS-CoV in Saudi Arabia is characterized by a slow and continual transmission with occasional outbreaks and clusters [7]. MERS-CoV has been showing a high tendency to cause healthcare associated outbreaks [15, 16]. The virus has already caused several hospital outbreaks in Saudi Arabia between 2013 and 2015 [15, 16]. The virus also caused household and community clusters [17, 18] and sometimes a mixture of healthcare and community clusters [19]. According to the Saudi MOH data, the largest outbreak happened in first half of 2014 and in the second half of 2015 [2]. It affected mainly hospitals in Riyadh and Jeddah [15, 16]. These outbreaks and clusters have increased the risk of mortality and morbidity among patients and healthcare workers in Saudi Arabia [16, 19].

According to setting, there are three patterns of transmission of MERS-CoV infections; sporadic and outbreak healthcare-acquired infections due to exposures between patients and healthcare workers, family clusters due to contact with the household infected index case, and sporadic community cases probably due to camel exposure [3]. The following factors are believed to facilitate the healthcare-acquired transmission; (1) delayed diagnosis of MERS-CoV due to non-specificity of MERS symptoms, (2) inadequate infection control measures including inadequate triaging and isolation of suspected cases, (3) overcrowding and long stay specially in the emergency department [3]. Human-to-human transmission may occur through droplets or contact exposure [20]. Additionally, the virus can spread either via air, fomites, and contaminated surfaces [20]. However, the role of environmental contamination in transmission specially in healthcare setting is still unclear [12]. The mode of zoonotic transmission of MERS-CoV is still unclear but is believed to be through direct contact with saliva or respiratory sections of infected camels [14].

MERS-CoV generally causes asymptomatic or mild disease with non-specific symptoms [4]. The diagnosis of MERS-CoV can easily be overlooked if the healthcare provider does not consider it in differential diagnosis and consequently does not request specific testing for MERS-CoV [21]. Symptomatic MERS-CoV is frequently associated with lower respiratory symptoms such as fever, cough, breathing difficulties, and sometimes pneumonia [22]. Severe disease can progress to acute respiratory distress syndrome and renal and other organ failure with high mortality rate [22]. Severe disease is typically more frequent in older males with multiple comorbidities such as diabetes, renal failure, chronic lung disease, and immunocompromised conditions [12, 22]. In a large outbreak in Riyadh, 16% of the cases were asymptomatic which was more common in healthcare workers than patients [16]. On the other hand, respiratory symptoms including shortness of breath and/or cough were the most common symptoms and were reported in 95% of symptomatic cases [16]. These were followed by fever, constitutional symptoms, and gastrointestinal symptoms [16]. Severe disease was associated with need of intensive care and/or ventilation [16].

The Saudi MOH divides MERS-CoV cases into suspected and confirmed cases [23]. Suspected cases are defined as patients with severe pneumonia or unexplained deterioration of the clinical condition of patients with congestive heart failure or those on hemodialysis, with or without documented exposure to camels or confirmed infection within two weeks of presentation. Additionally, cases should be suspected in any patient with documented exposure to camels or confirmed infection presented with an acute febrile illness with/without respiratory symptoms or presented with gastrointestinal symptoms with leukopenia or thrombocytopenia. A confirmed case is defined as a suspected case with laboratory confirmation of MERS-CoV infection [23].

Prevention of MERS-CoV is dependent in breaking the chain of infection through prevention of transmission. According to the US Centers for Disease Control and Prevention (CDC), this can be done through (1) frequent washing of hands with soap and water or with an alcohol-based hand sanitizer, (2) following cough etiquettes including covering nose and mouth with a tissue during coughing or sneezing, (3) avoiding touching eyes, nose and

mouth with unwashed hands, (4) avoiding personal contacts with sick people including kissing or sharing utensils, (5) cleaning and disinfecting surfaces and objects [24].

The Saudi MOH listed the following infection prevention and control measures to prevent MERS-CoV at healthcare setting; (1) triage for patients with acute respiratory illness (2) following standard, contact, and droplet precautions with suspected or confirmed cases (droplet is replaced with airborne precautions in case of aerosol-generating procedures), (3) avoiding patient transport if possible, (4) Asking healthcare workers to wear personal protective equipment (PPE) such as gloves, gowns, surgical mask, and goggles, (5) environmental cleaning and disinfection, and surveillance and reporting of new cases to the MOR [23].

There is no specific treatment for MERS-CoV infection and management of hospitalized patients remains mainly supportive [6]. Treatments such as rest, fluid and analgesics aim to relieve symptoms and manage complications [6]. Some medications such as broad-spectrum antimicrobial agents, antivirals, and antifungal agents are used to minimize the risk of co- infection with opportunistic microorganisms [6]. Rousehold contacts of a confirmed case who develop symptoms suggestive of MERS-CoV should be assessed clinically and managed at homes if stable enough or referred to a healthcare facility if admission deemed necessary [23].

Given the healthcare associated risk of MERS-CoV, a number of studies in Saudi Arabia sought to examine the knowledge, attitude, and practices regrading MERS-CoV among healthcare workers [25-29] or healthcare students [30, 31]. The finding of these studies showed a generally fair to good knowledge and positive attitude of healthcare workers who were anxious about their safety [26-28, 31]. For example, healthcare workers working in two hospitals of Qassim had a knowledge score of 73% (average 9.45 points out of 13 knowledge questions) [27]. Similarly, physicians and nurses at a primary care setting in Riyadh had a knowledge score of 67% (average 14 points out of 21 knowledge questions) [26]. Additionally, dentist and other dental health professionals registered with Saudi Dental Society had a knowledge score of 72% (average 12.26 points out of 17 knowledge questions) and attitude score of 86% (average 8.63 points out of 10 attitude questions) [28]. On the other hand, some of these studies showed poor knowledge of healthcare workers [25, 29] and students [30], specially the virus seasonality, immunity, and the proper diagnostic confirmatory test [29]. Additionally, more than 50% of physicians and 70% of nurses and other RCWs were not aware that MERS-CoV could be asymptomatic disease [25].

As Saudi Arabia had a unique annual hajj season where the largest mass gathering on earth is repeated every year, there have been fears of major outbreaks of MERS-CoV to happen during Rajj season. This fear encouraged the researchers to examine the awareness of MERS-CoV among pilgrims from Australia, France and Turkey [32-34]. Additionally, recent studies done during hajj season including Saudi and Non-Saudi Arabian pilgrims [35, 36]. The findings have found generally poor awareness about the disease and its prevention [32-34]. For example, 55% of Turkish pilgrims had never heard of MERS-CoV and approximately half of them had insufficient information about the protective measures [32]. Similarly, approximately two-thirds of the Australian pilgrims were not aware of the 2014 MERS-CoV epidemic in Saudi Arabia and many of them had misperception about the mode of disease transmission [33]. Interestingly, Saudi pilgrims were more aware of MERS-CoV causative agent, symptomatology, mode of transmission, and screening than non-Saudi Arabian pilgrims [36].

On the other hand, few studies sought to examine the knowledge, attitude, and practices regrading MERS-CoV among the patients [37] or the community [5, 38]. The majority of these studies raised high concern about the awareness of the disease and its precautionary measures [5, 37, 38]. For example, while more than 85% of dental patients in Riyadh heard of MERS-CoV almost half of them were not aware that camel could be a possible source of infection [37]. Similarly, while more than 90% of the public attending shopping malls in Riyadh were aware that the viral nature of the disease almost half of them mistakenly believed that MERS-CoV is an immunodeficiency disease [38]. Additionally, 25% of them wrongly believed that there was a vaccine to protect against MERS-CoV [38].

Unlike awareness, few studies really focused on practices related to MERS-CoV among Saudi public or patients with variable findings [37, 38]. For example, while almost half of the public attending shopping malls in Riyadh were not aware of the disease incubation period or the period of communicability, the majority of them (75%-94%) were utilizing precautionary measures to protect against MERS-CoV such as frequent hand washing, using face masks in crowded areas, following cough etiquettes, and avoiding touching eyes, nose and mouth with unwashed hands [38]. On the contrary, while 80% of dental patients in Riyadh were aware that dental professionals should wear mouth masks and protective eye glasses during treatment, only one-third of these patients were already taking some kind of precautionary measures to protect against MERS-CoV [37].

Few studies examined the factors associated with awareness and practices of MERS-CoV in Saudi Arabia. Using a multivariate logistic regression analysis, younger age, male gender, and lower education level were independent predictors of poor MERS-CoV knowledge among the public attending shopping malls in Riyadh [5]. Additionally, another study among the public attending shopping malls in Riyadh found that gender was the only significant independent predictor of higher level of concern about MERS-CoV [38]. Furthermore, high educational level and employment status were significantly associated with better knowledge of MERS-CoV while age and gender were significantly associated with positive attitude and good practices among a convenience sample of pilgrims during Rajj season [35]. As expected, better knowledge about MERS-CoV was significantly associated with both the level of concern and precaution in a number of studies [35, 38].

Sources of information regarding MERS-CoV are utilized differently among different populations. Internet was the major source of disease information among the public attending shopping malls in Riyadh, followed by healthcare providers, mobile SMS, television [5, 39]. On the other hand, internet-based search engine such as Google or Bing (6%) was the least used source of information about MERS-CoV among a nationally representative sample of American adults and it was preceded by news network, TV, and family and friends [40].

The lack of vaccine or specific therapeutic treatment for MERS-CoV highlights the importance of education and prevention [6, 7]. Although MERS-CoV has been

continuously seen in Saudi Arabia for more than 5 years, little is known about the awareness and behaviors of Saudi patients and public towards MERS-CoV [5]. Additionally, the few studies that sought to examine the MERS-CoV awareness among public and patients suffered from methodological limitations [5, 37, 38]. For example, choosing undefined population such as public attending shopping malls [5, 38] or lack of important information such as protective measures used by patients in healthcare facilities [37]. Furthermore, the sociodemographic characteristics associated with limited awareness and inappropriate preventive practices has never been comprehensively examined. Moreover, none of these studies examined patients attending primary health care centers. Assessing such awareness may help in any future educational campaigns aiming for improving compliance with preventive measures.

Aim and objectives

To assess the levels of knowledge, attitude, and practices of MERS-CoV and their influencing factors and evaluate the Knowledge, attitudes and practices concerning MERS-CoV disease and its prevention among the patients attending Wazarat Healthcare center (WHC) at PSMMC in Riyadh, Saudi Arabia. Also to examine the association between awareness regarding MERS-CoV disease and the appropriate preventive practices and to determine the patient's characteristics that are associated with better knowledge, attitudes and practices.

Methods

The study was conducted in Al-Wazarat Healthcare Center (WHC), a big family medicine center located in Riyadh City, the capital of Saudi Arabia. WHC consists of thirty two general clinics, specialized primary care clinics, pharmacy, laboratory, treatment room (where specimens are collected, minor procedures are done and urgent care is delivered) and radiology room (where x- ray is done). The center provides family and community services to approximately 400 patients every day, which may involve treatment for acute or chronic disorders, antenatal care, child welfare, and vaccination programs. A cross-sectional design was used to examine levels of knowledge, attitude, and practices of MERS-CoV and their influencing factors among patients attending WHC in Riyadh, Saudi Arabia. The study was conducted during the period between May and June 2018. The study targeted patients attending WHC in Riyadh, Saudi Arabia.

1nclusions

- Male and female patients attending WHC who came for their regular appointments in any of the WHC clinics
- Saudi nationality
- Age above 18

Exclusions

- Working in health-related occupation such as doctors, nurses, and technicians
- Children (below 18)
- Failure to provide informed consent

Sample size estimation

The level of awareness of MERS-CoV disease (such as symptoms, transmission, and mortality) measured among non-healthcare workers in Saudi Arabia was estimated at 50%-90% among public at shopping malls [38] and 80% among patients at dental clinic [37]. Assuming an average awareness of MERS-CoV disease of 70% with two-sided confidence limits of 7%, 165 primary care patients were needed to be interviewed, using 80% power level and 95% two-sided significance level. The equation used was

V. $N = \frac{Z^2_{\alpha/2} * P * (1-p) * D}{E^2}$ Zα/2: is normal deviate at a level of significance=1.96

P: is the hypothesized % frequency of adherence, which was set at 70% E: is the desired precision (half desired CI width), which was set at 7% D the design effect, which is usually set to 1 in cross-sectional studies

Sampling technique

Participants were recruited using convenience sampling technique while waiting for their regular appointments in WHC. Those who agreed to join the study and provided informed consent were included.

Data collection were done using a structured study questionnaire, which included questions on socio-demographic and clinical characteristics of the participants, as well as knowledge, attitude, and practices of MERS-CoV disease and its prevention. The questionnaire was developed based on previous similar studies done in Saudi Arabia [38]. The questionnaire was developed in English (language of previous studies and final report) but a translated Arabic copy was given to the study participants. Filling the questionnaire was self-administered. Assistance was allowed (by companion or researcher) for the participants who cannot read (such as illiterate or visual problem). The total duration required to answer the questions of the study questionnaire was on average 15 to 20 minutes. The following variables were collected:

- Socio-demographics: age, gender, marital status, having children, educational level, occupation, and living with a household working in a hospital or healthcare facility
- Clinical history: number of visits to primary care and previous diagnosis of MERS-CoV in the patient or one of his/her households
- Knowledge of MERS-CoV including source, spread, clinical presentations, prevention, treatment options and places, and mortality
- Attitude and beliefs of MERS-CoV such as seeking medical advice, preventive measures, and outbreak measures
- Practices and behaviors (of the participants or his family) regarding preventive measures at healthcare facilities and during outbreak situation
- Rating of self-knowledge about MERS-CoV and source of knowledge.
- IRB approval letter number 1088 dated May 23, 2018.
- Participants had the right to withdraw at any time without any obligation towards the study team and to contact the researcher for any inquiries
- The sensitive information of the study participants as name and contacts were not collected.
- The data collected were confidentially kept in a safe place and data were only used for the purposes described in the study objectives

Results

A total 181 participants completed the study questionnaire and were included in the final analysis. Table 1 shows the socio-demographic and medical characteristics of the study participants. The age of the participants ranged between 16 and 63 years with an average age of 35.3±11.0 years. Approximately 35.8% of the participants were below 30 years and 34.1% were above 40 years. The gender was equally represented with males 51.1% and female 48.9%. The majority (59.2%) of participants were married with 30.2% singles and 10.6% divorced/separated/ widow. Approximately 43.9% of the participants had college or higher education while 31.7% had high school education and 24.4% had lower than high school education, including 1.7% illiterates. Approximately half (51.5%) of the participants were working, including administrative (27.9%), professional (18.8%), and manual workers (4.8%). Non-working participants included unemployed participants (24.8%), students (17.0%) and retired employees (6.7%). Approximately 42.8% of the participants had a household working in healthcare occupations. On average, participants had 5 visits to primary care centers during the last year (interquartile range between 3 and 10). None of the participants had previous diagnosis of MERS-CoV while only one participant had previous diagnosis of MERS-CoV in her household.

Table 2 shows the participants' responses to 10 knowledge questions concerning MERS- CoV source, spread, clinical presentations, prevention, treatment options and places, and mortality. The majority (85.1%) of participants realized that MERS-CoV is infectious disease.

Approximately half of participants correctly identified the source of MERS-CoV as human (50.8%) and camels (52.5%). Approximately 66.9% of participants thought MERS-CoV is transmitted from an ill person to another through close contact while only 29.3% knew that MERS-CoV is transmitted through contact with an infected animal. Approximately 33.1% of participants correctly identified the average duration between exposure and appearance of MERS- CoV illness as one week. The possible presentations of MERS-CoV were correctly identified as fever (76.2%), shortness of breath (57.5%), and cough (38.1%). Approximately 60.8% of participants thought that people with prior health condition, such as heart disease or diabetes are at higher risk of getting MERS-CoV. Only 45.3% of participants correctly identified antivirals as a likely treatment for patients with MERS-CoV. On the other hand, vaccine (40.3%) and antibiotics (17.7%) were wrongly identified as possible treatment options. Preventive measures were correctly identified as wearing masks (50.8%), patient isolation (36.5%), hand hygiene (32.6%), and avoiding crowded places (32.0%). On the other hand, 57.5% of participants wrongly identified vaccine as a possible preventive option. Treatment places were identified as hospital only (55.8%) or hospital and home (39.8%). Approximately 52.5% of participants thought that MERS-CoV is fatal in some cases while 25.4% of participants thought that MERS-CoV is fatal in almost all cases.

Table 3 shows the participants' responses to attitude statements concerning MERS-CoV. The majority (88.1%) of participants would seek medical advice to check for MERS-CoV if they or any of their household members have a fever, cough and shortness of breath. The majority of participants would do the following preventive measures to protect themselves and their families from getting MERS-CoV when they visit a primary care center or a hospital; washing hands with soap and water (100.0%), using hand disinfectants (98.1%), avoiding touching eyes, nose and mouth with unwashed hands (95.4%), avoiding direct contact such as kissing or shaking hands with sick individuals (94.9%), and wearing mask (92.7%). On the other hand, 88.7% of participants would take vaccine to protect themselves and their families from getting MERS-CoV. At least half of participants would avoid/delay the following activities to protect themselves and their families in case of MERS-CoV outbreak; shopping in crowded malls (61.3%), making hajj and omrah (53.8%), and visiting hospitals (49.4%).

Table 4 shows the participants' responses to practices they did to protect themselves and their families from catching MERS-CoV. The majority of participants already did the following preventive measures when they visit a primary care center or a hospital; washing hands with soap and water (99.4%), avoiding touching eyes, nose and mouth with unwashed hands (97.6%), using hand disinfectants (97.0%), avoiding direct contact such as kissing or shaking hands with sick individuals (96.4%), and wearing mask (89.0%). The majority of participants already avoided/delayed the following activities at the time of MERS-CoV outbreak; making hajj and omrah (80.4%), shopping in crowded malls (74.5%), sending children to schools (63.3%), and visiting hospitals (59.4%).

Figure 1 shows the scores for knowledge, attitude and practice towards MERS-CoV among the study patients. The average scores were 57.2% for knowledge, 76.5% for attitude, and 85.6% practice. These constituted overall awareness score of 64.7% which was calculated from both knowledge and attitude scores and overall knowledge, attitude and practice score of 70.3%. The participants were divided into 2 groups based on whether the awareness score was above or below the median, which was 65%. Similarly, the participants were divided into 2 groups based on whether the practice score was above or below the median, which was 88.9%. Awareness score was positively and significantly correlated with practice score (correlation coefficient=0.232, p=0.002).

Table 5 shows the socio-demographic and medical characteristics of the study participants by the awareness groups. Righ (better) awareness score (> median of 65.0%) was significantly associated with having higher practice score (60.0% in higher practice group versus 41.8% in lower practice group, p=0.016) and marginally associated with working status (56.5% among working participants versus 41.3% among non-working participants, p=0.051). On the other hand, there were no significant associations between awareness and other characteristics including age, gender, marital status, educational level, occupation, having a household working in healthcare occupations, having household diagnosed with MERS-CoV, and last year visits to primary care ($p>0.05$ in all).

Table 6 shows the socio-demographic and medical characteristics of the study participants by the practice groups. Righ (better) practice score (> median of 88.9%) was associated with younger age (60.0% in age <30 years versus 42.1% in age >40 years, p=0.038), non-working status (56.4% among non-working participants versus 38.8% among working participants, p=0.025), number of visits to primary care during last year (55.6% among

participants with <5 visits versus 35.5% among participants with ◆ 5 visits, p=O.O14), and awareness groups (57.3% among higher awareness group versus 39.1% among lower awareness group, p=0.016). On the other hand, there were no significant associations between practice score groups and other characteristics including gender, marital status, educational level, occupation, having a household working in healthcare occupations, and having household diagnosed with MERS-CoV (p>0.05 in all).

Table 7 shows the multivariate logistic regression analysis for awareness. After adjusting the model for variables that were significantly associated (even marginally) with higher awareness score in Table 5 (including higher practice score and working status), awareness was independently associated with both higher practice score (odds ratio=2.74, 95% confidence 1.41- 5.33, p=0.003) and working status (odds ratio=2.33, 95% confidence 1.20-4.53, p=0.013).

Table 8 shows the multivariate logistic regression analysis for the predictors of better preventive practices. After adjusting the model for all variables that were significantly associated with higher practice score in Table 6 (including age, working status, number of visits to primary care during last year, in addition to awareness score), better preventive practices were independently associated with high awareness score (odds ratio=3.27, 95% confidence 1.52-7.01, p=0.002), non-working status (odds ratio=2.86, 95% confidence 1.34-6.11, p=0.007), and lower number of visits to primary care during last year (odds ratio=2.72, 95% confidence 1.30-5.71, p=0.008).

Table 9 shows sources of information about MERS-CoV. Internet and social media were the main sources used to get information about MERS-CoV (66.9%), followed by doctors (33.7%), TV (30.4%), friends & neighbors (19.9%), newspapers (15.5%), and others (5.5%). Approximately 51.4% of participants self-rated their knowledge level about MERS-CoV as good, followed by very good (27.2%), poor (11.6%), and excellent (9.8%). Approximately 60.7% of participants thought that they need more information about MERS-CoV. Similar to sources used to get information, internet and social media were the main sources preferred to get more information about MERS-CoV (69.1%), followed by doctors (51.9%), TV (37.6%), newspapers (19.9%), friends & neighbors (11.6%), and others (8.8%).

Table 1: Socio-demographic and medical characteristics of the study participants

	Number*	Percentage
Age		
Mean±SD	35.3±11.0	
<30	62	35.8%
30-40	52	30.1%
>40	59	34.1%
Gender		
Male	92	51.1%
Female	88	48.9%
Marital status		
Single	54	30.2%
Married	106	59.2%
Divorced/separated	12	6.7%
Widow	7	3.9%
Education		
Less than high school	44	24.4%
High school	57	31.7%
College or above	79	43.9%
Employment and occupational status		
Working	85	51.5%
Professional	31	18.8%
Administrative	46	27.9%
Manual worker	8	4.8%
Not working	80	48.5%
Unemployed	41	24.8%
Retired	11	6.7%
Students	28	17.0%
Household working in healthcare		
No	103	57.2%
Yes	77	42.8%
Number of visits to primary care during last year		
Median (IQR)	5 (3-10)	
<5	74	49.0%
◆5	77	51.0%
Previous diagnosed of corona in yourself		
No	180	100.0%
Yes	0	0.0%
Previous diagnosed of corona in your household		
No	179	99.4%
Yes	1	0.6%

* Unless mentioned otherwise; SD, standard deviation; IQR, intra-quartile range

Table 2: Knowledge of MERS-CoV among the study participants*

	Number	Percentage
What is/are the likely source of the corona virus?		
Human	92	50.8%
Camels	95	52.5%
Contaminated water or food	27	14.9%
Not sure	24	13.3%
Is corona virus infectious?		
No	2	1.1%
Yes	154	85.1%
Not sure	25	13.8%
How does corona virus likely spread?		
From an ill person to another through close contact	121	66.9%
Through contact with an infected animal	53	29.3%
By drinking camel milk or eating camel meat	64	35.4%
Not sure/don't know	32	17.7%
If someone has been exposed to corona virus, how soon would they become ill?		
Immediately	32	17.7%
Within a week	60	33.1%
2 to 3 weeks	26	14.4%
Not sure/don't know	66	36.5%
What is/are the possible presentations of patients with corona virus?		
No symptoms	2	1.1%
Fever	138	76.2%
Cough	69	38.1%
Shortness of breath	104	57.5%
Not sure	23	12.7%
Are people with prior health condition, such as heart disease or diabetes at higher risk of getting corona virus?		
No	20	11.0%
Yes	110	60.8%
Not sure	51	28.2%
What is/are the likely treatment of patients with corona virus?		
Antibiotics	32	17.7%
Antivirals	82	45.3%
Vaccine	73	40.3%
Not sure/don't know	43	23.8%
What is/are the likely measures to protect against corona virus?		
Vaccine	104	57.5%
Hand hygiene	59	32.6%
Avoiding crowded places	58	32.0%
Wearing masks	92	50.8%
Patient isolation	66	36.5%
Where patients with corona virus should be treated?		
Home only	1	0.6%
Hospital only	101	55.8%
Home or hospital	72	39.8%
Not sure	6	3.3%
Can corona virus cause death?		
No	5	2.8%
Yes, in almost all cases	46	25.4%
Yes, in some cases	95	52.5%
Not sure	35	19.3%

* More than one answer is allowed

Table 3: Attitude towards MERS-CoV among the study participants

	Agree		Disagree		Not sure	
	N	%	N	%	N	%
If I or any of my household members have a fever, cough and shortness of breath, I would seek medical advice to check for corona	156	88.1%	12	6.8%	9	5.1%
If I or my households visit a primary care center or a hospital, I will do the following to protect myself/family from getting corona virus and/or other similar diseases						
Washing hands with soap and water	155	100.0%	0	0.0%	0	0.0%
Taking vaccine	134	88.7%	11	7.3%	6	4.0%
Avoid touching eyes, nose and mouth with unwashed hands	145	95.4%	1	0.7%	6	3.9%
Avoid direct contact (such as kissing or shaking hands) with sick individuals	148	94.9%	3	1.9%	5	3.2%
Wearing mask	140	92.7%	4	2.6%	7	4.6%

Using hand disinfectants	152	98.1%	1	0.6%	2	1.3%
If a high number of corona cases are detected in the Kingdom, I and household members would avoid/delay the following activities as much as I/we could						
Making Hajj and Omrah	86	53.8%	40	25.0%	34	21.3%
Shopping in crowded malls	100	61.3%	28	17.2%	35	21.5%
Visiting hospitals	77	49.4%	55	35.3%	24	15.4%

Table 4: Practices for MERS-CoV among the study participants

	Always		Sometimes		Rarely		Never	
	N	%	N	%	N	%	N	%
While I am visiting the primary care center today, I did the following to protect myself/family from getting corona virus and/or other similar diseases								
Washing hands with soap and water	133	82.1%	28	17.3%	1	0.6%	0	0.0%
Avoid touching eyes, nose and mouth with unwashed hands	124	76.1%	35	21.5%	4	2.5%	0	0.0%
Avoid direct contact (such as kissing or shaking hands) with sick individuals	127	75.6%	35	20.8%	4	2.4%	2	1.2%
Wearing mask	103	62.8%	43	26.2%	11	6.7%	7	4.3%
Using hand disinfectants	124	75.2%	36	21.8%	4	2.4%	1	0.6%
When the ministry of health announced high number of corona cases in the Kingdom, I and my family avoided/delayed the following activities as much as I/we could								
Making Hajj and Omrah	88	55.7%	39	24.7%	15	9.5%	16	10.1%
Sending children to schools	47	31.3%	48	32.0%	32	21.3%	23	15.3%
Shopping in crowded malls	66	41.0%	54	33.5%	29	18.0%	12	7.5%
Visiting hospitals	59	38.1%	33	21.3%	11	7.1%	52	33.5%

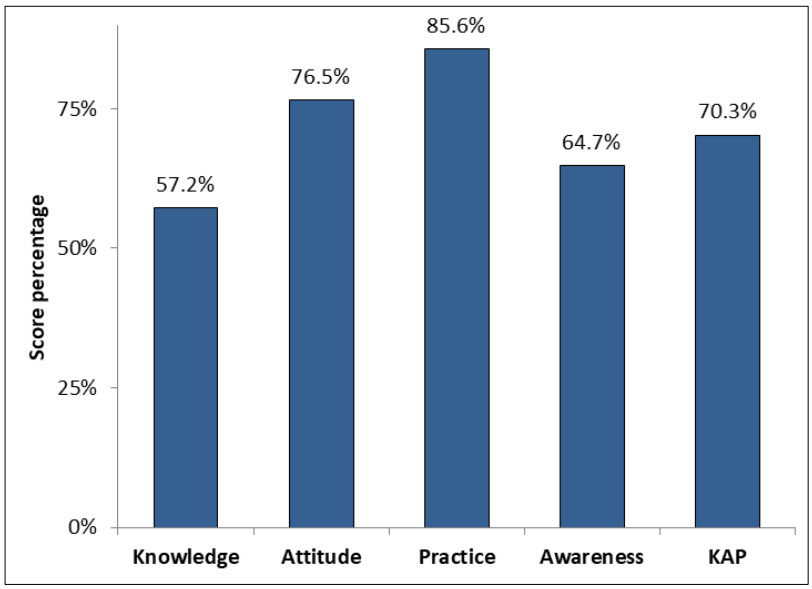

Fig 1: Scores for knowledge, attitude and practice towards MERS-CoV among the study patients

Table 5: Socio-demographic and medical characteristics of the study participants by the awareness groups

	Awareness score		p-value
	s median (50.3%)	> median (49.7%)	
Age			
Mean±SD	34.4±10.8	36.2±11.1	0.272
<30	34 (54.8%)	28 (45.2%)	0.149
30-40	30 (57.7%)	22 (42.3%)	
>40	24 (40.7%)	35 (59.3%)	
Gender			
Male	43 (46.7%)	49 (53.3%)	0.295
Female	48 (54.5%)	40 (45.5%)	
Marital status			
Single	32 (59.3%)	22 (40.7%)	0.297
Married	51 (48.1%)	55 (51.9%)	
Divorced/separated/widow	8 (42.1%)	11 (57.9%)	
Education			
Less than high school	25 (56.8%)	19 (43.2%)	0.536
High School	26 (45.6%)	31 (54.4%)	
College or above	40 (50.6%)	39 (49.4%)	
Employment status			
Not working	47 (58.8%)	33 (41.3%)	0.051

Working	37 (43.5%)	48 (56.5%)	
Occupation			
Professional	13 (41.9%)	18 (58.1%)	0.282
Administrative	19 (41.3%)	27 (58.7%)	
Manual worker	5 (62.5%)	3 (37.5%)	
Unemployed	26 (63.4%)	15 (36.6%)	
Retired	5 (45.5%)	6 (54.5%)	
Students	16 (57.1%)	12 (42.9%)	
Household working in healthcare			
No	53 (51.5%)	50 (48.5%)	0.780
Yes	38 (49.4%)	39 (50.6%)	
Number of visits to primary care during last year			
Median (IQR)	5 (3-10)	5 (3-10)	0.805
<5	37 (50.0%)	37 (50.0%)	0.936
⁄5	38 (49.4%)	39 (50.6%)	
Previous diagnosed of corona in yourself			
No	91 (50.6%)	89 (49.4%)	NA
Yes	0 (0.0%)	0 (0.0%)	
Previous diagnosed of corona in your household			
No	91 (50.8%)	88 (49.2%)	0.494
Yes	0 (0.0%)	1 (100.0%)	
Practice score groups			
S median	53 (58.2%)	38 (41.8%)	0.016
> median	34 (40.0%)	51 (60.0%)	

Table 6: Socio-demographic and medical characteristics of the study participants by the practice groups

	Practice score		**p-value**
	s median (51.7%)	**> median (48.3%)**	
Age			
Mean±SD	36.4±10.4	33.9±11.4	0.129
<30	24 (40.0%)	36 (60.0%)	0.038
30-40	32 (62.7%)	19 (37.3%)	
>40	33 (57.9%)	24 (42.1%)	
Gender			
Male	52 (57.8%)	38 (42.2%)	0.115
Female	39 (45.9%)	46 (54.1%)	
Marital status			
Single	27 (50.9%)	26 (49.1%)	0.847
Married	55 (53.9%)	47 (46.1%)	
Divorced/separated/widow	9 (47.4%)	10 (52.6%)	
Education			
Less than high school	23 (53.5%)	20 (46.5%)	0.516
High School	31 (57.4%)	23 (42.6%)	
College or above	37 (47.4%)	41 (52.6%)	
Employment status			
Not working	34 (43.6%)	44 (56.4%)	0.025
Working	52 (61.2%)	33 (38.8%)	
Occupation			
Professional	20 (64.5%)	11 (35.5%)	0.179
Administrative	29 (63.0%)	17 (37.0%)	
Manual worker	3 (37.5%)	5 (62.5%)	
Unemployed	19 (47.5%)	21 (52.5%)	
Retired	4 (36.4%)	7 (63.6%)	
Students	11 (40.7%)	16 (59.3%)	
Household working in healthcare			
No	48 (48.5%)	51 (51.5%)	0.288
Yes	43 (56.6%)	33 (43.4%)	
Number of visits to primary care during last year			
Median (IQR)	6 (3-11)	4 (2-7)	<0.001
<5	32 (44.4%)	40 (55.6%)	0.014
⁄5	49 (64.5%)	27 (35.5%)	
Previous diagnosed of corona in yourself			
No	91 (52.0%)	84 (48.0%)	NA
Yes	0 (0.0%)	0 (0.0%)	
Previous diagnosed of corona in your household			
No	91 (52.0%)	84 (48.0%)	NA
Yes	0 (0.0%)	0 (0.0%)	

Awareness score groups			
S median	53 (60.9%)	34 (39.1%)	0.016
> median	38 (42.7%)	51 (57.3%)	

Table 7: Multivariate logistic regression analysis* for the predictors of MERS-CoV awareness

Predictors	Groups compared	Odds ratio	95% confidence interval		p-value
			Lower	Upper	
Employment status	Working vs. not working	2.33	1.20	4.53	0.013
Practice score groups	> median vs. S median	2.74	1.41	5.33	0.003

* Adjusted for employment status and practice score groups
* Adjusted R square =0.103

Table 8: Multivariate logistic regression analysis* for the predictors of MERS-CoV practices

Predictors	Groups compared	Odds ratio	95% confidence interval		p-value
			Lower	Upper	
Employment status	Not working vs. working	2.86	1.34	6.11	0.007
Number of visits to primary care during last year	<5 times vs. ≥5 times	2.72	1.30	5.71	0.008
Awareness score groups	> median vs. S median	3.27	1.52	7.01	0.002

* Adjusted for age groups, employment status, number of visits to primary care during last year, and awareness score groups
* Adjusted R square =0.232

Table 9: Sources of information about MERS-CoV

	Number	Percentage
Sources used to get information about corona virus		
Doctor	61	33.7%
Newspaper	28	15.5%
TV	55	30.4%
Internet or social media	121	66.9%
Friends & neighbors	36	19.9%
Others	10	5.5%
Self-rating of knowledge about corona virus		
Excellent	17	9.8%
Very good	47	27.2%
Good	89	51.4%
Poor	20	11.6%
Need of more information about corona virus		
No	68	39.3%
Yes	105	60.7%
Sources preferred to get information about corona virus		
Doctor	94	51.9%
Newspaper	36	19.9%
TV	68	37.6%
Internet or social media	125	69.1%
Friends & neighbors	21	11.6%
Others	16	8.8%

Discussion

The current study reported the levels of awareness and practices of MERS-CoV and their influencing factors among a sample of patients at a primary care setting in Saudi Arabia.

The current study showed 64.7% MERS-CoV awareness level (including 57.2% for knowledge and 76.5% for attitude) among the study participants. Comparing the current fair level of awareness with previous studies is challenging due to different population examined and different study tools used. For example, the majority of the studies that examined the awareness of MERS-CoV in Saudi Arabia either targeted healthcare workers who inherently have better knowledge than the patients and public [25-29] or pilgrims who have traditionally very low levels of awareness [35, 36]. Additionally, the lack of standard tool that examined the awareness of MERS-CoV forced researchers to create their own questions which are not necessarily comparable. Furthermore, the few studies that sought to examine the MERS-CoV awareness among public either chose undefined population such as public attending shopping malls [5, 38], lack of important information such as precautionary measures used to protect patients in healthcare facilities [37], or didn't create an overall score to assess awareness [5, 38]. Nevertheless, as expected the current awareness rate (65%) is slightly lower than seen among healthcare workers (67%-73%) who are usually keen to get information about new emerging diseases for the sake of patient and own protection [26-28]. On the other hand, our findings are generally comparable with previous studies done among patient and public in Saudi Arabia. For example, 78% of our patients believed that MERS-CoV could be a fatal disease compared with 70% among dental patients [37]. Similarly, 57% of our patients wrongly believed that there was a vaccine to protect against MERS-CoV compared with 25% to 75% among public attending shopping malls [5, 38]. Finally, 38% to 76% of our patients believed that MERS-CoV is associated with flu-like

symptoms compared with 80% among public attending shopping malls [38].

Unlike awareness, the current study showed high appropriate practice level (85.6%) among the study participants. This could be related to the high concern about the disease fatality rather than sound understanding of the disease characteristics. As mentioned above, 78% of our patients believed that MERS-CoV could be a fatal disease. Our practice findings are generally comparable with the few studies that examined practices related to MERS-CoV among Saudi public [38] but better than reported in dental patients [37]. For example, 86% of our patients were taking precautionary measures to protect themselves against MERS-CoV such as frequent hand washing, following cough etiquettes, avoiding touching eyes, nose and mouth with unwashed hands, avoiding direct contact with sick individuals, and using face masks compared with 75% to 94% doing similar practices among public attending shopping malls [38]. On the contrary, our practice findings were much better than dental patients where no more than one-third of them were taking similar precautionary measures to protect themselves against MERS-CoV [37].

Awareness score in the current study was positively and significantly correlated with practice score and awareness was independent predictor of appropriate preventive practices. This was expected as patients with better awareness are more likely to implement the information they know and believe in. The current findings were similar to what has been reported before in similar studies. For example, better knowledge about MERS-CoV was significantly associated with both the level of concern and precautionary measures taken by public attending shopping malls [38] and pilgrim during Rajj season [35].

In addition to awareness, appropriate preventive practices in the current study were independently associated with non-employment status and small number of visits to primary care during last year. The non-employment status may indicate better access to internet information which may positively impact the preventive practices. The small number of visits to primary care during last year may indicate better health condition and/or generally appropriate health behaviors. We could not adequately compare such results as there is almost lack of studies that examined the factors associated with practices of MERS-CoV among patients and public. in Saudi Arabia [35].

Internet and social media were the main sources used in the current study to get information about MERS-CoV. This may be explained by the availability and high use of internet and social media in Gulf Cooperation Council (GCC) States [41]. Therefore, the Saudi MOR is using social media platforms alongside various other media platforms to raise the public awareness about MERS-CoV [41]. Similar to our findings, internet was the major source of disease information among the public attending shopping malls in Riyadh, followed by healthcare providers, mobile SMS, television [5, 39].

The current study had several strengths and few limitations. The current study is considered the first local study to examine awareness and practices of MERS-CoV among a sample of patients at a primary care setting. Additionally, the association between awareness and practices of MERS-CoV has been examined using both univariate and multivariate analysis. Moreover, the influences of a large number of socio-demographic and medical characteristics on the awareness and appropriate preventive practices have been examined.

Nevertheless, we acknowledge few limitations. For example, the cross-sectional design does not prove causations but only associations. Additionally, convenience sampling used in the current study may limit the generalizability of the current findings. Rowever, lack of casualty and limited generalizability are almost unavoidable limitations in all previous similar studies.

Conclusions and recommendation

A cross-sectional design was used to examine levels of awareness and practices related to MERS-CoV and their influencing factors among 181 patients attending a primary care center in Riyadh, Saudi Arabia. Data were collected using a structured study questionnaire, which includes data on knowledge, attitude, and practices related to MERS-CoV. The overall awareness level was 64.7% (including 57.2% for knowledge and 76.5% for attitude) and the level of appropriate preventive practices was 85.6%. The scores of both awareness and practices were positively and significantly correlated. In addition to awareness, appropriate preventive practices were independently associated with non- employment status and small number of visits to primary care during last year.

The current finding pointed to some important misconceptions related to MERS-CoV such as incubation period, animal reservoir, the use of vaccine for prevention, and the use of antibiotics for treatment. Internet and social media were the main sources used to get information about MERS-CoV (66.9%), followed by doctors, TV, friends & neighbors, newspapers, and others. The current finding indicated the need for improving awareness and understanding of the patients attending primary care services. Additionally, it calls for using internet and social media as an important platform in any future educational program. There is a need for a future intervention study that examines the impact of educational program that consider the above misconceptions on the awareness and practices levels of patients attending primary care services.

The findings of the current study revealed several points that represent a potential for improving MERS-CoV at the primary care setting;

- As the current finding showed that awareness levels is a strong independent predictor for appropriate preventive practices related to MERS-CoV, increasing awareness of patients attending primary care services is expected to improve the compliance with infection control measures.
- As the current finding showed that internet and social media were the main sources used in the current study to get information about MERS-CoV, any future educational program should use these platforms in addition to regular channels.
- The current finding pointed to some important misconceptions about MERS-CoV such as incubation period, animal reservoir, the use of vaccine for prevention, and the use of antibiotics for treatment. These misconceptions should be stressed in any future educational programs or awareness campaigns.
- As the current study design is descriptive from one center, the current finding can be further extended by an intervention study that examines the impact of educational program that consider the above

misconceptions on the awareness and practices levels of patients attending primary care services.

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