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Knowledge and awareness of COVID-19 epidemic preparedness and response among health care workers in Makkah city

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Abstract

Objective: This study determined and examined the knowledge and awareness of COVID-19 pandemic preparedness and response measures by health care workers (HCWs) in Makkah city.

Methods: This descriptive study used a quantitative method with a cross-sectional design. A survey (questionnaire) collected data from 251 HCWs working in 10 hospitals and 80 health care centers.

Results: The total score for the knowledge level was high (range: 50–76, mean ± SD = 65.370 ± 4.805). There was a relationship between the participants' workplace and education levels to the nature of the disease ($p = 0.009$*, 0.037*, respectively). Job descriptions were related to the transmission of the disease ($p = 0.003$*). The participants' age groups and years of experience were also associated with their actions in suspected, probable, and confirmed cases ($p = 0.015$*, 0.03*, respectively). The HCWs' knowledge of precautionary measures was not related to their demographic data, except for the education level shown ($p = 0.037$*).

Discussion: A similar level of knowledge and awareness was detected in Saudi Arabia in Riyadh and Al-Jouf, the UAE, Vietnam, and Uganda. Further study is recommended to measure the factors affecting HCWs' knowledge and awareness during an epidemic situation.

Keywords: knowledge, health care workers, COVID-19, response, Makkah city

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Introduction

The coronavirus disease 2019 (COVID-19) is a unique virus that infects animals and humans. Although bats are acknowledged as its natural hosts, other animals, such as camels and civet cats, are counted among its sources.[1]

COVID-19 was first discovered in China and is genetically similar to the severe acute respiratory syndrome coronavirus 1 (SARS-CoV-1) virus, which killed thousands of people in 2002. The current COVID-19 outbreak has resulted in many reported cases worldwide. There is no cure yet for this virus. Also, since it is a new virus, no one has preexisting immunity, which implies that the entire human population is potentially susceptible to COVID-19 infection.[2]

The COVID-19 virus is transmitted from person to person. The virus is mainly transferred through respiratory droplets produced when people sneeze, cough, or exhale. The virus may also survive for many hours on surfaces like tables and doorknobs.[1]

The COVID-19 incubation period is expected to be between 2 and 14 days. Infected people exhibit flu-like symptoms that range in clinical presentation from a mild upper respiratory infection to rapidly progressive pneumonia and multi-organ

failure. The symptoms are fever, cough, difficulty breathing, muscle discomfort, and fatigue. In more extreme cases, severe pneumonia, acute respiratory distress syndrome, sepsis, and septic shock may result in mortality.[1]

Severe symptoms are more prevalent among the elderly and individuals with chronic health disorders such as hypertension, diabetes, cardiovascular disease, chronic respiratory illness, and cancer. Infections in children seem to be rare and minor. The illness severity of pregnant women after childbirth has yet to be explored. However, pregnant women follow the same COVID-19 preventive methods as any person.

The European Center for Disease Prevention and Control is monitoring the pandemic situation.[3] The current testing advice is based on the pandemic stage in the nation or region. Testing methods may also change depending on national legislation. All these are tailored to the circumstances at the local and national scales.[4]

Preventive measures include hand washing with soap and water, keeping away from other individuals who are unwell and from others in general as some people may be asymptomatic and self-isolating if symptoms are experienced while seeking medical attention.[5] As there is no particular therapy for this condition, health care practitioners address patients' clinical symptoms (e.g. fever and trouble breathing) using supportive treatment (e.g. hydration management and oxygen therapy), which may benefit individuals suffering from COVID-19 symptoms.

There is a growing corpus of academic studies on this subject. It is critical to examine the public's knowledge, attitude, and behavior regarding significant and widespread infectious illnesses. This information offers a baseline for preventing and controlling these illnesses by estimating the effect of previous government preventive initiatives and determining the need for further actions.[1]

The best way to prevent and slow down the transmission of COVID-19 is to make people well informed about it and how it spreads. The COVID-19 has already taken hold in Europe, the United States, and Southeast Asia and has begun to wreak havoc in Saudi Arabia.[2] There have been more than 141,984,507 cases, 120,515,040 recoveries, and 3,032,182 deaths worldwide.[3,5] In Saudi Arabia, where the first COVID-19 infection was declared by the Ministry of Health (MOH) on 2 March 2020, increased diagnostic examinations, preventive measures, vaccination, and preparedness measures to contain the spread of the disease led to 388,702 recoveries.[6]

Health care workers (HCWs) are the first line of defense against any disease outbreak, but their knowledge levels vary. HCWs in Lebanon have shown a satisfactory level of knowledge about COVID-19.[7] In Northern Ethiopia, the HCWs displayed good knowledge, good infection prevention practices, but disturbing psychological responses toward COVID-19.[8]

In a study of 500 HCWs in five regions of Saudi Arabia, most of the HCWs had excellent knowledge of COVID-19. Some HCWs reported significant prevention knowledge and treatment skills, while the rest had little expertise on COVID-19. More than half of the HCWs had strong positive attitudes toward caring for COVID-19 patients. However, non-Saudi nurses self-reported higher levels of knowledge and awareness, positive attitudes and perceptions, and optimal prevention skills compared to Saudi nurses.[9]

In Jeddah city, which has been seriously affected by the global pandemic, HCWs showed sufficient knowledge and positive attitudes toward COVID-19.[10] Jeddah is near Makkah city, which receives millions of Muslims around the world who do Umrah and Hajj yearly, considered among the largest mass gatherings in the world.[11,12] The importance of Makkah city motivated the researchers to conduct this study so as to examine the city HCWs' knowledge and awareness of the COVID-19 pandemic as well as their preparedness and response. This study examined the knowledge and awareness of COVID-19 pandemic preparedness and response measures by HCWs in Makkah city.

Methods

This descriptive study used a quantitative method with a cross-sectional design. A survey (questionnaire) collected data from 9,317 HCWs working in 10 hospitals and 80 health care centers. The HCWs included technicians, physicians, nurses,

pharmacists, social workers, dieticians, and paramedics in Makkah city to assess their preparedness and response to COVID-19. Ethical approval was granted by Makkah's Ethical Committee at the Ethical Approval Department of Makkah Health Affairs (no. H-02-K-076-0520-295). The survey started on 23 June 2020 and ended on 20 December 2020. The data were analyzed over 4 months.

Inclusion criteria

The following criteria for HCWs who were included in the survey:

- HCWs in Makkah city.
- Working in hospitals and health care centers in Makkah.
- Male or female.
- Saudi and non-Saudi.

Exclusion criteria

The following criteria for HCWs who were excluded from the survey:

- HCWs outside Makkah city.
- HCWs outside health care centers and hospitals.
- Employees other than HCWs.

Sample size calculation

The size of the study sample was calculated based on the number of HCWs in Makkah city in 2019: 9,317 workers. The researchers desired a degree of confidence of 95% with a type-I error (5%) and a power of the test of 90%, which required a minimum sample of 369 respondents.

Research rigor

A team of experts from the Medical Research Center at Hera General Hospital in Makkah city assessed the final questionnaire in this study for face validity and pilot-tested it on 20 people from the target group who were not involved in this study.

Survey composition

The research data were gathered using one tool: a structured questionnaire that examined the HCWs' knowledge and awareness of pandemics and their preparedness to face the COVID-19 pandemic. The survey was based on the knowledge scale factor load.[13] The base knowledge of the survey was gathered from the Centers for Disease Control and Prevention.[14]

The questionnaire had two main sections. The first section contains nine questions asked about the participants' demographic and socioeconomic data (age, gender, income, working experience, working place, and education). The second section covered the participants' COVID-19 epidemiological data.

The second section included 43 questions divided into four domains or fields of COVID-19 knowledge and awareness. The first domain was the nature of the disease, under which there were nine questions. The second domain was the transmission of the disease, with eight items. The third domain was the correct actions to deal with suspected, probable, and confirmed cases, with 22 items. The fourth and final domain was the precautionary measures, with four items. Thanks to expert translators familiar with the medical language, the survey was available in Arabic and English (see Table 1).

Data collection and analysis

The survey was distributed electronically through a link to a Google Form sent officially to the participants' official MOH emails and distributed on social media. A brief introductory message explained the aim of the study and the researchers' qualifications. The participants were informed of their right to withdraw from the survey before answering any questions. They were also made aware that their completion of the surveys would mean they were consenting to the researchers' inclusion of their answers in this study.

The questionnaire was open for 6 months. The participants' responses were collected directly from the Google Form and posted on an Excel sheet. Then the expert researchers analyzed them using SPSS v23 and determined significant values using the chi-square, mean, and standard deviation, as well as the results of a *T*-test and ANOVA, which they then organized into categories in tables.

The proportion of correct responses to the questionnaire's 43 questions was used to get the

Table 1. Knowledge scale factor load.

First domain: nature of the disease	**Yes**	**No**	**I do not know**
1. Do you know the symptoms of COVID-19?			
2. The diagnostic sample for COVID-19 is throat swab?			
3. The diagnostic sample for COVID-19 is blood test?			
4. Some types of fruit-eating bats are the main source of the disease in wildlife			
5. The causative agent of **COVID-19** is **COVID-19**			
6. **COVID-19** can be eliminated with 70% alcohol			
7. **COVID-19** can be prevented with the injection of a vaccine			
8. The incubation period of **COVID-19** is 2–14 days			
9. The **COVID-19** can survive for 48 hours in the environment			
Second domain: transmission of disease	**Yes**	**No**	**I do not know**
1. COVID-19 is transmitted through direct contact			
2. The disease can be transmitted through contact with contaminated Person-to-person			
3. The disease can be transmitted through someone without being sick?			
4. COVID-19 is spread from contact with contaminated surfaces or objects			
5. The virus that causes COVID-19 to be spreading easily and sustainably in the community ("community spread") are one of the sources of transmission of COVID-19 to human			
6. COVID-19 is probably transmissible community spread means people have been infected with the virus in an area, including some who are not sure how or where they became infected			
7. The disease can be transmitted from asymptomatic patients or those who are in the latent period of the disease			
Third domain: actions in dealing with suspected, probable, and confirmed cases	**Yes**	**No**	**I do not know**
1. The use of personal protective equipment is necessary during aerosol production procedures, such as preparing for community N95 respirators are the PPE most often used to control exposures to infections transmitted *via* the airborne route, though their effectiveness is highly dependent upon proper fit and use			
2. The complete collection of data, including disease history, clinical presentation, complications, and completion of the relevant form are required after confirmed diagnosis of COVID-19 infection			
3. Suspected cases of COVID-19 infection after triage should be taken into care in a respiratory isolation room			
4. Training and observation of standard precautionary measures are required by care-giving staff in suspected and probable cases of COVID-19 infection			
5. It is advisable to sample all respiratory secretions from all patients admitted to the hospital with a primary diagnosis of pneumonia and suspicion of COVID-19 infection			
6. Suspected and probable cases of COVID-19 infection must be reported immediately to the infectious disease control center			

(Continued)

Table 1. (Continued)

Third domain: actions in dealing with suspected, probable, and confirmed cases	Yes	No	I do not know
7. A complete list should be provided of all people who have been in contact with the confirmed patient with COVID-19 infection			
8. The use of N95 masks is necessary when sampling of induced sputum from patients suspected of COVID-19 infection			
9. Avoid the visitors to patients with suspected, probable and confirmed cases of COVID-19 infection			
10. The number of caregiving personnel for suspected, probable, and confirmed cases of COVID-19 infection, including physicians and nurses, should be limited and certain			
11. Exposed people with symptoms of fever, cough, and diarrhea should have sputum samples taken and PCR testing			
12. Admitted patients should be hospitalized in the respiratory isolation room, preferably with negative pressure			
13. All members of the family of a patient with COVID-19 infection are considered to have a history of contact with the disease			
14. If no isolation room is available, patients with a diagnosis of COVID-19 infection can be put in the same room with beds 1 m apart			
15. After confirming the diagnosis of COVID-19 infection, patient's contacts in the past 14 days must be checked and controlled			
16. After diagnosis of COVID-19 infection, it is necessary to find possible patients among those who have been in contact with the patient			
17. The N95 mask is required to be put on when entering the room of a patient with COVID-19 infection and caring at a distance of 2 m from the patient			
18. A person with mild symptoms of COVID-19 infection must remain at home until resolution of clinical symptoms and negative results of the PCR test			
19. Patients with COVID-19 infection admitted to an isolation room should use a surgical mask when moving and leaving the room for diagnostic and therapeutic procedures			
20. All surfaces contaminated by the patients with COVID-19 infection should be cleaned with diluted bleaching solution			
Fourth domain: HCWs' precautionary measures	**Yes**	**No**	**I do not know**
1. Droplet precautions should be followed by health care providers in dealing with suspected, probable, and confirmed cases of COVID-19 infection			
2. Contact precautions should be followed by health care providers in dealing with suspected, probable, and confirmed cases of COVID-19 infection			
3. People in the high-risk group with heart, lung and kidney disease can be selected as care providers at home and in hospital			
4. Standard precautions should be followed by health care providers in dealing with suspected, probable, and confirmed cases of COVID-19 infection			
5. Airborne precautions should be followed by health care providers in dealing with suspected, probable, and confirmed cases of COVID-19 infection			

COVID-19, coronavirus disease; HCW, health care workers; PCR: polymerase chain reaction; PPE, personal protective equipment.

Table 2. Nature of the disease domain.

Items	Nature of the disease						Chi-square	
	No.		I do not know		Yes			
	N	%	*N*	%	*N*	%	χ^2	*p* value
1. Are you aware of the updated definition of COVID-19?	13	5.2	11	4.4	227	90.4	368.351	0.000
2. Do you know the symptoms of COVID-19?	0	0.0	0	0.0	251	100.0	–	–
3. Is the diagnostic sample for COVID-19 a throat swab?	65	25.9	2	0.8	184	73.3	204.199	0.000
4. Is the diagnostic sample for COVID-19 a blood test?	218	86.9	6	2.4	27	10.8	326.159	0.000
5. The causative agent of COVID-19 is COVID-19	36	14.3	23	9.2	192	76.5	211.418	0.000
6. We can eliminate the COVID-19 virus by 70% using alcohol	59	23.5	37	14.7	155	61.8	94.120	0.000
7. COVID-19 can be prevented with the injection of a vaccine	118	47.0	67	26.7	66	26.3	21.139	0.000
8. The incubation period of COVID-19 is 2–14 days	4	1.6	7	2.8	240	95.6	438.223	0.000
9. The COVID-19 virus can survive for 48 hours in the environment	40	15.9	47	18.7	164	65.3	115.992	0.000

COVID-19, coronavirus disease.

overall score. Categorical variables were expressed in percentages, while continuous variables were presented as means and standard deviations. The Kolmogorov–Smirnov test was performed to determine whether the data had a normal distribution or not and the type of test used.

Results

A total of 260 participants responded to the survey. Nine participants were working outside the Makkah region and were excluded from the data, so 251 participants were ultimately included.

Demographic data

Both genders responded to the survey. There were 161 female participants (64.1%) and 90 male participants (35.9%). Sixty-two were 20–30 years of age (24.7%), 116 were 31–40 (46.2%), and 73 were 40 or above (29.1%). The hospital setting was the most common workplace, as it was the workplace of 187 participants (74.5%), while 59 worked in health care centers (23.5%) and five worked in other locations (2%). There were 157 nurses (62.5%), 63 physicians (25.1%), 3 technicians (1.2%), and 28 in other roles (11.2%). A total of 148 respondents (59.0%) had 9–15 years of experience, 55 (21.9%) had 3–9 years, 28 (11.2%) had 1–3 years, 16 (6.4%) had less than 1 year, and 4 (1.6%) had more than 15 years. Half of the respondents (128) had a bachelor's degree, 75 had a diploma (29.9%), 35 (13.9%) had a master's degree, 10 (4%) had a higher education degree, and 3 (1.2%) did not specify their educational achievement.

Knowledge and awareness level

Of the four domains (nature of the disease; transmission of the disease; actions dealing with suspected, probable, and confirmed cases; and HCWs' precautionary measures).

A total of 183 (72.91%) participants showed a moderate level of knowledge of the nature of the disease. The range of their knowledge level to the nature of the disease was 6–18, and the mean ± SD = 12.087 ± 1.969 (see Table 2). A total of 206 (82.07%) participants showed a high

Table 3. Transmission of disease domain.

Items	Transmission of disease						Chi-square	
	No.		I don't know		Yes			
	N	%	*N*	%	*N*	%	χ^2	*p* value
1. COVID-19 is transmitted through direct contact	30	12.0	2	0.8	219	87.3	333.044	0.000
2. COVID-19 is transmitted through indirect contact	99	39.4	10	4.0	142	56.6	108.343	0.000
3. COVID-19 is transmitted through the airborne route	122	48.6	10	4.0	119	47.4	97.347	0.000
4. COVID-19 is transmitted through the droplet route	6	2.4	2	0.8	243	96.8	455.243	0.000
5. The disease can be transmitted through contact with a contaminated person	7	2.8	4	1.6	240	95.6	438.223	0.000
6. The disease can be transmitted from asymptomatic patients	41	16.3	5	2.0	205	81.7	271.681	0.000
7. COVID-19 spreads from contact with contaminated surfaces or objects	4	1.6	5	2.0	242	96.4	449.458	0.000
8. The disease can be transmitted from those who are in the latent period of the disease	34	13.5	22	8.8	195	77.7	223.084	0.000

COVID-19, coronavirus disease.

level of knowledge of the transmission of disease. The range of their knowledge level to the transmission of disease was 8–16 and the mean ± SD = 13.051 ± 2.014 (see Table 3). A total of 191 (76.10%) participants were highly knowledgeable about dealing with suspected, probable, and confirmed cases. The range was 24–42 and the mean ± SD = 34.577 ± 3.420 (see Table 4). A total of 207 (82.47%) participants were highly knowledgeable about precautionary measures. The content was 0, and the mean ± SD = 5.6534 ± 0.9052 (see Table 5). The total score for the knowledge level was high, as the range was 50–76 and the mean ± SD = 65.370 ± 4.805 (see Table 6).

Relationships between demographic data and domains

The HCWs' age group, gender, job description, and years of experience were statistically unrelated to the nature of the disease domain. On the contrary, the HCWs' workplace and education level were significantly related to the nature of the disease domain (*p* values = 0.009* and 0.037*, respectively; see TABLE7Table 7). The age group, gender, workplace, education level, and years of experience were not related to the transmission of the disease domain. However, the job descriptions were related to the transmission of the disease domain (*p* value = 0.003*; see Table 8).

The actions to deal with suspected, probable, and confirmed COVID-19 cases were unrelated to the participants' gender, workplace, job description, and education level. However, the participants' age group and years of experience were related to their actions to deal with suspected, probable, and confirmed cases (*p* values = 0.015* and 0.03*, respectively; see Table 9).

The precautionary measures taken by health care providers were unrelated to their demographic data but were related to their education level,

Table 4. Actions dealing with suspected, probable, and confirmed cases domain.

Items	Actions in dealing with suspected, probable, and confirmed cases						Chi-square	
	No.		I do not know		Yes			
	N	%	*N*	%	*N*	%	χ^2	*p* value
1. The use of personal protective equipment (PPE) is necessary to deal with COVID-19 cases	1	0.4	0	0.0	250	99.6	247.016b	0.000
2. Caregivers must have training and observe standard precautionary measures for suspected and probable cases of COVID-19 infection	0	0.0	0	0.0	251	100.0	–	–
3. N95 respirators are the PPE most often used to control the spread of COVID-19	102	40.6	12	4.8	137	54.6	99.402	0.000
4. Surgical masks are the PPE most often used to control the spread of COVID-19 virus	37	14.7	1	0.4	213	84.9	307.633	0.000
5. Suspected cases of COVID-19 infection after triage should be taken into care in a respiratory isolation room	25	10.0	5	2.0	221	88.0	340.526	0.000
6. It is advisable to sample all respiratory secretions from all patients admitted to the hospital with a primary diagnosis of pneumonia and suspicion of COVID-19 infection	36	14.3	24	9.6	191	76.1	207.402	0.000
7. Suspected and probable cases of COVID-19 infection must be reported immediately to the infectious disease control center	5	2.0	10	4.0	236	94.0	416.183	0.000
8. A complete list should be provided of all people who have been in contact with the patient with a confirmed COVID-19 infection	5	2.0	3	1.2	243	96.8	455.171	0.000
9. Avoid allowing visitors to patients with suspected, probable, and confirmed cases of COVID-19 infection	0	0.0	4	1.6	247	98.4	235.255b	0.000
10. All family members of a patient infected by COVID-19 may be considered infected by a COVID-19	89	35.5	8	3.2	154	61.4	127.896	0.000
11. The number of caregiving personnel with suspected, probable, and confirmed cases of COVID-19, including physicians and nurses, should be limited and certain	21	8.4	18	7.2	212	84.5	295.323	0.000
12. After the diagnosis of the COVID-19 infection, it is necessary to find possible patients among people who have been in contact with the patient	7	2.8	6	2.4	238	94.8	427.036	0.000
13. The use of full PPE is necessary when sampling induced sputum from patients suspected of COVID-19 infection	0	0.0	1	0.4	250	99.6	247.016b	0.000

(Continued)

Table 4. (Continued)

Items	Actions in dealing with suspected, probable, and confirmed cases						Chi-square	
	No.		I do not know		Yes			
	N	%	*N*	%	*N*	%	χ^2	*p* value
14. The use of N95 masks is enough protection when sampling induced sputum from patients suspected of COVID-19 infection	132	52.6	8	3.2	111	44.2	105.283	0.000
15. The use of surgical masks is enough protection when sampling induced sputum from patients suspected of COVID-19 infection	196	78.1	10	4.0	45	17.9	233.554	0.000
16. Exposed people with symptoms of fever, cough, and diarrhea should have sputum samples taken	23	9.2	7	2.8	221	88.0	339.665	0.000
17. When the doctor makes the decision to admit a patient, he/she should be admitted to be hospitalized in a negative pressure room	46	18.3	24	9.6	181	72.1	172.741	0.000
18. If no isolation room is available, patients with a COVID-19 diagnosis can be admitted in a room distanced from other beds	38	15.1	16	6.4	197	78.5	233.171	0.000
19. A person with mild symptoms of a COVID-19 infection must be isolated at home until the resolution of clinical symptoms and negative results of the sample test	9	3.6	5	2.0	237	94.4	421.610	0.000
20. Patients with COVID-19 infection admitted to an isolation room should use a surgical mask when moving around and leaving the room for diagnostic and therapeutic procedures	18	7.2	6	2.4	227	90.4	369.187	0.000
21. All surfaces contaminated by patients with COVID-19 should be cleaned with a sterile solution	33	13.1	15	6.0	203	80.9	257.243	0.000
22. A patient with COVID-19 can usually receive a second throat swab after 10 days	69	27.5	10	4.0	172	68.5	160.693	0.000

COVID-19, coronavirus disease; PPE, personal protective equipment.

Table 5. HCWs' precautionary measures.

Items	HCWs' precautionary measures						Chi-square	
	No.		I do not know		Yes			
	N	%	*N*	%	*N*	%	χ^2	*p* value
1. Health care providers should follow standard precautions when dealing with suspected, probable, and confirmed cases of COVID-19	4	1.6	1	0.4	246	98.0	472.502	0.000
2. Health care providers should follow droplet precautions when dealing with suspected, probable, and confirmed cases of COVID-19	4	1.6	1	0.4	246	98.0	472.502	0.000
3. Health care providers should follow contact precautions when dealing with suspected, probable, and confirmed cases of COVID-19	6	2.4	2	0.8	243	96.8	455.243	0.000
4. Health care providers should follow airborne precautions when dealing with suspected, probable, and confirmed cases of COVID-19	34	13.5	5	2.0	212	84.5	300.295	0.000

HCW, health care workers; COVID-19, coronavirus disease.

which significantly differed (p value = 0.037*; see Table 10). The connection between the participants' demographic data and their total scores for the domains were unrelated to all their demographic data, except to their workplace, which significantly differed (p value = 0.008*; see Table 11).

Discussion

An online survey measured Makkah HCWs' knowledge and awareness of COVID-19 and their preparedness for and response to the pandemic. More than half of the participants were women (161, 64.1%), most likely because nursing is regarded as a female-dominant profession, as it was established by the efforts of Florence Nightingale in the 19th century.[15] According to the findings of this study in terms of age and education level, the majority of the HCWs in this study (46.2%) were between the ages of 31 and 40, and half of the respondents (128, 51%) had a bachelor's degree. These results are similar to those of Al-Rasheedi *et al.*,[16] in which the majority of the participants (66%) had a bachelor's degree and around 75% were 20–40 years old. The focus of this study was whether health care providers are aware of the condition they are fighting and if they are helping to eliminate it. COVID-19 is well-known for sneaking up on the Saudi nation just as it was preparing to deal with the outbreak. In Saudi Arabia, no prior study had been conducted to establish how aware health care

Table 6. Knowledge and awareness scores.

Domains	Weak		Average		High		Score	
	N	%	*N*	%	*N*	%	Range	Mean ± SD
Nature of the disease	11	4.38	183	72.91	57	22.71	6–18	12.087 ± 1.969
Transmission of disease	0	0.00	45	17.93	206	82.07	8–16	13.051 ± 2.014
Actions dealing with suspected, probable, and confirmed cases	0	0.00	60	23.90	191	76.10	24–42	34.577 ± 3.420
HCWs' precautionary measures	3	1.20	41	16.33	207	82.47	0–8	5.6534 ± 9.052
Total	0	0.00	95	37.85	156	62.15	50–76	65.370 ± 4.805

HCW, health care workers; SD, standard deviation.

personnel and other Saudi people were of COVID-19 and how prepared they were for it.

The participants in this study showed a moderate level of knowledge and awareness of the nature of the disease, which was inconsistent with the results of the study conducted in the Qassim region. The researchers found that 129 of the 130 participants were aware of COVID-19.[16] However, in this study, 95.6% of the participants recognized the correct incubation period of the virus, similar to the findings of Al-Rasheedi *et al.*[16]

A similar level of knowledge and awareness was detected in Riyadh[17,18] and Al-Jouf[19] in Saudi Arabia and in the UAE,[20] Vietnam,[21] and Uganda.[22] Nour *et al.*[23] assessed the knowledge, attitudes, and practices (KAP) of health care providers in public hospitals in Makkah with regard to the MERS-CoV infection and evaluated the effectiveness of a health education intervention to improve KAP. Significant post-intervention improvements were found in the median scores for knowledge ($p < 0.001$) and attitudes ($p = 0.022$), and in the cumulative KAP ($p < 0.001$). The scores improved irrespective of the age group and the gender.[23] These results support this study's finding that the HCWs were moderately knowledgeable of the nature of the disease.

In this study, 207 participants (82.47%) were highly knowledgeable about the precautionary measures. The range was 0–8 and the mean ± SD = 5.6534 ± 0.9052. These results are in line with those of Tripathi *et al.*[24] that most of the respondents knew that COVID-19 is transmitted through human-to-human contact (97.7%). Hand hygiene (92.7%), and social distancing (92.3%) were the most common preventive measures that the respondents took, followed by avoiding travel (86.9%) to an infected area or country, and wearing face masks (86.5%). An overwhelming 88% of the participants were familiar with the associated symptoms and common causes of COVID-19, similar to Tripathi *et al.*[24]

The participants' age, gender, and area were insignificant predictors of COVID-19 knowledge and awareness by Tripathi *et al.*,[24] as they were in this study, except for the relationship between the job description and the transmission of the disease domain (p value = 0.003*). A total of 157 nurses participated in this study (62.5%), which reflects a high total knowledge level, as the range was 50–76 and the mean ± SD = 65.370 ± 4.805. Similarly, in a study done in radiology departments in Saudi Arabia again through a survey, 234 HCWs (91%) replied that they had good knowledge of the precautions needed to examine positive COVID-19 cases in radiology departments, and 216 (84%) answered that they knew the necessary precautions when using a portable X-ray machine.[25] These results reflect that among HCWs in Saudi Arabia, nurses, and radiologists generally have the same level of knowledge.

COVID-19 awareness and knowledge increased by combining characteristics such as specialization, degree of education, and wealth. HCWs between the ages of 20 and 30 were particularly

Table 7. Relationships between demographic data and the nature of the disease.

		N	Nature of the disease			T or F	*T*-test or ANOVA	
			Mean	±	SD		Test value	*p* value
Gender	Female	161	12.050	±	1.836	T	−0.408	0.684
	Male	90	12.156	±	2.198			
Age	20–30	62	12.048	±	2.092	F	0.070	0.932
	31–40	116	12.138	±	2.085			
	40 or above	73	12.041	±	1.679			
Working place	Hospital	187	11.914	±	1.882	F	4.779	0.009*
	Health care center	59	12.458	±	1.959			
	Other	5	14.200	±	3.633			
Job description	Physician	63	11.889	±	1.567	F	0.296	0.828
	Nurse	157	12.166	±	2.115			
	Technician	3	12.000	±	0.000			
	Other	28	12.107	±	2.079			
Years of experience	<1	16	12.375	±	2.156	F	1.782	0.133
	1–3	28	12.000	±	2.373			
	3–9	55	11.491	±	1.643			
	9–15	148	12.291	±	1.970			
	>15	4	12.250	±	1.258			
Education level	Higher education	10	11.600	±	1.838	F	2.594	0.037*
	Diploma	75	12.653	±	2.121			
	Bachelor	128	11.867	±	1.884			
	Masters	35	11.743	±	1.837			
	Other	3	13.000	±	1.000			

ANOVA, analysis of variance; SD, standard deviation.

knowledgeable about COVID-19, which may be attributed to their involvement in COVID-19 initiatives on either prevention or treatment of the infected.

Infectious illness outbreaks, such as SARS, avian influenza, and the influenza strain H1N1, have been the subject of several investigations. However, a literature search has yielded no public awareness of coronavirus in Saudi Arabia. As a result, the government might find the information gathered from this poll of the general public useful for its development of preventive measures in the event of another pandemic.

Table 8. Relationships between demographic data and the transmission of disease.

		N	Transmission of disease			T or F	*T*-test or ANOVA	
			Mean	±	SD		Test value	*p* value
Gender	Female	161	12.907	±	2.024	T	−1.529	0.128
	Male	90	13.311	±	1.981			
Age	20–30	62	13.339	±	1.679	F	1.015	0.364
	31–40	116	12.888	±	2.113			
	40 or above	73	13.068	±	2.110			
Working place	Hospital	187	13.075	±	1.885	F	0.048	0.953
	Health care center	59	12.983	±	2.453			
	Other	5	13.000	±	1.000			
Job description	Physician	63	13.857	±	1.615	F	4.740	0.003*
	Nurse	157	12.796	±	2.044			
	Technician	3	12.333	±	2.887			
	Other	28	12.750	±	2.188			
Years of experience	<1	16	13.938	±	1.611	F	1.790	0.131
	1–3	28	13.500	±	1.915			
	3–9	55	12.636	±	1.975			
	9–15	148	13.014	±	2.050			
	>15	4	13.500	±	2.517			
Education level	Higher education	10	14.300	±	1.947	F	1.881	0.114
	Diploma	75	12.680	±	1.925			
	Bachelor	128	13.125	±	2.031			
	Masters	35	13.286	±	2.052			
	Other	3	12.333	±	2.082			

ANOVA, analysis of variance; SD, standard deviation.

Limitations

The researchers used a survey due to strict curfew and health regulations during the pandemic. The researchers avoided writing the respondents' names on the survey questionnaire to prevent bias, as the participants and the researchers might have known each other. The researchers only sent the respondents an official email to offer them further information if needed. Since this study was conducted during the early stages of the Makkah COVID-19 pandemic, it had a small sample size. The researchers' ability to reach out to the targeted population was restricted due to the pandemic lockdown, so the researchers performed a self-reported poll online. Access by the respondents

Table 9. Relationships between demographic data and the actions in dealing with suspected, probable, and confirmed cases.

		N	Actions in dealing with suspected, probable and confirmed cases			T or F	*T*-test or ANOVA	
			Mean	±	SD		Test value	*p* value
Gender	Female	161	34.627	±	3.382	T	0.307	0.759
	Male	90	34.489	±	3.507			
Age	20–30	62	33.516	±	3.861	F	4.302	0.015*
	31–40	116	34.793	±	2.815			
	40 or above	73	35.137	±	3.739			
Working place	Hospital	187	34.299	±	3.593	F	2.698	0.069
	Health care center	59	35.305	±	2.781			
	Other	5	36.400	±	1.817			
Job description	Physician	63	34.857	±	2.890	F	0.622	0.601
	Nurse	157	34.484	±	3.681			
	Technician	3	32.333	±	4.726			
	Other	28	34.714	±	2.904			
Years of experience	<1	16	32.438	±	4.427	F	2.724	0.03*
	1–3	28	34.000	±	3.722			
	3–9	55	34.418	±	2.644			
	9–15	148	34.912	±	3.413			
	>15	4	37.000	±	3.830			
Education level	Higher education	10	34.300	±	4.322	F	1.808	0.128
	Diploma	75	35.187	±	3.408			
	Bachelor	128	34.078	±	3.408			
	Masters	35	34.971	±	3.129			
	Other	3	37.000	±	1.732			

ANOVA, analysis of variance; SD, standard deviation.

to a computer and the Internet to answer the survey was considered a challenge due to their inability to use the Internet, which affected the sample size. However, the researchers thought the main reason for the small sample size was the work overload of the HCWs during the pandemic.

Summary and recommendations

This study examined the knowledge and awareness of COVID-19 pandemic preparedness and response among HCWs in Makkah city. The total score for their knowledge level was high (50–76 and mean ± SD = 65.370 ± 4.805). In terms of the demographic data, there was a relationship

Table 10. Relationships between demographic data and the precautionary measures by health care providers.

		N	Precautionary measures by health care providers			T or F	*T*-test or ANOVA	
			Mean	±	SD		Test value	*p* value
Gender	Female	161	5.696	±	0.895	T	0.989	0.323
	Male	90	5.578	±	0.924			
Age	20–30	62	5.629	±	0.996	F	0.031	0.970
	31–40	116	5.664	±	0.874			
	40 or above	73	5.658	±	0.885			
Working place	Hospital	187	5.588	±	0.993	F	1.996	0.138
	Health care center	59	5.831	±	0.562			
	Other	5	6.000	±	0.000			
Job description	Physician	63	5.571	±	1.027	F	1.556	0.201
	Nurse	157	5.707	±	0.834			
	Technician	3	4.667	±	2.309			
	Other	28	5.643	±	0.780			
Years of experience	<1	16	5.875	±	0.500	F	0.979	0.420
	1–3	28	5.786	±	0.568			
	3–9	55	5.491	±	1.230			
	9–15	148	5.655	±	0.855			
	>15	4	6.000	±	0.000			
Education level	Higher education	10	4.800	±	1.033	F	2.593	0.037*
	Diploma	75	5.760	±	0.654			
	Bachelor	128	5.641	±	0.876			
	Masters	35	5.714	±	1.296			
	Other	3	5.667	±	0.577			

ANOVA, analysis of variance; SD, standard deviation.

between the participants' workplace and education levels and the Nature of the disease domain (p-values = 0.009* and 0.037*, respectively). Job descriptions were related to the Transmission of the disease domain (p-value = 0.003*). The participants' age groups and years of experience were also associated with their actions in suspected, probable, and confirmed cases (p-value = 0.015* and 0.03*, respectively). The HCWs' knowledge of precautionary measures was not related to their demographic data, except for the education level, with significant differences (p-value = 0.037*).

Table 11. Participants' demographic data and total score for the domains.

		N	Total			T or F	*T*-test or ANOVA	
			Mean	±	SD		Test value	*p* value
Gender	Female	161	65.280	±	4.925	T	−0.401	0.689
	Male	90	65.533	±	4.606			
Age	20–30	62	64.532	±	5.533	F	1.430	0.241
	31–40	116	65.483	±	4.418			
	40 or above	73	65.904	±	4.706			
Working place	Hospital	187	64.877	±	4.806	F	4.931	0.008*
	Health care center	59	66.576	±	4.496			
	Other	5	69.600	±	4.561			
Job description	Physician	63	66.175	±	4.305	F	1.418	0.238
	Nurse	157	65.153	±	4.907			
	Technician	3	61.333	±	9.866			
	Other	28	65.214	±	4.614			
Years of experience	<1	16	64.554	±	4.281	F	2.091	0.083
	1–3	28	65.286	±	5.623			
	3–9	55	64.036	±	4.367			
	9–15	148	65.872	±	4.607			
	>15	4	68.750	±	5.123			
Education level	Higher education	10	65.000	±	5.598	F	1.573	0.182
	Diploma	75	66.280	±	4.373			
	Bachelor	128	64.711	±	4.856			
	Masters	35	65.714	±	5.228			
	Other	3	68.000	±	2.000			

ANOVA, analysis of variance; SD, standard deviation.

Finally, the HCWs' total scores for the four domains showed no relation to all their demographic data, except for their workplace, which had significant differences (p-value = 0.008*). Further study is recommended to measure the factors that affect HCWs' knowledge and awareness during a pandemic situation. Moreover, we hope this study might motivate the government and the health sector to raise HCWs' knowledge and awareness of COVID-19.

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Author contributions

Asrar Mansoor Alrajhi: Project administration; Writing – original draft; Writing – review & editing.

Waleed Abdul-Halim Hussain: Resources; Supervision.

Basmah Amin Rafie: Supervision; Writing – review & editing.

Mehar Taj: Formal analysis; Methodology; Writing – original draft.

Abdelaziz Moustafa Elgarf: Data curation; Formal analysis; Investigation; Validation.

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