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An analytical study on the awareness, attitude and practice during the COVID-19 pandemic in Riyadh, Saudi Arabia

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ARTICLE INFO

Article history:

Received 21 April 2020

Received in revised form 3 June 2020

Accepted 8 June 2020

Keywords:

COVID-19

Awareness

Attitude

Practice

Saudi Arabia

ABSTRACT

Background: Coronavirus disease (COVID-19) is an infectious disease caused by a new variable of the *Coronaviridae* family. COVID-19 spreads primarily by contacting the virus either from a COVID-19-infected individual through coughing or sneezing or from COVID-19-contaminated surfaces. On March 12, 2020, the World Health Organization (WHO) announced COVID-19 as a pandemic. The government of Saudi Arabia was among the first countries in the world to take quick and serious precautions. The Ministry of Health (MOH) has made the public aware of the virus transmission patterns and the importance of quarantine and curfew. Despite strict measures taken, the awareness of people towards infectious viruses remains the most important factor in limiting the widespread of diseases.

Method: A cross-sectional survey of 1767 participants, was conducted to explore the awareness, attitude and practice of COVID-19 in relation to socioeconomic data among residents in the city of Riyadh.

Results: Of all the participants, 58% showed a moderate level of awareness, 95% presented a high attitude and 81% presented an adequate practice regarding COVID-19. Significant positive correlation between awareness-attitude ($r = 0.132$, p -value < 0.001) and attitude-practice ($r = 0.149$, p -value < 0.001) were found. The gender of the participants was the only common characteristic significantly associated with both awareness and practice. This study revealed that males showed a slight increase (60%) in the level of awareness compared to female participants (57%), however, when it comes to the practice towards COVID-19, females showed slightly better practice (82%) than males (80%). The World health organization (WHO) and the Ministry of Health (MOH) were the main sources of information.

Conclusion: Despite the moderate public awareness, their attitude and practice were better. Therefore, public awareness must be improved to be prepared for epidemic and pandemic situations. A comprehensive public health education program is important to increase awareness and to reach sufficient knowledge.

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Introduction

During epidemics and pandemics, a gap in knowledge about the emerging disease can cause chaos and panic among the public. Distributing the proper information can not only guide society through such events but can also increase epidemic preparedness that might occur in the future. In addition, negative attitudes and practices towards new infectious diseases can aggravate epidemics which may eventually result in pandemics. Awareness, Attitude and prac-

tice have been studied in many previous epidemics such as swine influenza [1], Middle East Respiratory Syndrome (MERS) [2] and Dengue fever [3]. Better awareness of these diseases along with positive attitudes and practices towards them have shown to help contain the spread of the causative viruses.

COVID-19 disease first appeared in Wuhan City, Hubei Province of China, in December 2019. First cases were detected from patients visiting the wet market, which also contains some wildlife species. Since that time, large outbreaks have been reported in other Chinese Provinces and many nearby countries to eventually spread in all contents. Thus, the World Health Organization (WHO) declared this outbreak as a global pandemic on the 12th of March, with the continuous increase in reported cases [4]. COVID-19 disease is caused by Severe Acute Respiratory Coronavirus 2 (SARS-CoV-2).

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This new variable SARS-CoV-2 is the seventh member of human *Coronaviridae* [5]. The first identification of Coronaviruses (CoV) goes back to the 1960s in which diseases related to CoV showed mild influenza-like symptoms. The real-time of CoV existence is still unknown. It has been shown that CoV can infect a broad range of vertebrates including birds, snakes, bats, camels and many other animals [6]. However, strains with new variables occur every few years causing deadly epidemics and pandemics [7]. In 2003, an outbreak of virulent strains known as Severe Acute Respiratory Syndrome (SARS) was first detected in China, which then affected 26 countries with 8098 cases worldwide according to WHO. In 2012, an outbreak occurred with another Coronavirus strain, known as Middle East Respiratory Syndrome (MERS). This time MERS-CoV outbreak was first detected in Saudi Arabia and spread to 27 countries causing a total of 2494 cases worldwide. MERS-CoV and SARS-CoV have a higher mortality rate of 11% and 34.4% respectively, compared to 4.4% of SARS-CoV-2 [8]. Similarities were observed in the sequence homology of viral nucleic acids isolated from COVID-19 patients with a sequence of CoV isolated from bats, snakes, and pangolins [9].

The virus spreads between humans by coughing discharge that contaminates the surfaces. It can also be highly transmitted by asymptomatic individuals during the virus incubation period [4]. The virus can last on surfaces up to 5 days depending on the type of surfaces [10,11]. Although infected people may be asymptomatic, others may develop flu-like symptoms including fever and coughing, which may deteriorate in some cases [12].

The severity of symptoms has shown to be more in elderlies, along with those with underlying chronic health conditions as a result of pneumonia, cytokine storm and multi-organ failure [13]. Additionally, infected pregnant women were more likely to develop COVID-19 pneumonia, despite no evidence of more susceptibility compared with other adults [14]. There is a risk of transmitting the SARS-CoV-2 from mother to baby when the baby is delivered by cesarean section, despite it not being proven [15]. SARS-CoV-2 infects human cells by the action of Angiotensin-converting enzyme 2 (ACE2) which is expressed in alveolar cells within the lung. Therefore, the lung is considered the most affected organ in the human body. SARS-CoV-2 uses glycoprotein surface molecules known as spikes that interact with ACE2. ACE2 is also expressed in many cells such as glandular, endothelial and enterocytes which indicate the susceptibility of COVID-19 infection from human fluids [16]. SARS-CoV-2 has been detected in the feces and this could indicate the virus shedding from the respiratory system to the digestive system [17,18].

The Pandemic of COVID-19 has caused an international crisis at various levels to include; humans' psychology and economics. Extreme prevention methods have been adopted by countries which include; self-isolation, quarantine the entire country, prevent public gathering, closing schools and universities, closing borders and in some cases, the measures reached to complete cities lockdown. Community prevention and control groups were formed in many countries aimed to; discriminate individuals with fever and report them as COVID-19 suspects and to prevent the possible transmission of the virus. Additionally, different government and organizations groups were keen to improve awareness of preventions and control through hand washes and usage of masks and gloves. To this end, SARS-CoV-2 is considered a continuous threat to human beings. New measures must be adopted to prevent new outbreaks in the future through developing vaccines and spreading awareness.

In Saudi Arabia, the first COVID-19 infected case was reported on the 2nd of March 2020. Since then more cases have been reported, with 10,484 reported infected people till now 20th of April 2020. Since the few early reported cases, awareness programs have been initiated by the MOH to educate the public about

the virus mode of transmission and the importance of curfew. Also, strict measures have been imposed by the MOH to control the virus transmission, including limiting outdoor activities, suspending schools, minimizing social contacts and banning mosques' prayers. However, it appeared that understanding the mode of transmission between humans is the more immediate need at this stage. Therefore, more emphasis on public awareness needs to be implemented in order to be ready to stand against the pandemic. In this study, awareness, attitude and practice survey was conducted among the city of Riyadh community and the level of awareness and the knowledge were assessed, regarding the prevention of COVID-19.

Research methodology

Study design

This cross-sectional survey has been conducted among people in the city of Riyadh. The study carried for 10 days, from the 1st till the 10th of April 2020. The participants aged between 18 and 65 years old. The questionnaire was designed in accordance with previously published literature and the survey was pre-tested for validation among healthcare providers [19]. All methods were performed in accordance with the relevant guidelines and regulations of the National Committee of Bioethics (NCBE), Saudi Arabia. All participants were requested to sign a consent form before filling the questionnaire to register their willingness to participate. The survey was conducted in Arabic languages and took about 5 min to be completed.

The questionnaires were distributed online using Google Forms. Communication between the researchers and the participants was conducted if needed. The questionnaire consisted of two main sections; the first section focuses on socioeconomic and background information such as age, education level, outcome and gender of the participants. While the second section asked about the participants' level of awareness (22 items), attitude (9 items) and practice (11 items). The possible answers were "I agree", "I disagree" and "I don't know". Accordingly, all the data were collected through one survey with different sections.

Participants who did not consent to participate in the study, and/or did not answer the questions of the study, were excluded from the study. Also, participants were given the freedom to terminate the survey anytime. Ethical approval was obtained from the Institutional Review Boards Committee of Princess Norah bint Abdulrahman University (20-0129).

Sample size

The minimum sample size to conduct this research is 1067 with a 3% margin of error and a 95% confidence level. However, a larger sample size of 1767 was collected in this research after excluding any participants who did not meet the inclusion criteria.

Study variables

Sociodemographic characteristics which were gender, age, education level, employment status, marital status, family size, income were considered as explanatory/independent variables. Whereas the level of awareness, attitude and practice were considered as response/dependent variables. Each correct response was given a score of one and zero for both wrong and I do not know responses. The possible scores were the sum of all correct responses ranging from 0–22, 0–9 and 0–11 for the level of awareness, attitude and practice, respectively.

Table 1
Demographic characteristics of the research sample.

Characteristics	Male (428)		Female (1339)		Total (1767)	
	No.	%	No.	%	No.	%
Saudi vs non-Saudi						
Saudi	387	90.40	1273	95.07	1660	93.94
Non-Saudi	41	9.57	66	4.92	107	6.05
Marital status						
Single	83	19.39	372	27.78	455	25.75
Married	345	80.61	932	69.60	1277	72.27
Widowed	0	0.00	35	2.61	35	1.98
Family size						
2–4	189	44.15	450	33.60	639	36.16
5–7	176	41.12	619	46.22	795	44.99
7+	63	14.71	270	20.16	333	18.84
Age						
18–28	49	11.45	288	21.51	337	19.07
29–39	187	43.69	462	34.50	649	36.73
40–49	111	25.93	342	25.54	453	25.64
50–59	52	12.15	193	14.41	245	13.87
60+	29	6.78	54	4.03	83	4.70
Education level						
High school or less	58	13.55	216	16.13	274	15.51
Bachelor's degree	249	58.18	849	63.41	1098	62.14
Postgrad degree	121	28.27	274	20.46	395	22.35
Employment status						
Student	14	3.27	191	14.26	205	11.60
Unemployment	3	0.70	380	28.38	383	21.68
Business	26	6.07	23	1.72	49	2.77
Private sector	135	31.54	133	9.93	268	15.17
Government sector	213	49.77	495	36.97	708	40.07
Retired	37	8.64	117	8.74	154	8.72
Income						
Less than 3000	13	3.04	147	10.98	160	9.05
3000–10000	91	21.26	488	36.45	579	32.77
10000–20000	186	43.46	448	33.46	634	35.88
More than 20,000	138	32.24	256	19.12	394	22.30

Data analysis

The data were imported into R, version 3.6.3 (<http://www.r-project.org>), on the RStudio, version 1.2.5033, development environment, and analyzed using the survey package, version 4. Multivariate logistic regression (syglm function) was used to analyze the significant variables of the level of awareness, attitude and practice. Statistical significance was considered at a *P-value* of less than 0.05 for all analyses.

Results

In this section, the sociodemographic characteristics of the research sample are reported along with the findings for each factor separately: awareness, attitude and practice.

Sociodemographic characteristics

A total of 1767 participants have completed the survey, 75% of the respondents were female (1339/1767) and 25% were male (428/1767). The majority of respondents were Saudi, representing 94% and the rest were non-Saudi. The majority of the respondents were married, representing 72.27%. While in terms of age groups, more than half of the respondents were between 29–39 and 40–49, representing 36.73% and 25.64%, respectively. Sixty-two (62.14%) of the respondents were Bachelor degree holders. More than half of the respondents (58.01%) were employed either in the private, government or business sectors. Most of the participants (90.95%) of the respondents have income higher than 3000 Saudi Riyal. Table 1 shows the demographic characteristics of the research sample based on gender, marital status, age, the level of education and the employment status for the respondents.

Awareness

To measure the participants' awareness of COVID-19, questions set on the methods of transmission, symptoms, vulnerable cases, incubation and recovery period, treatments and the virus fatality (Table 2). Regarding COVID-19 disease transmission, 70% of respondents disagreed that COVID-19 is transmitted among individuals with genetic diseases, whereas 56% reported that the transmission is among individuals with immunodeficiencies. The majority of the respondents were aware that SARS-CoV-2 virus transmitted from an infected person (99%), through touching contaminated surfaces and shaking hands (98%), using COVID-19-infected personal tools (94.9%) and through coughing (92%). Nearly half of the respondents reported that COVID-19 can be transmitted sexually (49%) but cannot be transmitted from pets to humans and vice versa (45.6%). COVID-19 causes a range of symptoms, as almost all the cases develop fever 98%, cough 76%, fatigue and muscle ache 44% and 55% developed d. A smaller percentage of patients developed headaches (8%), hemoptysis, which is coughing up of blood (5%), and diarrhea (3%) [20]. Most of the respondents (95%) agreed that COVID-19 symptoms are similar to seasonal influenza symptoms. However, there was an uncertainty in the respondents' awareness of symptoms related to the digestive system, as 38% agreed that COVID-19 causes diarrhea and 35% did not. In addition, around 45% reported that vomiting is not a symptom of the COVID-19 virus. Moreover, about two-thirds of the respondents (63%) and (64%) excluded skin rash and bleeding respectively from COVID-19 symptoms, which has been recently included among COVID-19 symptoms [21]. Studies have shown that people are generally susceptible to SARS-CoV-2, however, the elderly with underlying diseases are more vulnerable to develop severe complications that may lead to death [22]. A high proportion of 89% of the respondents indicated that the most vulnerable people to get COVID-19 are among the elderly and people with underlying health conditions. In addition, more than half of the respondents showed that pregnant women are more susceptible to COVID-19 (56.9%), unlike children who are the least vulnerable (82.5%) [22]. Related to the incubation period, unlike other Coronaviruses, the current pandemic has a longer incubation period that can reach up to 14 days [23]. Data from our study showed that (71%) of the respondents disagreed on the 1–3 days incubation period, however, about half of respondents (51%) indicated that one week is enough for recovery and to start socializing with others. When participants were asked about COVID-19 treatments' availability, different responses were received. The majority of respondents agreed that there are neither available vaccines (56%), nor the use of antibiotics is sufficient to kill the virus (60%). Related to reinfection with the virus, there were some reports of people who were cleared from the virus, then to be tested positive again with the same SARS-CoV-2 virus [24]. In our study, nearly half of respondents (46%) did not know that COVID-19 has the ability to re-infect people. According to WHO, the estimated overall mortality rate of COVID-19 is 3.4% [25]. Similarly, the majority of respondents in this study reported that SARS-CoV-2 is fatal to the infected individual.

Attitude

Over 90% of the respondents were in favor of attitudes towards limiting the spread of COVID-19 listed in Table 3. From the participants' responses, staying at home and isolating the infected individuals ranked the first with 99.7% and 99.9% respectively. These measures have been taken by many countries and have shown to be significantly successful in controlling the spread of the virus [26]. The second-ranked attitude detected in participants' responses was the closure of universities and schools with around 96%. Closure of universities and schools was found to be a suc-

Table 2
Awareness about COVID-19 disease.

Question	Agree		Not agree		Don't know	
	No.	%	No.	%	No.	%
Q1. COVID-19 is transmitted because of immunodeficiency	992	56.14	549	31.07	226	12.79
Q2. COVID-19 is transmitted because of genetic diseases	148	8.37	1237	70.01	382	21.62
Q3. COVID-19 is transmitted from a viral-infected person to a non-infected another person	1751	99.09	7	0.40	9	0.51
Q4. COVID-19 is transmitted by coughing	1631	92.30	95	5.38	41	2.32
Q5. The disease is transmitted through touching and shaking hands	1740	98.47	14	0.79	13	0.74
Q6. The disease is transmitted by using an infected person tools	1678	94.96	39	2.21	50	2.83
Q7. The disease is transmitted by sexual intercourse	867	49.07	399	22.58	501	28.35
Q8. The disease can be transmitted from human to pets and vise versa	395	22.35	807	45.67	565	31.98
Q9. The disease symptoms are similar to seasonal influenza symptoms	1684	95.30	48	2.72	35	1.98
Q10. One of the disease symptoms is diarrhea	679	38.43	621	35.14	467	26.43
Q11. One of the disease symptoms is vomiting	378	21.39	789	44.65	600	33.96
Q12. One of the disease symptoms is skin rash	79	4.47	1129	63.89	559	31.64
Q13. One of the disease symptoms is bleeding	52	2.94	1132	64.06	583	32.99
Q14. Infection with the virus cause death always	68	3.85	1601	90.61	98	5.55
Q15. The virus can infect a person more than once	601	34.01	349	19.75	817	46.24
Q16. One week is the period needed to recover from COVID-19 disease and able to socialize with others	907	51.33	452	25.58	408	23.09
Q17. The virus incubation period is from 1–3 days	209	11.83	1267	71.70	291	16.47
Q18. Children cannot be infected with the virus that causes COVID-19	129	7.30	1464	82.85	174	9.85
Q19. Pregnant women are more vulnerable to get the COVID-19 disease	1006	56.93	332	18.79	429	24.28
Q20. Elderlies and people with chronic diseases are more vulnerable to get the COVID-19 disease	1573	89.02	124	7.02	70	3.96
Q21. There is a vaccine for COVID-19 disease	150	8.49	997	56.42	620	35.09
Q22. Treatment with antibiotics can kill the virus caused COVID-19 disease	161	9.11	1061	60.05	545	30.84

Table 3
Attitude towards COVID-19 disease.

Question	Agree		Not agree		Don't know	
	No.	%	No.	%	No.	%
Q1. Stay at home helps to reduce the spread of the virus	1763	99.77	2	0.11	2	0.11
Q2. Closure of the land, sea and airports can reduce the spread of the virus	1611	91.17	138	7.81	18	1.02
Q3. Isolate infected people can help to limit the spread of disease	1765	99.89	2	0.11	0	0.00
Q4. Socialize with family and friends can limit the spread of the virus	226	12.79	1518	85.91	23	1.30
Q5. Stop Umrah and pilgrimage can limit the spread of the virus	1653	93.55	73	4.13	41	2.32
Q6. Stop schools and universities can reduce the spread of the virus	1723	97.51	37	2.09	7	0.40
Q7. Closure of malls can reduce the spread of the virus	1703	96.38	58	3.28	6	0.34
Q8. Stop travelling between cities can control the spread of the disease	1705	96.49	54	3.06	8	0.45
Q9. Curfew can reduce the spread of the virus	1701	96.26	53	3.00	13	0.74

successful strategy to suppress pandemic, as social distancing cannot be achieved without it resulting in virus transmission between households [27]. Similar responses of around 96%, was received in relation to closing malls, curfew and travel ban between cities to control the spread of COVID-19. However, the responses were reduced to 91% when participants were asked if closing land, sea and air helps in COVID-19 spread reduction. This could be due to negative impacts on the global economy, which may lead to a recession [28]. The last attitude to limit the spread of COVID-19 detected from respondents was the ban of Umrah and pilgrimage with 93.5%. According to the Ministry of Health (MOH), the number of positive cases in both Makkah and Madinah have been accelerating since the start of the pandemic, thus stopping Umrah and pilgrimage is a must until the number of new cases is ceased.¹ Unexpectedly, nearly 13% of respondents agreed that socializing with family and friends can reduce the spread of COVID-19 compared to 85% who agreed on the opposite.

Practice

WHO and MOH have suggested several practices that can help contain COVID-19 at an individual level. For example, lots of stress had been made on washing hands, wearing masks and stopping handshakes. Over 99% of respondents agreed on the importance

of hand wash, whereas 98% of the respondents agreed on mask-wearing during sickness and cleaning surfaces as a good practice (Table 4) It has been suggested to cover the mouth and nose which was detected in the participants' responses with nearly 98%. However, the coverage through the masks is still controversial. Some recommended using masks all day for protection especially when outdoors, others strict the use to patients and health workers due to shortage of masks worldwide. Although around 92% of the respondents favor wearing masks in public, 55% do not recommend wearing masks among healthy individuals. Participants negatively responded to touching eyes, nose and mouth along with shaking hands with 90% and 86.9% respectively, which reflected. However, a significant 11% of the respondents in favor of handshake during this pandemic, which is considered one of the main causes of spreading the disease [29,30]. In relation to participants' practice toward bought products, groceries and food, 89% recommended sanitizing all groceries prior usage, 77% recommended washing fruit and vegetables with soap and water. Lastly, most of the participants (89.5%) recommended drinking water, despite this is not going to help eradicate the virus.

Regression analysis

We performed multiple regression analyses of the level of awareness, attitude and practice in relation to several independent variables: gender, age, education, employment, marital status, family size and income. Gender, education, employment, family size

¹ https://data.gov.sa/Data/en/organization/ministry_of_health

Table 4
Practice towards COVID-19 disease.

Question	Agree		Not agree		Don't know	
	No.	%	No.	%	No.	%
Q1. Washing hands carefully with soap can reduce the spread of the virus?	1759	99.55	8	0.45	0	0.00
Q2. Touching eyes, nose and mouth can reduce the spread of the virus?	150	8.49	1597	90.38	20	1.13
Q3. Covering mouth and nose during sneezing and coughing can reduce the spread of the virus?	1731	97.96	32	1.81	4	0.23
Q4. Wearing a mask during sickness can reduce the spread of the virus?	1732	98.02	30	1.70	5	0.28
Q5. Wearing masks in public places can reduce the spread of the virus?	1622	91.79	113	6.40	32	1.81
Q6. Wearing masks for healthy people can reduce the spread of the virus?	709	40.12	985	55.74	73	4.13
Q7. Drinking water is a positive practice that can reduce the spread of the virus?	1583	89.59	94	5.32	90	5.09
Q8. Cleaning and sanitizing surfaces can reduce the spread of the virus?	1737	98.30	20	1.13	10	0.57
Q9. Shaking hands can reduce the spread of the virus?	211	11.94	1536	86.93	20	1.13
Q10. Washing fruit and vegetables with soap and water can reduce the spread of the virus?	1373	77.70	320	18.11	74	4.19
Q11. Sanitize all groceries before using can reduce the spread of the virus?	1577	89.23	131	7.41	59	3.33

Table 5
Level of awareness as per sociodemographic characteristics which found significant.

	Mean score	Standard deviation	p-Value
Gender		0.002	
Male	13.22	3.40	
Female	12.72	2.97	
Education level		0.000	
High school or less	11.76	3.05	
Bachelor's degree	12.77	2.99	
Postgrad degree	13.78	3.10	
Employment status		0.003	
Student	12.32	2.76	
Unemployment	12.23	3.13	
Business	13.69	2.94	
Private sector	12.87	3.08	
Government sector	13.34	3.13	
Retired	12.40	2.81	
Family size		0.005	
2–4	13.15	3.11	
5–7	12.85	3.08	
7+	12.19	2.97	
Income		0.000	
Less than 3000	11.85	3.18	
3000–10000	12.37	3.00	
10000–20000	12.95	2.98	
More than 20,000	13.74	3.10	

and income were significantly associated with the level of awareness with a p-value less than 0.05. The level of awareness mean score of the study respondents (out of the maximum of 22) was 12.84 ± 3.09 with males having the highest score of 13.22 ± 3.40 followed by females 12.72 ± 2.97 . Considering the level of attitude, the income was only the significant explanatory variable with p-value = 0.002. The level of attitude mean score of the study respondents (out of the maximum of 9) was 8.57 ± 0.93 . Gender and age were significantly associated with the level of practice with p-values 0.003 and 0.000, respectively. The level of practice mean score of the study respondents (out of the maximum of 11) was 9 ± 1.04 with females having the highest score of 9.04 ± 0.99 followed by males 8.87 ± 1.16 . Correlation between awareness-attitude was significant and positive ($r = 0.132$, p-value < 0.001). Also, there was a significant correlation between attitude-practice ($r = 0.149$, p-value < 0.001). Tables 5 and 6 show the level of awareness and practice as per sociodemographic characteristics which have been found significant, respectively.

Discussion

The purpose of this study was to estimate the general level of awareness, practice and attitude towards the emerging COVID-19 disease, in Saudi communities located in Riyadh. Various socio-economic characteristics of the population were explored to obtain

Table 6
Level of practice as per sociodemographic characteristics which found significant.

	Mean score	Standard deviation	p-Value
Gender			0.003
Male	8.87	1.16	
Female	9.04	0.99	
Age			0.000
18–28	9.21	1.10	
29–39	8.95	1.03	
40–49	9.01	1.00	
50–59	8.91	0.95	
60+	8.62	1.06	

information that could be used to guide the mapping of an awareness campaign and to determine whether people's knowledge differed based on particular characteristics of the target population. The majority of the participants had a good general level of awareness, attitude and practice toward the virus. However, according to the participants' responses less knowledge was detected in various aspects related to the virus' way of transmission, the disease symptoms, vulnerable people, re-infections and incubation period and practice (Fig. 1).

Since the initial outbreak of COVID-19 disease in China, it has spread widely to various countries. According to the MOH update on the 20th of April 2020, the number of COVID-19 cases raised to 10,484 in Saudi Arabia with the majority of cases 2210 in Riyadh. Many studies have reported the importance of awareness, attitude and practice of society to reduce the spreading rate during epidemics and pandemics [19,31]. Similarly, lack of awareness contributes to undesirable attitudes and practice, which leads to negative impacts on infection-control [29]. Therefore, in this study, the awareness of participants towards COVID-19 was assessed in Riyadh. In this study, we found a significant positive correlation between awareness and attitude, indicating that the better the level of awareness was reflected in their attitude. The same was also true for the correlation between attitude and practice. Data from this study indicated a moderate general awareness level of COVID-19 (58%). During the MERS outbreak, a similar awareness was detected in Riyadh [19] and Al-Jouf [32]. A similar level of awareness was detected among health care providers in UAE [31], Vietnam [33] and Uganda [34]. The participants' education, employment status, gender, family size and income are significantly associated with participants' awareness, as evidenced by this study. People with higher levels of education were more knowledgeable compared with other categories. Also, increased incomes were positively correlated with better awareness. In agreement with this study, other studies found similar findings, as knowledge towards COVID-19 was significantly lower among less educated and lower-income participants in Saudi Arabia [35], Egypt [36], China [37], USA [38] and Nepal [39]. Participants from business and

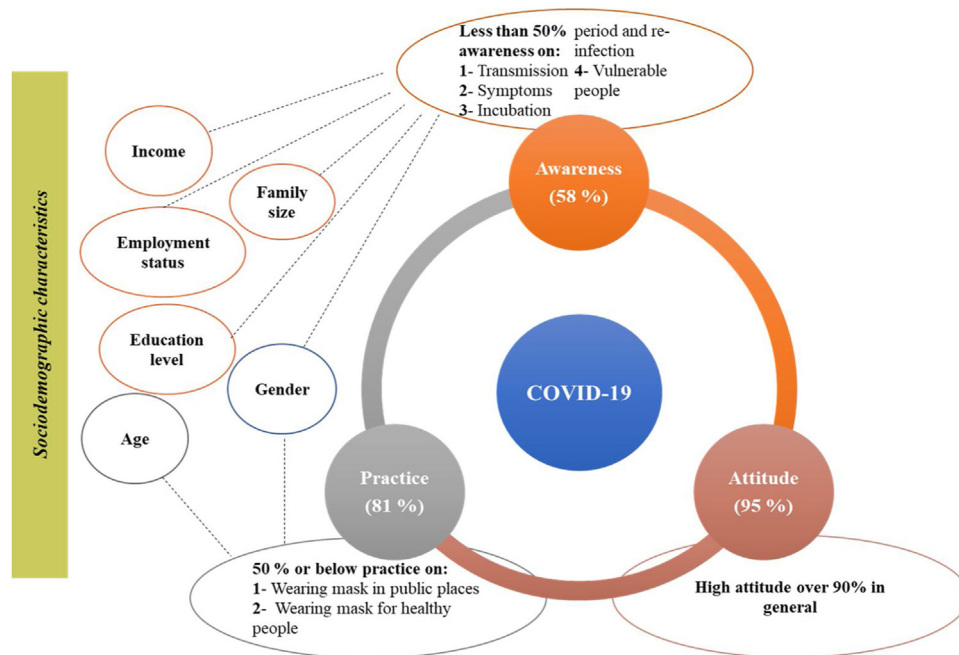


Fig. 1. Diagram represents the Sociodemographic factors affecting awareness, attitude and practice levels towards COVID-19 in Riyadh, Saudi Arabia.

governmental sectors have significantly shown the highest COVID-19 awareness with (62% and 60% respectively). To improve people's level of awareness towards pandemics, governments should make more efforts in increasing awareness among society, using different communication channels. Despite the effort made by the MOH in providing educational information about COVID-19 in seven different languages through many platforms, still, people with lower socioeconomic status may require alternative channels for communicating information about the virus risk and prevention [30]. This can be done through recommended strategies that focus on attracting the attention of this segment of the population in the most frequently visited places including, shopping malls and grocery stores. Data from this study revealed that males showed a slight increase in the level of awareness (60%) compared to female participants (57%). Our finding was different to a similar study conducted in USA, in where better awareness was found in women compared to men [40].

However, when it comes to the practice towards COVID-19, females showed slightly better practice (82%) than males (80%). This can be explained by different gender-related activities in the profession and in family roles. Overall, the score for the practice section was high (81%) for most participants. There was a significant difference in the practice score in different age groups. The better practice was observed amongst the 18–49 age group compared to the above 60 age group, which could be explained by the increased usage of different social media channels compared to the older group. Interestingly, participants' high level of awareness was reflected in their attitude. Finally, with respect to the level of attitude, a high general attitude towards COVID-19 was detected from participants (95%).

The primary limitation of this study is that these findings are limited to Riyadh, Saudi Arabia. The study population only included participants within the city of Riyadh, Saudi Arabia. Furthermore, the number of males is less compared to female participants. The authors hypothesized that higher female participation was due to the gender differences in response rate. Even though the authors tried to equally distribute the survey through their professional and personal channels of social networks, literature shows that gender influences online survey response behavior [41].

Conclusion and recommendation

COVID-19 disease was announced as a pandemic on the 12th of March 2020. The causative of this disease is highly contagious, therefore, raising awareness is a major aspect to curb the transmission of the SARS-CoV-2. The results of this study identified areas of misconceptions and specific groups to be targeted for educational programs regarding COVID-19. Several aspects were less knowledgeable among respondents, including the virus mode of transmission, symptoms, incubation period and re-infection and the vulnerable people. It is therefore suggested that a well-planned and structured educational program should be undertaken to improve the level of awareness and contribute to better practice. In this current pandemic, people should follow the ministry of health instructions and avoid close contact with others, especially immunocompromised individuals. Also, washing hands frequently and following strict personal hygiene measures are necessary to control virus transmission. This population-based questionnaire could provide baseline data to the government for preventive measures in case of future outbreaks. Future studies could investigate smoking as an important factor in relation to SARS-CoV-2 infection. Furthermore, we will investigate the correlation between the level of awareness with the participant's health state: infected and not infected.

Funding

This research was funded by the Deanship of Scientific Research at Princess Nourah bint Abdulrahman University through the Fast-track Research Funding Program.

Competing interests

None declared.

Ethical approval

Not required.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.jiph.2020.06.015>.

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