

Research Article

Knowledge, Attitude and Practices of Health Care Workers about Corona Virus Disease 2019 in Saudi Arabia

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practice**ABSTRACT**

Background and Objectives: Corona Virus Disease 2019 (COVID-19) pandemic is a global health emergency. Health Care Workers (HCWs) with sound knowledge and practices can help curb the pandemic. This study aimed to assess the knowledge, attitude and practices of HCWs about COVID-19 and compare physicians and non-physicians in Saudi Arabia.

Methods: An online survey was conducted among HCWs in Saudi Arabia in March and April 2020. Data were collected using a structured questionnaire having four sections including; socio-demographic and professional profile, knowledge, attitude and practices regarding COVID-19. Questionnaire link was sent through social media. Descriptive analysis was used for assessment of knowledge, attitude and practice and Chi-square test was used for comparing physicians and non-physicians. Data were analyzed using SPSS version 21.0.

Results: A total of 398 HCWs completed the questionnaire. Only 45% of the participants had correct knowledge about the agent while about 97% knew that close contact with infected person is the most important risk factor. Only 63% had correct knowledge about the role of antibiotics in COVID-19 treatment. Majority of the HCWs were worried and most frequently reported worry was risk to family. Carrying infection to home was most commonly reported fear, 92%. Cleaning hands often or always was 11.5% and 87% respectively. About 71% wore mask during work. Knowledge was better among physicians compared to non-physicians while attitude and practices were comparable between the two groups.

Conclusion: We found that there was poor knowledge about causative agent and role of antibiotics for COVID-19 but for mode of transmission and prevention there was good knowledge. There were widely prevalent worries and fears among the participants. Overall, there were good infection control practices among the HCWs. Interventions are needed to improve knowledge and address worries and fears of HCW.

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1. INTRODUCTION

Increasing globalization, population and intrusion of man into new places has led to exposure of humans to unknown pathogen which results in new diseases called emerging diseases. Emerging and re-emerging diseases have always posed threat to human health. Recent emerging diseases were Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), Ebola, Chikungunya, Avian flu, Swine flu and Zika. The latest among emerging diseases was discovered in Wuhan city, Hubei province of China in late December 2019 which is known as Corona Virus Diseases 2019 (COVID-19).

On December 31st 2019, World Health Organization (WHO) was informed about cases of pneumonia of unknown etiology [1]. Later the number of cases rose very rapidly and also the number of affected countries increased drastically. On January 31st 2020, WHO declared this outbreak as Public Health Emergency of international concern and later on 11th March 2020 as pandemic [2].

As of April 30th 2020, more than 3.2 million cases and 234,005 deaths have been reported globally [3].

Droplet precautions are recommended by WHO for prevention of COVID-19 as there is possibility of air born transmission in aerosol generating settings [4]. Given global extent of problem and high potential of transmission, Health Care Workers (HCWs) are at higher risk of contracting COVID-19 at their work settings. A report of Chinese center for disease control and prevention (11 February 2020) indicated 1716 HCWs contracted the COVID-19 and majority, 63% of these HCWs belonged to Wuhan where outbreak started [5].

Health care workers are the backbone of health systems. A healthy and skilled workforce is the basic requirement to ensure healthy community and this is even more important during crisis such as COVID-19 pandemic. It is also important that HCWs should have good knowledge about the disease and practice preventive measures to protect themselves and community at large. Studies from China have reported high level of knowledge among HCWs and majority of them had received training about COVID-19 [6,7]. This level of knowledge of HCWs about the disease could be one of the contributory factors behind China's exemplary control of

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the disease [8]. An understanding of status of knowledge, attitude and practices of HCWs and differences between physicians and non-physicians is an important step towards outbreak control. This would help prepare the health care workforce with targeted approaches for a better response to the pandemic.

Saudi Arabia is the Muslim pilgrimage country with millions of people across the globe visiting holy places of Makkah and Al-Madinah. Additionally there are about 10 million expatriates in the country. Saudi Arabia is no exception from the COVID-19 infection. As of April 30th 2020, a total of 24,097 cases and 169 deaths have been reported from Saudi Arabia [3]. Saudi Arabia is currently implementing a multi-sectoral national level response according to WHO operational planning guidelines [9]. To the best of our knowledge, no study has been published on assessment of knowledge of HCWs about COVID-19 in The Kingdom of Saudi Arabia. This study aimed to assess the knowledge, attitude and practices of HCWs related to COVID-19 and to compare the knowledge, attitude and practices of physicians and non-physicians in Saudi Arabia.

2. MATERIALS AND METHODS

2.1. Study Setting and Population

This was a cross-sectional survey conducted among HCWs in public and private health care facilities in Saudi Arabia from March 24th to April 15th 2020. Health care workers included; doctors, dentists, nurses, public health inspectors, technicians (laboratory, radiology and dental) and pharmacists.

2.2. Sampling Procedure

Convenience and snow ball sampling strategy was used to enroll potential participants. Health care workers, currently on job in Saudi Arabia were eligible to participate in the study. Questionnaire link was shared through email, WhatsApp, Facebook and Twitter by the research team. Message was also added, requesting receivers to further share the link with other co-workers in Saudi Arabia.

2.3. Data Collection Tool and Procedure

An online structured questionnaire with close ended questions was developed by the research team after review of literature [10–13]. Face validity of the questionnaire was done however content validity was not performed. Research team assessed all the variables for their relevance to the study objectives and contextual applicability. Questionnaire had four sections. First section was about demographic and professional characteristics. This section collected information about; age, gender, nationality, occupation and workplace. Sections 2–4 assessed knowledge, attitude and practices respectively regarding COVID-19. Section on Knowledge had 20 items related to knowledge about the disease, agent, risk factors, incubation period, symptoms, modes of transmission, role of antibiotics, antivirals and flu vaccine in the disease prevention and management, effectiveness of simple surgical mask, high risk groups for severe disease, effectiveness of hand washing and recommendations of

masks for general population and HCWs, comparative fatality with MERS-CoV and seasonal flu, source of information and attending session on COVID-19. Section 3 about attitude had 11 questions which collected information about worriedness and fears associated with COVID-19, sufficiency of information from Ministry of Health (MoH), difficulty in obtaining protective gears, preparation status of institute, controllability of the pandemic and accuracy of reported disease burden. Last section had five variables to collect data about practices such as washing hands, wearing surgical mask, advising and educating people about sign and symptoms of COVID-19. Questions in the knowledge section were either with specific options or “Yes/No/Don’t Know”, while in the attitude and practice section, 5-point likert scale either of agreement (strongly disagree, disagree, don’t know, agree, strongly agree) or frequency (always, often, sometimes, occasionally, never) were used. Questionnaire was translated into Arabic language. Both Arabic and English version were provided to participants to choose language of their preference. The questionnaire is available from the link: <https://forms.gle/xtP6pGqdHfto14cm6>.

2.4. Data Analysis

Data were cleaned and assessed for completeness. Descriptive analysis was carried out to calculate frequencies and proportions for categorical and means with standard deviation for continuous variables. All the items were analyzed individually. Chi-square test was used to compare knowledge, attitude and practices of physicians and non-physicians. All HCWs including; nurses, pharmacist, technologists, technicians and health inspectors were merged as single category. *P*-value <0.05 was considered significant.

2.5. Ethical Considerations

This study was reviewed and approved by Qassim Regional Bioethics Committee (ref #: 1441-1528621). Informed consent was obtained from all the participants before proceeding to questions in the survey. Anonymity of the participants was ensured and no personal identifier was obtained.

3. RESULTS

A total of 398 participants completed the questionnaire and included in the analysis. Mean age of the participants was 35.6 (± 9.7) years. Fifty nine percent of the participants were male. A little more than half 57% were Saudis and majority of the participants were from Qassim region (67%). Near half (52%) were physicians and working in Primary Health Care (PHC) centers (49.7%) (Table 1).

Table 2 presents the knowledge, attitude and practices of HCWs about COVID-19. Only 45.5% of the participants knew about the causative agent. Almost all (97.5%) of the respondents were aware that close contact with infected person is the most important risk factor. More than 90% of the respondents could identify common symptoms and modes of transmission. Only 63% of the respondents were aware that antibiotics have no role in treatment of COVID-19, however surprisingly, 25% were not sure about it.

Table 1 | Socio-demographics and work characteristics of the participants (N = 398)

Variables	n (%)
Gender (n = 393)	
Male	232 (59.0)
Female	161 (41.0)
Region	
Qassim	266 (66.8)
Others	132 (33.2)
Nationality (n = 394)	
Saudi	224 (56.9)
Non-Saudi	170 (43.1)
Occupation (n = 391)	
Physician/Dentists	205 (52.4)
Nurse	72 (18.4)
Technologist/Health Inspector	73 (18.7)
Others	41 (10.5)
Type of facility (n = 392)	
Public sector	387 (98.7)
Private sector	5 (1.3)
Place of work (n = 376)	
PHC/Polyclinic	187 (49.7)
Hospital	121 (32.2)
Health Administration	49 (12.3)
Others	19 (5.1)
Worksite (n = 375)	
Out-patient	163 (43.5)
In-patient	62 (15.6)
Emergency Department	19 (4.8)
Others	131 (34.9)

Table 2 | Knowledge, attitude and practices of healthcare workers about COVID-19 (N = 398)

Variables	n (%)
Knowledge	
Correct knowledge about agent (n = 379)	
Yes	181 (45.5)
No	85 (22.4)
Don't know	113 (29.8)
Close contact with infected person is most important risk factor (n = 393)	
Yes	383 (97.5)
No	6 (1.5)
Not sure	4 (1.0)
Incubation period of COVID-19 (n = 396)	
3–5 days	8 (2.0)
2–14 days	366 (92.0)
Up to 4 weeks	20 (5.0)
Not sure	2 (0.5)
Most common symptoms of COVID-19 (Yes)	
Fever (n = 392)	387 (98.7)
Cough (n = 388)	381 (98.2)
Shortness of breath (385)	379 (95.2)
Hemoptysis (n = 280)	32 (11.4)
Sneezing (n = 323)	154 (47.7)
Most common modes of transmission (Yes)	
Touching (n = 362)	346 (95.6)
Coughing (n = 373)	363 (97.3)
Blood transfusion (n = 254)	46 (18.1)
Shaking hands (n = 368)	368 (98.7)
Mosquito bite (n = 247)	6 (2.4)

(Continued)

Table 2 | Knowledge, attitude and practices of healthcare workers about COVID-19 (N = 398)—Continued

Variables	n (%)
Antibiotics are effective against COVID-19 (n = 396)	
Yes	28 (7.1)
No	249 (62.6)
Not sure	99 (25.0)
Don't know	20 (5.1)
Antivirals are effective against COVID-19 (n = 395)	
Yes	70 (17.7)
No	141 (35.7)
Not sure	146 (37.0)
Don't know	38 (9.6)
Flu vaccine is effective for COVID-19 (n = 395)	
Yes	18 (4.6)
No	272 (68.9)
Not sure	81 (20.5)
Don't know	24 (6.0)
Past episode of flu can reduce the risk (n = 395)	
Yes	24 (6.1)
No	285 (72.2)
Not sure	57 (14.3)
Don't know	29 (7.3)
In routine practice simple surgical mask is effective (n = 394)	
Yes	268 (68.0)
No, N95 mask should be used	102 (25.6)
Not sure	24 (6.1)
Factors affecting severity of COVID-19 (Yes)	
Age more than 50 years (n = 382)	376 (98.4)
Age less than 5 years (n = 295)	140 (47.5)
Presence of chronic diseases (382)	380 (99.5)
Pregnancy (n = 332)	271 (81.6)
Skin disorders (n = 269)	32 (11.9)
Seasonal flu (281)	90 (32.0)
Washing hands can reduce the risk if disease transmission (n = 394)	
Disagree	1 (0.3)
Don't know	0 (0)
Agree	393 (99.7)
Mask is recommended to be worn by every person all the time (n = 392)	
Yes	70 (17.9)
No	311 (79.3)
Not sure	10 (2.6)
Don't know	1 (0.3)
Health care workers should wear mask all the time at work (n = 395)	
Disagree	91 (23.0)
Don't know	12 (3.0)
Agree	292 (73.9)
COVID-19 has high fatality than MERS-CoV (n = 394)	
Yes	82 (21.0)
No	309 (79.0)
COVID-19 has high fatality than seasonal flu (n = 391)	
Yes	82 (21.0)
No	309 (79.0)
Proportion of COVID-19 case requiring intensive care (n = 388)	
Less than 10%	271 (68.1)
Around 30%	78 (19.6)
More than 50%	39 (10.1)

(Continued)

Table 2 | Knowledge, attitude and practices of healthcare workers about COVID-19 (*N* = 398)—Continued

Variables	<i>n</i> (%)
I know the concerned authority for notification (<i>n</i> = 387)	
Yes	371 (95.9)
No	16 (4.1)
Sources of information (Yes)	
Ministry of Health	388 (97.4)
Saudi CDC	254 (63.8)
WHO	291 (73.1)
US CDC	117 (29.4)
Chinese CDC	68 (17.1)
Social Media	41 (11.1)
Scientific database	13 (3.3)
Attended session on COVID-19 (<i>n</i> = 393)	
Yes (In-class)	94 (23.9)
Yes (Online)	138 (35.1)
No	161 (41.0)
Attitude	
I am worried about COVID-19 pandemic (<i>n</i> = 393)	
Yes	203 (51.7)
Somewhat	188 (47.8)
No	02 (0.5)
I am worried about dangers of disease (<i>n</i> = 323)	
Yes	256 (79.3)
No	67 (20.7)
I am worried about risk to my family and friends (<i>n</i> = 364)	
Yes	360 (98.9)
No	4 (1.1)
I am worried about social isolation (<i>n</i> = 264)	
Yes	144 (54.5)
No	120 (45.5)
I am afraid of getting disease during work (<i>n</i> = 392)	
Disagree	23 (5.9)
Neutral	83 (21.2)
Agree	286 (73.0)
I am afraid of carrying infection from my work place to home (<i>n</i> = 390)	
Disagree	12 (3.1)
Neutral	20 (5.1)
Agree	358 (91.8)
I think available information from MoH is sufficient (<i>n</i> = 393)	
Disagree	11 (2.8)
Neutral	38 (9.7)
Agree	344 (87.5)
I find it difficult to obtain protective equipment (<i>n</i> = 392)	
Disagree	196 (50.0)
Neutral	58 (14.8)
Agree	138 (34.7)
My institute is well prepared for COVID-19 pandemic (<i>n</i> = 391)	
Disagree	44 (11.3)
Neutral	51 (13.0)
Agree	296 (75.7)
In my opinion COVID-19 outbreak will (<i>n</i> = 391)	
Disappear completely	111 (28.4)
Continue as small epidemics in different parts	155 (39.6)
Shrink to sporadic cases	125 (32.0)

(Continued)

Table 2 | Knowledge, attitude and practices of healthcare workers about COVID-19 (*N* = 398)—Continued

Variables	<i>n</i> (%)
I think disease burden is (<i>n</i> = 390)	
Same as being reported	163 (41.8)
Over reported	26 (6.7)
Under reported	177 (45.4)
Don't know	24 (6.2)
Practices	
I clean my hands with soap or alcohol based rub (<i>n</i> = 391)	
Occasionally	1 (0.3)
Sometimes	5 (1.3)
Often	45 (11.5)
Always	340 (87.0)
I wear surgical mask during my work (<i>n</i> = 391)	
Never	25 (6.4)
Occasionally	17 (4.3)
Sometimes	71 (18.2)
Often	117 (29.9)
Always	161 (41.2)
I advise all people to seek care if they have symptoms of flu (<i>n</i> = 390)	
Yes	251 (64.4)
No	139 (35.6)
I educate my patients about preventive measures for COVID-19 (<i>n</i> = 389)	
Never	5 (1.3)
Occasionally	3 (0.8)
Sometimes	24 (6.2)
Often	83 (21.3)
Always	274 (70.4)
I feel confident enough to educate my patients about COVID-19 (<i>n</i> = 390)	
Yes	299 (76.6)
To some extent	83 (21.3)
No	8 (2.1)

About role of flu vaccine in prevention of COVID-19, 20% were not sure. Regarding use of mask during routine practice, about one-third (32%) thought that surgical mask is not suitable or were unsure about it. About use of mask, (74%) agreed that HCWs should wear mask all the time at work. Most common sources of knowledge were MoH (97.4%), WHO (73.1%) and Saudi Center for Disease Prevention and Control (CDC) (64%). Only 24% and 35% of the participants had attended an in-class and online session respectively on COVID-19.

Almost all of the participants were worried about COVID-19 pandemic; most common worries were risks of contracting the infection or transmitting it to friends and family members. About one-third reported that they found it difficult to obtain personal protective equipment (PPEs).

Majority (87%) always cleaned their hands with soap or alcohol based rub and washing hands was quite common practice. Near two-third (64%) reported that they advised all people to seek care if there are symptoms of flu.

We also compared physicians and non-physicians with respect to their knowledge, attitude and practices (Table 3). Compared with

Table 3 | Comparison of physicians' and non-physicians' knowledge, attitude and practices regarding COVID-19 (N = 398)

Variables	Physician	Non-physician	p
Comparison of knowledge			
Correct knowledge about agent			
Yes	123 (62.8)	56 (31.5)	<0.001
No	39 (19.6)	45 (25.3)	
Don't know	17.3 (34)	77 (43.3)	
Total	196	178	
Close contact with infected person is important risk factor			
Yes	201 (98.5)	177 (96.2)	0.363*
No	2 (1.0)	4 (2.2)	
Not sure	1 (0.5)	3 (1.6)	
Total	204	184	
Incubation period of COVID-19 is			
3–5 days	3 (1.5)	4 (2.2)	0.926*
2–14 days	191 (93.2)	171 (91.9)	
Up to 4 weeks	10 (4.9)	10 (5.4)	
Not sure	1 (0.5)	1 (0.5)	
Total	205	186	
Most common symptoms of COVID-19 include:			
Fever			
Yes	203 (100)	179 (97.3)	0.024*
No	0 (0)	2.7 (5)	
Total	203	184	
Cough			
Yes	200 (99.5)	176 (96.7)	0.057*
No	1 (0.5)	6 (3.3)	
Total	201	182	
Shortness of breath			
Yes	198 (98.5)	176 (98.3)	1.000*
No	3 (1.5)	3 (1.7)	
Total	201	179	
Hemoptysis			
Yes	8 (5.4)	24 (18.5)	0.001
No	140 (94.6)	106 (81.5)	
Total	148	130	
Sneezing			
Yes	61 (36.5)	90 (59.2)	<0.001
No	106 (63.5)	62 (40.8)	
Total	167	152	
Common modes of transmission			
Touching			
Yes	179 (95.2)	163 (96.4)	0.607
No	9 (4.8)	6 (3.6)	
Total	188	169	
Coughing and sneezing			
Yes	192 (97.5)	166 (97.1)	1.000
No	5 (2.5)	5 (2.9)	
Total	197	171	
Blood transfusion			
Yes	11 (8.2)	34 (28.8)	<0.001
No	123 (91.8)	84 (71.2)	
Total	134	118	
Shaking hands			
Yes	189 (99.0)	174 (98.3)	0.675*
No	2 (1.0)	3 (1.7)	
Total	191	177	

(Continued)

Table 3 | Comparison of physicians' and non-physicians' knowledge, attitude and practices regarding COVID-19 (N = 398)—Continued

Variables	Physician	Non-physician	p
Mosquito bite			
Yes	0 (0)	6 (5.4)	0.008
No	134 (100)	105 (94.6)	
Total	134	111	
Antibiotics are effective against COVID-19			
Yes	14 (6.8)	13 (7.0)	<0.001
No	166 (81.0)	82 (44.1)	
Not sure	19 (9.3)	78 (41.9)	
Don't know	6 (2.9)	13 (7.0)	
Total	205	186	
Antivirals are effective against COVID-19			
Yes	30 (14.6)	39 (21.1)	<0.001
No	94 (45.9)	46 (24.9)	
Not sure	66 (32.2)	77 (41.6)	
Don't know	15 (7.3)	23 (12.4)	
Total	205	185	
Flu vaccine is effective in preventing COVID-19			
Yes	7 (3.4)	11 (5.9)	<0.001
No	167 (81.5)	101 (54.6)	
Not sure	27 (13.2)	53 (28.6)	
Don't know	4 (2.0)	20 (10.8)	
Total	205	185	
Having flu in the past can reduce the risk			
Yes	9 (4.4)	14 (7.6)	<0.001
No	168 (82.0)	113 (61.1)	
Not sure	21 (10.2)	36 (19.5)	
Don't know	7 (3.4)	22 (11.9)	
Total	205	185	
In routine practice simple surgical mask is effective			
Yes	157 (76.6)	108 (58.7)	0.001
No, N95 mask should be used	39 (19.0)	62 (33.7)	
Not sure	9 (4.4)	14 (7.6)	
Total	205	184	
Factors affecting severity of COVID-19			
Age more than 50 years			
Yes	195 (98.0)	176 (98.9)	0.688*
No	4 (2.0)	2 (1.1)	
Total	199	178	
Age <5 years			
Yes	62 (40.0)	76 (55.5)	0.008
No	93 (60.0)	61 (44.5)	
Total	155	137	
Presence of chronic disease			
Yes	201 (99.5)	174 (99.4)	1.000
No	1 (0.5)	1 (0.6)	
Total	202	175	
Pregnancy			
Yes	158 (86.8)	111 (75.5)	0.008
No	24 (13.2)	36 (24.5)	
Total	182	147	

(Continued)

Table 3 | Comparison of physicians’ and non-physicians’ knowledge, attitude and practices regarding COVID-19 (N = 398)—Continued

Variables	Physician	Non-physician	p
Skin disorders			
Yes	17 (11.5)	15 (12.6)	0.780
No	131 (88.5)	104 (87.4)	
Total	148	119	
Seasonal flu			
Yes	31 (21.1)	57 (43.5)	<0.001
No	116 (78.9)	74 (56.5)	
Total	147	131	
Washing hands can reduce the risk of transmission			
Agree	203 (99.5)	185 (100)	1.000
Disagree	1 (0.5)	0 (0)	
Total	204	185	
Mask is recommended to be worn by every persons all the time			
Yes	24 (11.8)	45 (24.65)	0.004
No	173 (85.2)	134 (72.8)	
Not sure	6 (3.0)	4 (2.2)	
Don't know	0 (0)	1 (0.5)	
Total	203	184	
Health care workers should wear mask all the time at work during pandemic			
Disagree	40 (19.6)	50 (26.9)	0.154
Don't know	5 (2.5)	7 (3.8)	
Agree	159 (77.9)	129 (69.4)	
Total	204	186	
COVID-19 has high fatality rate than MERS-CoV			
Yes	26 (12.7)	37 (20.0)	0.052
No	178 (87.3)	148 (80.0)	
Total	204	185	
COVID-19 has high fatality rate than seasonal flu			
Yes	46 (22.5)	35 (19.2)	0.424
No	158 (77.5)	147 (80.8)	
Total	204	182	
Proportion of COVID-19 patients requiring intensive care			
Less than 10%	163 (80.7)	103 (56.9)	<0.001
Around 30%	27 (13.4)	51 (28.2)	
More than 50%	12 (5.9)	27 (14.9)	
Total	202	181	
Know about concerned authority to report suspected case			
Yes	194 (97.0)	172 (94.5)	0.224
No	6 (3.0)	10 (5.5)	
Total	200	182	
Sources of information			
Ministry of Health			
Yes	200 (97.6)	183 (98.4)	0.562
No	5 (2.4)	3 (1.6)	
Total	205	186	
Saudi CDC			
Yes	146 (71.2)	105 (56.5)	0.002
No	59 (28.8)	81 (43.5)	
Total	205	186	

(Continued)

Table 3 | Comparison of physicians’ and non-physicians’ knowledge, attitude and practices regarding COVID-19 (N = 398)—Continued

Variables	Physician	Non-physician	p
WHO			
Yes	184 (89.8)	105 (56.5)	<0.001
No	21 (10.2)	81 (43.5)	
Total	205	186	
US CDC			
Yes	84 (41.0)	32 (17.2)	<0.001
No	121 (59.0)	154 (82.8)	
Total	205	186	
Chinese CDC			
Yes	40 (19.5)	28 (15.1)	0.245
No	165 (80.5)	158 (84.9)	
Total	205	186	
Social Media			
Yes	19 (9.3)	24 (12.9)	0.251
No	186 (90.7)	162 (87.1)	
Total	205	186	
Scientific database			
Yes	11 (5.4)	2 (1.1)	0.018
No	194 (94.6)	184 (98.9)	
Total	205	186	
Comparison of attitudes			
I am worried about COVID-19 pandemic			
Yes	201 (99.0)	184 (100)	0.500
No	2 (1.0)	0 (0)	
Total	203	184	
My worriedness is about dangers of disease			
Yes	152 (82.6)	101 (74.8)	0.090
No	32 (17.4)	34 (25.2)	
Total	184	135	
My worriedness is about risk to friends and family members			
Yes	185 (98.9)	170 (98.8)	1.000
No	2 (1.1)	2 (1.2)	
Total	187	172	
My worriedness is about social isolation			
Yes	72 (51.4)	69 (57.5)	0.327
No	68 (48.6)	51 (42.5)	
Total	140	120	
I am afraid of getting disease during my work			
Disagree	6 (3.0)	17 (9.2)	0.006
Neutral	36 (17.7)	44 (23.9)	
Agree	161 (79.3)	123 (66.8)	
Total	203	184	
I am afraid of carrying infection to my home			
Disagree	2 (1.0)	10 (5.5)	0.024
Neutral	8 (4.0)	11 (6.0)	
Agree	192 (95.0)	162 (88.5)	
Total	202	183	

(Continued)

Table 3 | Comparison of physicians' and non-physicians' knowledge, attitude and practices regarding COVID-19 ($N = 398$)—Continued

Variables	Physician	Non-physician	<i>p</i>
I think available information from MoH is sufficient			
Disagree	6 (3.0)	5 (2.7)	0.312
Neutral	15 (7.4)	22 (12.0)	
Agree	182 (89.7)	157 (85.3)	
Total	203	184	
I found it difficult to obtain protective equipment			
Disagree	118 (58.1)	76 (41.3)	<0.001
Neutral	33 (16.3)	24 (13.0)	
Agree	52 (25.6)	84 (45.7)	
Total	203	184	
My institute is well prepared for COVID-19 pandemic			
Disagree	19 (9.4)	25 (13.7)	0.072
Neutral	33 (16.3)	17 (9.3)	
Agree	151 (74.4)	141 (77.0)	
Total	203	183	
In my opinion COVID-19 outbreak will			
Disappear completely	43 (21.4)	65 (35.3)	0.008
Continue as small epidemics	85 (42.3)	68 (37.0)	
Shrink to sporadic cases	73 (36.6)	51 (27.7)	
Total	201	184	
I think disease burden is			
Same as being reported	79 (39.1)	80 (44.0)	0.075
Over reported	11 (5.4)	14 (7.7)	
Under reported	104 (51.5)	73 (40.1)	
Don't know	8 (4.0)	15 (8.2)	
Total	202	182	
Comparison of practices			
I clean my hands with soap or alcohol rub			
Occasionally	0 (0.0)	1 (0.5)	0.056
Sometimes	3 (1.5)	2 (1.1)	
Often	31 (15.3)	14 (7.7)	
Always	169 (83.3)	166 (90.7)	
Total	203	183	
I wear surgical care mask during my work			
Never	8 (3.9)	17 (9.3)	0.075
Occasionally	8 (3.9)	9 (4.9)	
Sometimes	32 (15.8)	39 (21.3)	
Often	63 (31.0)	53 (29.0)	
Always	92 (45.3)	65 (35.5)	
Total	203	183	
I advise all people to seek care if they have symptoms of flu			
Yes	121 (59.9)	127 (69.4)	0.052
No	81 (40.1)	56 (30.6)	
Total	202	183	
I educate my patients about preventive measures for COVID-19			
Never	0 (0)	5 (2.7)	0.021*
Often	0 (0)	3 (1.6)	

(Continued)

Table 3 | Comparison of physicians' and non-physicians' knowledge, attitude and practices regarding COVID-19 ($N = 398$)—Continued

Variables	Physician	Non-physician	<i>p</i>
Sometimes	11 (5.4)	13 (7.1)	
Occasionally	49 (24.3)	33 (18.1)	
Always	142 (70.3)	128 (70.3)	
Total	202	182	
I feel confident enough to educate my patients about COVID-19			
Yes	157 (77.7)	138 (75.4)	0.679*
To some extent	42 (20.8)	40 (21.9)	
No	3 (1.3)	5 (2.7)	
Total	202	183	

*Fisher exact *p*-value.

non-physicians, physicians generally showed better knowledge in most of the studied items. The differences in identifying the causative agent, role of antibiotics, flu vaccine, fear of getting disease at work place and carrying infection to home were statistically significant, while there was no significant differences for other items such as; identifying main modes of transmission, factors that increases the severity of the disease, worriedness about COVID-19 and hand washing and wearing mask practices. About effectiveness of antibiotics, correct answer was given by 81% physicians and 44% non-physicians (p -value <0.001). There was no significant difference between the two groups with respect to worriedness about COVID-19. However, fear of getting disease at work place and carrying infection to home were higher among physicians, 79% and 95% respectively compared to non-physicians, 67% and 88% respectively. With respect to practices, we did not find significant difference between physicians and non-physicians. Around 8% of the physicians and 35% of non-physicians never or occasionally used mask during their work. These respondents were mainly working in administrative and non-patient care areas.

4. DISCUSSION

This study, to the best of our knowledge is the first of its kind from Saudi Arabia to assess knowledge, attitude and practices of HCWs in the Kingdom.

Correct knowledge about a disease is an important factor in prevention and control of disease [14] this is even more important during pandemics where a large section of population is susceptible. In our study, knowledge about agent was low 45%. This is lower than studies from China [7] and Pakistan [15] where 99% and 100% respondents were correct. However, in these studies researchers inquired only if this was a viral disease, whereas in our study we inquired about the name of the specific virus. Knowledge about close contact as most important risk factor was higher in our study (97%) compared to HCWs in China (67%) [7]. Knowledge about incubation period was slightly lower 92% than reported from Pakistan 96% [15]. Our study found that correct knowledge about role of antibiotics was 63% which is higher than reported from China 58% [7] but lower than Pakistan 82% [15]. Having more than one third of participants with incorrect knowledge about the antibiotics use for COVID-19 indicates a poor state of basic understanding of

infectious diseases. This has important implications on patients as well as health care system in terms of health consequences such as antimicrobial resistance and costs of care.

Previous studies from Saudi Arabia and Greece also reported a higher proportion of HCWs being worried about their families during MERS-CoV and H1N1 epidemics respectively [11,13]. Risk to friends and family members was most frequent reason in our study, a finding similar to earlier report from China during this pandemic [7,16]. Majority (75%) of the HCWs believed that their institution was not prepared for COVID-19 pandemic. Similar findings were reported previously from Saudi Arabia during MERS-CoV outbreak [10]. This is also reflected as fear among 92% of the respondents about carrying infection to their homes. This is important finding as one's beliefs about preparedness of his/her institution has effects on feelings of safety, motivation and morale during work [17]. Proper risk communication with HCWs and their training is essential in this regard along with upgrading and maintaining health care facilities to face the challenge of emerging diseases such as COVID-19.

Without adequate practices, knowledge and attitude do not provide the desired outcome for prevention and control of diseases. In our study we found that a large proportion frequently cleaned their hands. This finding is similar to a study from Pakistan [15] while a lower proportion 82% of HCWs reported cleaning their hands often or always following MERS-CoV outbreak in Saudi Arabia [10]. This may indicate improvement in hygiene practice which has resulted from previous experience of an outbreak. For a respiratory disease, wearing mask during practice is an effective measure for prevention of infection among HCWs. Our study found that about 30% often and 41% always used surgical mask at work. This finding is similar to previous study from Saudi Arabia where 24% and 43% of HCWs used mask often and always respectively [10]. We assume that even small proportion of workers who do not practice can pose risk to other colleagues and patients.

We also compared knowledge, attitudes and practices between physicians and non-physicians. The findings are similar to previous study from Saudi Arabia where physicians were found to have better knowledge about MERS-CoV than other HCWs [10]. Generally, it was observed that knowledge about agent, roles of antibiotics and antivirals and use of masks were better among physicians compared to non-physicians. However there was no significant difference in knowledge between the two groups with respect to common signs and symptoms, modes of transmission, factors affecting severity of the disease and concerned authority for reporting a case.

There was no significant difference between physicians and non-physicians in terms of worriedness. However, fear of getting disease during work and carrying infection to home was higher among physicians. There were no significant differences in the practices of both types of HCWs except for educating patients about prevention and control of COVID-19, which was higher among physicians. These differences could be due to the fact that in our sample non-physicians also included technicians, health inspectors and those working in administration and they are not in direct contact with the patient. This may have led to perception of lower risk of getting infected and different opportunities for educating patients. We also did exploratory analysis (results not shown) by excluding technicians and health inspectors and

compared physician with nurses. This exercise however did not show any major changes in the results.

Poor knowledge about causative agent, role of antibiotics and antiviral medications and wide spread fears need to be addressed. Policy makers and administrators should arrange workshops and training sessions for the staff. Health care workers need to avoid information from unauthentic sources and refer to only official communications from their ministry and/or other recognized international organizations such as CDC and WHO. Social media is known source of misinformation and may lead to myths and malpractices [18]. Therefore HCWs should not give any heed to such information. Psychological assessment and counselling are also required to protect the mental health of frontline workers.

In this study we comprehensively assessed the knowledge, attitude and practices of a diverse group of HCWs. However there are certain limitations which should be considered while interpreting findings of this study. First, given the COVID-19 pandemic and lockdown across the country, face-to-face interviews were not possible, therefore we designed this study as online survey in which it is possible that some of the respondents might have not understood the question properly and may not answer accurately. This however, we assume to be affecting our results minimally because we developed questionnaire based on previous studies specifically from Saudi Arabia and we also translated questionnaire to Arabic language for better understanding by some respondents. Second, in our sample there was over representation of participants from Qassim region. This, we assume to be a minor limitation as there is unified response at the country level for the prevention and control of COVID-19. There are standardized protocols and guidelines from MoH and Saudi CDC which are implemented across the country uniformly. Third, this was an open online survey where response rate cannot be ascertained. It is also possible that those responded might be different from those who did not respond despite receiving the survey link. This may limit the generalizability of our study. We did not do *a priori* sample size calculation given the open nature of survey and defined time period of data collection (3 weeks). However, we are able to reach a sample size which would give us absolute precision ranging from 1.5% to 5.0%. Additionally, composition of our sample with respect to gender and nationality among physicians and non-physicians was comparable to national health workforce statistics [19]. Finally, as the epidemic continues, more disease factors are evolving and staff knowledge and practices are changing.

5. CONCLUSION

We found the knowledge about the agent of the disease and role of antibiotics was poor among HCWs in Saudi Arabia which needs attention of policy makers. However, knowledge about the other aspects of disease such as modes of transmission and prevention was better. Worriedness and fears were present among majority of the HCWs which may affect their level of motivation. Infection control practices such as cleaning hands, wearing mask and educating people about the disease were also high. These findings call for targeted interventions such as timely orientation about emerging diseases, training on disease management and counseling services for worries and fears. Ensuring adequate infection control supplies and constructive supervision of staff practices can augment the overall performance.

CONFLICTS OF INTEREST

The authors declare they have no conflicts of interest.

AUTHORS' CONTRIBUTION

UR conceived the research idea and developed the proposal. Both UR and AMAS developed the study tool. UR analyzed the data and AMAS reviewed the results with UR. UR wrote the first draft and both edited the draft for final submission. Both the authors approved final version for publication.

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