Patient Preference and Adherence

Dovepress

open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

General Public Knowledge of Coronavirus Disease 2019 (COVID-19) at Early Stages of the Pandemic: A Random Online Survey in Saudi Arabia

This article was published in the following Dove Press journal:
Patient Preference and Adherence

Ali Alqahtani[1]
Afaf Aldahish[1]
V Krishnaraju[1]
Mona Alqarni[2]
Mohammed Al-Sheikh Hassan[3]

[1]Department of Pharmacology, College of Pharmacy, King Khalid University, Abha, Saudi Arabia; [2]Medical Services Company by AbbVie Biopharmaceutical, Jeddah, Saudi Arabia; [3]Faculty of Health and Life Sciences, De Montfort University, Leicester, UK

Background: A novel coronavirus was identified at the end of 2019 in Wuhan City, China. Later, it was named as coronavirus disease 2019 (COVID-19) and declared a pandemic in March 2020. Saudi and global health agencies have provided various COVID-19 knowledge tools and facts to the general public. Therefore, this study aims to assess COVID-19 knowledge among the general public in Saudi Arabia at the early stages of the pandemic.

Participants and Methods: A cross-sectional study was conducted in March 2020 in Saudi Arabia. The study included 1006 participants who responded to a random online COVID-19 public knowledge questionnaire that included five sections: demographic characteristics, general knowledge, prevention practices, home quarantine measures, and knowledge of governmental restrictions. Three levels of knowledge were established: excellent, intermediate, and poor. Differences in the percentages of participants with different knowledge levels by the demographic variables were analyzed using the chi-square test.

Results: Regarding overall general knowledge of COVID-19, 75%, 24%, and 1% of the participants had excellent, intermediate, and poor knowledge levels, respectively. Knowledge levels were significantly different by nationality and age (P=0.027 and 0.008, respectively). Most participants (98.4%) reported excellent knowledge of prevention practices, with no statistically significant differences among groups (P>0.005). Older age groups reported higher knowledge of home quarantine measures (86.6% and 86.4% of the 51–60 and older than 60 age groups, respectively, P=0.001).

Conclusion and Recommendations: High levels of knowledge about the virus, including prevention practices, are essential. The provision of COVID-19 facts and knowledge tools should be focused on younger generations to enhance compliance with the governmental restrictions required to stop the spread of COVID-19.

Keywords: coronavirus, COVID-19, knowledge, prevention, quarantine, pandemic, Saudi Arabia

Introduction

To date, six different coronaviruses (CoVs) [OC43,[1,2] 229E,[1,2] NL63,[3,4] HKU1,[3,4] severe acute respiratory syndrome coronavirus (SARS-CoV)[5,6] and Middle East respiratory syndrome coronavirus (MERS-CoV)][5,6] have been identified in humans. Of these six CoVs, the first four were endemic, and the last two were epidemic. In

Correspondence: Mohammed Al-Sheikh Hassan
Faculty of Health and Life Sciences, De Montfort University, The Gateway, Leicester, LE1 9BH, UK
Email P17236771@my365.dmu.ac.uk

submit your manuscript | www.dovepress.com
DovePress
http://doi.org/10.2147/PPA.S300641

general, endemic CoVs produce mild infections[7] and does not harm humans to a greater extent. However, the two epidemic CoVs that have emerged in humans in the last 2 decades, SARS-CoV in 2003 and MERS-CoV in 2012, had devastating consequences. Notably, both epidemic CoVs belonged to beta CoV subgroups, and the outbreaks resulted in high case fatality rates. SARS-CoV affected at least 8000 individuals with a case fatality rate of approximately 10%,[8] whereas MERS-CoV affected more than 2000 people, and the case fatality rate was approximately 35%.[9]

Recently, a more virulent CoV was identified at the end of 2019 in Wuhan, a city in Hubei Province of China.[7] The virus was temporarily named 2019 novel coronavirus (2019-nCoV) by the World Health Organization (WHO).[10] On February 11, 2020, the WHO named the virus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the disease caused by the virus coronavirus disease 2019 (COVID-19).[11] In a short period, SARS-CoV-2 spread rapidly and resulted in an epidemic throughout China, followed by an increasing number of cases in other countries throughout the world. Based on this global spread of SARS-CoV-2, a pandemic was declared by the WHO on March 11, 2020.[12]

SARS-CoV-2 can be transmitted by both symptomatic[13] and asymptomatic individuals.[14] SARS-CoV-2 is reported to have an incubation period of 14 days,[15,16] with a median incubation period of 4 days[16] to 5.1 days.[17] The severity of COVID-19 symptomatic infection ranges from mild to critical. Most infections are not severe.[16] The severity depends predominantly on advanced age or underlying medical comorbidities. Various clinical studies have reported COVID-19 case fatality rates from 0.7% to 7.2%[13,18,19] with notably increased mortality rates associated with older age. Among the clinical manifestations, pneumonia appears to be the most frequent, primarily accompanied by fever, fatigue, dry cough, anorexia, myalgias, dyspnoea, and bilateral infiltrates on chest imaging.[7,20,21]

Advice for the public has been provided by the WHO for the prevention of COVID-19, which included wearing masks, physical distancing, hands cleaning, avoiding crowded areas, maintaining well ventilated residential places, and coughing into a bent elbow or tissue.[22] Besides, cultural factors are found to have essential impact on the control of infections, which require these factors to be rooted and acknowledged in prevention efforts that includes measures such as avoidance of social gatherings.[23]

Saudi Arabia reported the first case of COVID-19 on March 2nd, 2020, for a person who arrived from Iran through the Kingdom of Bahrain.[24] Consequently, newly recorded cases of COVID-19 continued to increase, and the first reported death in Saudi Arabia was recorded on March 24th, 2020.[25] Due to the rapid spread of COVID-19 across countries and the increasing number of reported cases and deaths, the Saudi government imposed extreme restrictions to control the spread of COVID-19, which included closing schools and universities, banning domestic and international travel, and temporarily suspending group prayers at mosques, including Umrah at the holy mosque in Makkah. Moreover, local and global health agencies started to provide various COVID-19 knowledge tools and information for the general public. Therefore, this study aimed to assess COVID-19 knowledge among the general public in Saudi Arabia, including knowledge of prevention practices, home quarantine measures, and compliance with governmental restrictions at the early stages of the pandemic, which provides a base for further knowledge tracking studies during different stages of the pandemic.

Participants and Methods

Study Design

A cross-sectional study was conducted in March 2020 during the early stages of the COVID-19 pandemic. Data were collected using Google Forms, through which an online questionnaire was randomly circulated on social media platforms such as Twitter, Facebook, and WhatsApp in the Kingdom of Saudi Arabia with no consideration as to the geographic location of participants. Each participant could provide one input only without duplication. Additionally, the circulation of the questionnaire on multiple online and social media platforms enhanced the accessibility to the tool, which minimized any potential sampling bias. The study collected responses from the general public regardless of their demographic characteristics or their degree of risk for acquiring COVID-19. Responses were collected for one week until no more responses were received. Raosoft[26] sample calculation software recommended a minimum of 385 subjects using the total Saudi population size of people aged 15 years or older of 25,828,206,[27] response distribution of 50%, confidence interval of 95%, and margin of error of 5%. A total of 1363 responses were received, including responses from 357 healthcare workers, which were

excluded from this study. The final sample consisted of 1006 random responses from the Kingdom of Saudi Arabia. The study included subjects of both genders who were at least 15 years old. Ethical approval was obtained by the research ethics committee at King Khaled University in Abha, Saudi Arabia (Reference ECM# 2020-2018 – HAPO-06-01). The ethics committee approved the voluntary participation of subjects under 18 years on their own. Participants were asked to take part in the study voluntarily and to not provide personal or identity-revealing information. A statement was included in the questionnaire explaining the purpose of the study. Participants' completion of the questionnaire was considered consent to participate in the study.

Study Tools

Data were collected using a questionnaire that was designed based on the latest general public information on COVID-19 published by the Centers for Disease Control and Prevention, the Saudi Ministry of Health, and the Saudi Center for Disease Prevention and Control.[10,28,29] The questionnaire comprised five sections: demographic data, general COVID-19 knowledge, prevention practices knowledge, home quarantine knowledge, and knowledge of governmental measures to stop the spread of COVID-19. Questions were prepared and arranged according to pretested available questionnaires designed to assess public knowledge and awareness of infectious diseases.[30] Furthermore, except for the high-risk group question, which had four choices with one most appropriate answer, all the other questions had three options: as "Yes", "No", and "I do not know". The most appropriate answers were considered the correct responses and scored "one", while inappropriate answers and "I do not know" answers were considered incorrect responses and scored "zero". The reliability of the questionnaire's sections was evaluated by conducting a pilot study on 87 participants. Cronbach's alpha coefficients were as follows: general knowledge=0.82, prevention knowledge=0.76, home quarantine knowledge =0.69 and governmental restrictions knowledge=0.76. Similarly, the scientific credibility and validity of the tool was evaluated by three independent public health preventive medicine experts, who provided feedback on the accuracy, relevance, and simplicity of the included questions and statements with reference to the knowledge sources used to create the questionnaire, which resulted in the improved clarity and presentation of all items. Likewise,

Statistical Analysis

Three levels of knowledge were established: excellent, intermediate, and poor. Moreover, the scores were classified in three close intervals as follows: two-thirds and more correct responses were considered "excellent", one-third to less than two-thirds correct responses "intermediate," and one-third and less correct responses "poor".[31]

Demographic variables were analyzed using the frequency distribution for categorical variables. The chi-square test was used to test the differences in knowledge levels by selected independent demographic variables for categorical and proportion data. The statistical significance level was set at a P-value < 0.05. All analyses were performed using the statistical software package STATA (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX).

Results

The total cohort consisted of 1006 participants after we excluded healthcare workers, who might have introduced bias due to the main study objective, ie, to test the knowledge of the general public. There were no missing data, as the questionnaire was designed to capture complete responses to all questions. Data were collected after the WHO declared COVID-19 as a pandemic and a threat to the world's public health.[12] During the period of data collection, the number of confirmed positive COVID-19 cases in Saudi Arabia ranged from 500 to 1200, with four reported cases of death.[23] Participants were categorized according to their gender, nationality, age group, and level of education. Male participants accounted for 61.7% of the total sample, and the 21–30 and 31–40-year-old age groups were the largest two segments, representing 34.3% and 29.1% of the participants, respectively. Moreover, Saudi nationals accounted for 92.3% of participants, and participants with a college or university degree accounted for 72.4% of the total respondents (Table 1).

General knowledge of COVID-19 was assessed by 14 questions on high-risk groups, transmission, availability of a vaccine and treatment, signs and symptoms, and possible complications (Table 2). Regarding overall knowledge of COVID-19, 75%, 24% and 1% of the participants had excellent, intermediate, and poor knowledge levels, respectively. Specifically, the differences in

Table 1 Demographic Characteristics

Variable	Number (n)	Percentage (%)
Gender		
Male	621	61.7
Female	385	38.3
Nationality		
Saudi	928	92.3
Non-Saudi	78	7.7
Age Group (years)		
15–20	109	10.8
21–30	345	34.3
31–40	293	29.1
41–50	170	16.9
51–60	67	6.7
>61	22	2.2
Education		
Secondary school or less	278	27.6
College or university level	728	72.4

the reported levels of knowledge by gender and level of education were not statistically significant. In contrast, we found that older participants were significantly more likely to have excellent knowledge levels than younger participants (P-value of 0.008). Moreover, Saudi nationals had significantly higher levels of knowledge than non-Saudi nationals (P-value of 0.027).

Knowledge of COVID-19 prevention practices, such as the avoidance of crowded places and close contact with people who had tested positive, correct practices for coughing and sneezing, social distancing, cleaning and disinfection of surfaces, and stay at home measures, was measured through another set of questions and statements (Table 3). Most participants (98.4% of all respondents) reported an excellent level of knowledge of COVID-19 prevention practices regardless of their demographic characteristics. There were no statistically significant differences across categories. Table 3 presents the percentages of participants with different levels of prevention knowledge by demographic characteristic.

Participants were asked questions related to what they should do if they were in home quarantine due to a definite or suspected case of COVID-19, and 75.8% and 22.5% of participants reported excellent and intermediate knowledge, respectively. Participants in the older age groups reported higher knowledge of home quarantine knowledge and compliance, as the age groups of 51–60 years old and more than 60 years old were the two age groups with the highest percentages of excellent responses (86.6% and 86.4%, respectively) (P-value of 0.001) (Table 4).

As the government of Saudi Arabia took extreme measures to control and stop the spread of COVID-19, participants' knowledge of measures required by the government was

Table 2 General Knowledge of COVID-19

General Knowledge Questions/Statements Regarding COVID-19	Variable	Poor n (%)	Intermediate n (%)	Excellent n (%)	P-value
1. High-risk groups	Gender				0.554
2. Is the new coronavirus like the common flu?	Male	5 (0.8)	144 (23.2)	472 (76)	
3. Does receiving a letter or package from an infected country put you at risk of being infected with the new coronavirus?	Female	5 (1.3)	97 (25.2)	283 (73.5)	
4. Is there currently a vaccine available that protects against infection with the new coronavirus?	Nationality				0.027
5. Is there a treatment for the new coronavirus?	Saudi	7 (0.8)	221 (23.8)	700 (75.4)	
6. Older adults and people of any age who have serious underlying medical conditions may be at higher risk for more serious complications from the new coronavirus.	Non-Saudi	3 (3.9)	20 (25.6)	55 (70.5)	
7. Coronavirus can be transmitted when you touch contaminated surfaces with droplets from an infected person and touch your eyes, mouth, or face afterward.	Age Group (years)				0.008
8. It is also possible for the coronavirus to be transmitted through diffused droplets in the air from those infected.	15–20	2 (1.8)	43 (39.5)	64 (58.7)	
9. Signs and Symptoms: Fever	21–30	4 (1.2)	89 (25.8)	252 (73)	
10. Signs and Symptoms: Cough	31–40	2 (0.7)	53 (18.1)	238 (81.2)	
11. Signs and Symptoms: Shortness of Breath	41–50	1 (0.6)	38 (22.4)	131 (77)	
12. Complications: Pneumonia	51–60	1 (1.5)	14 (20.9)	52 (77.6)	
13. Complications: Multi Organ Failure	> 61	0 (0)	4 (18.2)	18 (81.8)	
14. Complications: Death	Education				0.202
	Secondary school or less	5 (1.8)	71 (25.5)	202 (72.7)	
	College or university level	5 (0.7)	170 (23.4)	553 (75.9)	

Table 3 Knowledge of COVID-19 Prevention Practices

Prevention Practices Statements	Variable	Poor n (%)	Intermediate n (%)	Excellent n (%)	P-value
1. Avoid crowded places	Gender				0.513
2. Avoid close contact with people who are sick	Male	1 (0.2)	9 (1.4)	611 (98.4)	
3. Cover your cough or sneeze with a tissue and then throw the tissue in the trash	Female	2 (0.5)	4 (1)	379 (98.5)	
4. Avoid touching your eyes, nose, and mouth	Nationality				0.252
5. Clean and disinfect frequently touched objects and surfaces	Saudi	2 (0.2)	12 (1.3)	914 (98.5)	
6. Wash your hands often with soap and water for at least 40 seconds	Non-Saudi	1 (1.3)	1 (1.3)	76 (97.4)	
7. Avoid sharing your mobile phone and personal belongings	Age Group (years)				0.100
8. Maintain an appropriate distance from gathering areas, as the virus is transmitted by saliva droplets at a distance of up to one to two metres	15–20	1 (0.9)	4 (3.7)	104 (95.4)	
9. Stay home when you are sick, except to get medical care	21–30	0 (0)	3 (0.9)	342 (99.1)	
10. Stay home if instructed by government agencies and health officials even if you are not sick	31–40	0 (0)	3 (1)	290 (99)	
	41–50	2 (1.2)	1 (0.6)	167 (98.2)	
	51–60	0 (0)	1 (1.5)	66 (98.5)	
	> 61	0 (0)	1 (4.6)	21 (95.4)	
	Education				0.101
	Secondary school or less	1 (0.4)	7 (2.5)	270 (97.1)	
	College or university level	2 (0.3)	6 (0.8)	720 (98.9)	

Table 4 Knowledge of Home Quarantine Measures for Exposed, Suspected, or Positive Cases of COVID-19

Home Quarantine Measures	Variable	Poor n (%)	Intermediate n (%)	Excellent n (%)	P-value
1. Stay home, except going out for medical treatment	Gender				0.188
2. Use separate toilets	Male	10 (1.6)	128 (20.6)	483 (77.8)	
3. Wash hand frequently for 40 seconds	Female	7 (1.8)	98 (25.5)	280 (72.7)	
4. Monitor symptoms and call 937 if they get worse	Nationality				0.945
5. Maintain good ventilation	Saudi	16 (1.7)	209 (22.5)	703 (75.8)	
6. Isolate yourself from others in the same home by staying inside the room	Non-Saudi	1 (1.3)	226 (21.8)	60 (76.9)	
7. Do not share home equipment and personal belongings	Age Group (years)				0.001
8. Wear a face mask if you need to go out	15–20	3 (2.8)	36 (33)	70 (64.2)	
	21–30	6 (1.7)	99 (28.7)	240 (69.6)	
	31–40	4 (1.4)	52 (17.7)	237 (80.9)	
	41–50	3 (1.8)	28 (16.5)	139 (81.7)	
	51–60	1 (1.5)	8 (11.9)	58 (86.6)	
	> 61	0 (0)	3 (13.6)	19 (86.4)	
	Education				0.789
	Secondary school or less	4 (1.4)	66 (23.8)	208 (74.8)	
	College or university level	13 (1.8)	160 (22)	555 (76.2)	

assessed. Table 5 shows the set of questions related to the government measures to stop the spread of COVID-19. In total, 53.7%, 45.8%, and 0.5% of participants reported excellent, intermediate, and poor knowledge, respectively. Although most participants from most demographic categories reported similar responses, there were significant differences by nationality and level of education in responses related to the government measures to stop the spread of COVID-19 (P-values of 0.009 and 0.001, respectively). In addition to the four main sections of questions on COVID-19 knowledge, participants were asked one general question about when they expected the COVID-19 pandemic to be controlled. The

Table 5 Knowledge of Measures Required by the Government to Prevent the Spread of COVID-19

Governmental Measures to Prevent the Spread of COVID-19	Variable	Poor n (%)	Intermediate n (%)	Excellent n (%)	P-value
1. Quarantine everyone coming in from abroad for 14 days	Gender				0.133
2. Suspend all air travel	Male	3 (0.5)	300 (48.3)	318 (51.2)	
3. Go door to door to measure everyone's temperature	Female	2 (0.5)	161 (41.8)	222 (57.7)	
4. Close all schools and universities	Nationality				0.009
5. Forbid any mass gatherings (eg, sport events or concerts)	Saudi	3 (0.3)	420 (45.3)	505 (54.4)	
6. Make it mandatory for adults to wear a face mask while outdoors	Non-Saudi	2 (2.5)	41 (52.6)	35 (44.9)	
7. Require everyone to remain in their homes except to seek medical care	Age Group (years)				0.060
	15–20	2 (1.8)	57 (52.3)	50 (45.9)	
	21–30	0 (0)	158 (45.8)	187 (54.2)	
	31–40	0 (0)	136 (46.4)	157 (53.6)	
	41–50	3 (1.8)	71 (41.8)	96 (56.4)	
	51–60	0 (0)	27 (40.3)	40 (59.7)	
	>61	0 (0)	12 (54.5)	10 (45.5)	
	Education				0.001
	Secondary school or less	2 (0.7)	153 (55)	123 (44.3)	
	College or university level	3 (0.4)	308 (42.3)	417 (57.3)	

majority (43.8%) expected the pandemic to be over within a few months, while 22.9% and 7.6% expected the crisis to be resolved within weeks or after more than a year, respectively; 25.7% said they do not know when such a crisis would be over.

Discussions

Awareness of CoV in general has always been common in Saudi Arabia, as the Kingdom has experienced various outbreaks of MERS-CoV, starting in 2012,[5] and still recorded limited cases and clusters of the infection as of the latest WHO report on April 8th 2020.[32] This study assessed knowledge of the general public regarding the 2019 novel coronavirus during the early stages of the spread of COVID-19 in Saudi Arabia in March 2020. The findings of this research can be helpful in designing and implementing prevention and public compliance programs for COVID-19 by the Saudi Ministry of Health and non-health-related entities. Specifically, the outcomes of this study address various levels of knowledge of COVID-19 in general, prevention, home quarantine compliance, and governmental measures aimed at stopping the spread of COVID-19.

Three-quarters of our sample demonstrated excellent knowledge of COVID-19, which can be explained by the high intensity of media coverage in Saudi Arabia and the close attention of health officials, who have conducted daily press briefings highlighting the current COVID-19 situation in the Kingdom. Our study shows similar outcomes to a study conducted to assess the general public awareness of MERS-CoV conducted by Al-Mohrej et al.[33] Although our study classifies levels of knowledge as excellent, intermediate, or poor, Al-Mohrej et al[33] took another approach by assessing proportions of the most appropriate answers, which might limit the overall understanding of various levels of awareness and knowledge.

Currently, there are no specific vaccines or treatments for COVID-19. However, scientists from all over the world are evaluating potential treatments, as evidenced by the many ongoing clinical trials. Consequently, focusing on strategic prevention measures by educating the public about the disease caused by the virus and how the virus spreads seems to be an important proactive measure. Most participants in our study showed an excellent level of knowledge of prevention practices. The fact that there are no available vaccines and treatments should enhance people's compliance with prevention measures such as social distancing and personal hygiene practices.

Excellent knowledge of prevention was reported by approximately 95% of participants in this study. These results on knowledge of prevention practices demonstrate two findings. First, an excellent level of knowledge was

the dominant outcome. Second, there were no significant differences among the demographic groups, which illustrates consistency in practices related to COVID-19 prevention measures and practices by the general public. In contrast to our findings, an online survey of respondents in the United States and the United Kingdom showed inappropriate conceptions of COVID-19 transmission and prevention among participants that was mainly caused by false social media content.[34] Furthermore, high knowledge levels of COVID-19 prevention might help limit the spread of the virus as the world, including Saudi Arabia, races to control COVID-19 by working on potential vaccines and treatments. Meanwhile, high levels of prevention knowledge should be sustained with more and frequent simplified guiding information and tools, which will help minimize the spread of COVID-19 by increasing individuals' knowledge until an effective vaccine and treatment become available.

The questions related to knowledge of home quarantine were constructed based on the latest WHO recommendations for persons who have been exposed to people who tested positive for COVID-19.[35] Compliance with home quarantine relies on good knowledge of its requirements. In addition, our findings showed acceptable levels of home quarantine knowledge considering that home quarantine was an uncommon practice in Saudi Arabia until COVID-19 became a global pandemic. More specifically, older participants reported higher levels of knowledge than younger participants less than 30 years old. This finding emphasizes the need to focus on young people using relevant content and platforms, which will enhance their knowledge and compliance with COVID-19 home quarantine requirements.

Reported knowledge of the measures required by the government to prevent the spread of COVID-19 was the lowest among all types of knowledge in this study. Overall, approximately 50% of participants reported excellent knowledge, and we observed differences in knowledge levels by nationality and level of education. Additionally, the study illustrates that high levels of knowledge of the disease and its prevention measures might not be enough to support compliance with the imposed restrictions by the government, such as complete or partial lockdowns. In addition, non-Saudi nationals reported knowledge levels of governmental measures that were clearly below those reported by Saudi nationals, which is consistent with the higher rates of infection among non-Saudi nationals.[36]

Conclusion and Recommendations

Knowledge of COVID-19 in general was excellent, including knowledge of prevention practices and home quarantine measures. However, knowledge of governmental restrictions to stop the spread of COVID-19 was excellent only among half of the participants. The study recommends that ongoing updates on COVID-19 information, directions, and prevention measures continue to be provided with enhanced clarity and emphasis of messages related to governmental restrictions to control COVID-19.

Limitations of the Study

This study has various limitations, such as a lack of other comparable studies at the early stages of COVID-19 pandemic, as the topic is still evolving. Consequently, this limitation was addressed through the comparison of our outcomes with the results of studies related to SARS-CoV or MERS-CoV instead. Furthermore, some answers to the questions included in the study tool might have been easily guessed, and a future study that includes distracting answers might be helpful in determining levels of COVID-19 knowledge. Moreover, data collection for this study was carried out through the random circulation of the questionnaire on social media covering a random sample of people in Saudi Arabia, which did not ensure equal representation across all demographic variables and regions. Although the sampling procedure and the results do not present a nation-wide outcome, researchers might find this study useful when conducting studies of the same or a similar concept in a nationally representative sample to track changes in knowledge levels during later stages of the pandemic. Equally, the study did not conduct further analysis to find connections between each level of identified knowledge, which might be conducted in further studies. Finally, the outcomes of this study might be relevant only to Saudi Arabia due to differences in the circulation of COVID-19 information in other countries. For instance, populations in Saudi Arabia rely heavily on social media as a source of information, which might not be the case in other locations.

Abbreviations

CoVs, coronaviruses; COVID-19, coronavirus disease 2019; OC43, beta coronavirus; 229E, alpha coronavirus; NL63, alpha coronavirus; HKU, beta coronavirus; SARS, severe acute respiratory syndrome; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; MERS, Middle East respiratory syndrome; WHO, World Health Organization.

Data Sharing Statement

The datasets used and/or analyzed in the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

The study was reviewed and approved by the research ethics committee at King Khaled University in Abha, Saudi Arabia (Reference ECM# 2020-2018 – HAPO-06-01). Prior to participation, respondents were asked to take part in the study voluntarily and to not provide personal or identity-revealing information to maintain anonymity and confidentiality. A statement was included in the questionnaire explaining the purpose of the study. Participants' completion of the questionnaire was considered consent to participate in the study.

Acknowledgments

The authors would like to thank all colleagues and persons who posted and helped circulate the study questionnaire on their social media profiles and the participants who contributed their responses to this study.

Funding

No funding was used to assist in the preparation of this study.

Disclosure

The authors report no conflicts of interest for this work.

References

1. Hamre D, Procknow JJ. A new virus isolated from the human respiratory tract. *Proc Soc Exp Biol Med*. 1966;121(1):190–193. doi:10.3181/00379727-121-30734
2. McIntosh K, Dees JH, Becker WB, Kapikian AZ, Chanock RM. Recovery in tracheal organ cultures of novel viruses from patients with respiratory disease. *Proc Natl Acad Sci U S A*. 1967;57(4):933–940. doi:10.1073/pnas.57.4.933
3. van der Hoek L, Pyrc K, Jebbink MF, et al. Identification of a new human coronavirus. *Nat Med*. 2004;10(4):368–373. doi:10.1038/nm1024
4. Woo PC, Lau SK, Chu CM, et al. Characterization and complete genome sequence of a novel coronavirus, coronavirus HKU1, from patients with pneumonia. *J Virol*. 2005;79(2):884–895. doi:10.1128/JVI.79.2.884-895.2005
5. Zaki AM, van Boheemen S, Bestebroer TM, Osterhaus AD, Fouchier RA. Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. *N Engl J Med*. 2012;367(19):1814–1820. doi:10.1056/NEJMoa1211721
6. Drosten C, Günther S, Preiser W, et al. Identification of a novel coronavirus in patients with severe acute respiratory syndrome. *N Engl J Med*. 2003;348(20):1967–1976. doi:10.1056/NEJMoa030747
7. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395(10223):497–506. doi:10.1016/S0140-6736(20)30183-5
8. Cheng VC, Lau SK, Woo PC, Yuen KY. Severe acute respiratory syndrome coronavirus as an agent of emerging and reemerging infection. *Clin Microbiol Rev*. 2007;20:660–694.
9. World Health Organization. Middle East respiratory syndrome coronavirus (MERS-CoV) – Saudi Arabia; 2020. Available from: https://www.who.int/csr/don/09-october-2017-mers-saudi-arabia/en/. Accessed March 15, 2020.
10. Centers for Disease Control and Prevention. Coronavirus disease 2019 (COVID-19); 2020. Available from: https://www.cdc.gov/coronavirus/2019-ncov/index.html. Accessed April 17, 2020.
11. World Health Organization. Naming the coronavirus disease (COVID-19) and the virus that causes it; 2020. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it. Accessed April 17, 2020.
12. World Health Organization. WHO director-general's opening remarks at the media briefing on COVID-19-11 March 2020; 2020. Available from: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020. Accessed March 16, 2020.
13. World Health Organization. Report of the WHO-China joint mission on coronavirus disease 2019 (COVID-19); 2020. Available from: https://www.who.int/publications-detail/report-of-the-who-china-joint-mission-on-coronavirus-disease-2019-(covid-19). Accessed April 17, 2020.
14. Rothe C, Schunk M, Sothmann P, et al. Transmission of 2019-nCoV infection from an asymptomatic contact in Germany. *N Engl J Med*. 2020;382(10):970–971. doi:10.1056/NEJMc2001468
15. Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med*. 2020;382(13):1199–1207. doi:10.1056/NEJMoa2001316
16. Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med*. 2020;382(18):1708–1720. doi:10.1056/NEJMoa2002032
17. Lauer SA, Grantz KH, Bi Q, et al. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. *Ann Intern Med*. 2020;172(9):577–582. doi:10.7326/m20-0504
18. Grasselli G, Pesenti A, Cecconi M. Critical care utilization for the COVID-19 outbreak in Lombardy, Italy: early experience and forecast during an emergency response. *JAMA*. 2020;323(16):1545. doi:10.1001/jama.2020.4031
19. Onder G, Rezza G, Brusaferro S. Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. *JAMA*. 2020. doi:10.1001/jama.2020.4683
20. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*. 2020;395(10223):507–513. doi:10.1016/S0140-6736(20)30211-7
21. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*. 2020;323(11):1061–1069. doi:10.1001/jama.2020.1585
22. World Health Organization. When and how to use masks [Internet]. Who.int. 202. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/when-and-how-to-use-masks. Accesed February 7, 2021.
23. Huynh T. Does culture matter social distancing under the COVID-19 pandemic? *Saf Sci*. 2020;130:104872. doi:10.1016/j.ssci.2020.104872
24. Ministry of Health. MOH news - MOH reports first case of coronavirus infection; 2020. Available from: https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2020-03-02-002.aspx. Accessed March 17, 2020.

25. Covid19 Ministry of Heath. COVID-19 dashboard: Saudi Arabia; 2020. Available from: https://covid19.moh.gov.sa/. Accessed April 17, 2020.
26. Raosoft. Sample size calculator by raosoft, Inc; 2020. Available from: http://www.raosoft.com/samplesize.html. Accessed March 18, 2020.
27. General Authority for Statistics. Population estimates; 2020. Available from: https://www.stats.gov.sa/en/43. Accessed April 17, 2020.
28. Ministry of Health. Public health - novel coronavirus (COVID-19); 2020. Available from: https://www.moh.gov.sa/en/HealthAwareness/EducationalContent/PublicHealth/Pages/corona.aspx. Accessed March 17, 2020.
29. SCDC. Community & public; 2020. Available from: https://covid19.cdc.gov.sa/community-public/. Accessed March 17, 2020.
30. Liu H, Li M, Jin M, Jing F, Wang H, Chen K. Public awareness of three major infectious diseases in rural Zhejiang province, China: a cross-sectional study. *BMC Infect Dis*. 2013;13(1). doi:10.1186/1471-2334-13-192
31. Nooh H, Alshammary R, Alenezy J, et al. Public awareness of coronavirus in Al-Jouf region, Saudi Arabia. *J Public Health (Bangkok)*. 2020;13:1–8.
32. World Health Organization. Middle East respiratory syndrome coronavirus (MERS-CoV) – the Kingdom of Saudi Arabia; 2020. Available from: https://www.who.int/csr/don/08-april-2020-mers-saudi-arabia/en/. Accessed April 18, 2020.
33. Al-Mohrej OA, Al-Shirian SD, Al-Otaibi SK, Tamim HM, Masuadi EM, Fakhoury HM. Is the Saudi public aware of Middle East respiratory syndrome? *J Infect Public Health*. 2016;9(3):259–266. doi:10.1016/j.jiph.2015.10.003
34. Geldsetzer P. Knowledge and perceptions of COVID-19 among the general public in the United States and the United Kingdom: a cross-sectional online survey. *Ann Intern Med*. 2020;173(2):157–160. doi:10.7326/m20-0912
35. The World Health Organization. Guidelines for home quarantine; 2020. Available from: https://www.who.int/docs/default-source/searo/whe/coronavirus19/the-guideline-for-home-quarantine—quarantine-in-non-health-care-settings-is-intended-for-anyone-who-believes-they-have-been-exposed-to-covid-19-and-are-required-to-be-home-quarantined-to-prevent-community-trans.pdf?sfvrsn=1bc12565_4. Accessed March 18, 2020.
36. Saudi Press Agency. New cases detected via active screening; 2020. Available from: https://www.spa.gov.sa/viewstory.php?lang=en&newsid=2076884. Accessed April 20, 2020.