

# Assessment of knowledge and attitude of allied healthcare professionals about COVID-19 across Saudi Arabia

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## Abstract.

**BACKGROUND:** The coronavirus disease (COVID-19) has shown a catastrophic effect on mankind. The allied healthcare professionals (AHPs) play a pivotal role against COVID-19.

**OBJECTIVE:** To appraise the knowledge and attitude about COVID-19 of AHPs working across Saudi Arabia.

**METHODS:** This cross-sectional study was conducted using Qualtrics software to gather data from all five regions of Saudi Arabia during the nationwide lockdown in April 2020. Complete responses of 195 AHPs were considered for analysis. The questionnaire consisted of 15 and 14 questions on knowledge and attitude, respectively. The overall scores of each domain were calculated and modified Bloom's criterion was applied to categorize them into a three-point ordinal scale. Statistical analysis was performed using Chi-square test along with multivariate logistic regression for significant parameters.

**RESULTS:** The AHPs displayed a moderate level of knowledge (58.2%) and a good level of attitude (80%). The AHPs were found to have a non-significant ( $P > 0.05$ ) difference in the level of knowledge within age, gender, region, occupation, educational level, organizational setup and years of experience. The attitude of AHPs working in a private setup has shown a 2.8 times ( $P = 0.020$ ) higher risk for having moderate/poor attitude compared to the AHPs working in a government organization.

**CONCLUSION:** AHPs displayed a moderate level of knowledge and good attitude towards COVID-19. Emphasis should be given to continuous professional development in order to enhance their knowledge. Furthermore, strategies should be developed in the private sector to positively reinforce the attitude of AHPs.

Keywords: Pandemic, health services research, SARS CoV-2, infection control, coronavirus

## 1. Introduction

Since the inception of the coronavirus disease (COVID-19) in December 2019 [1], healthcare workers (HCWs) are constantly providing services to the

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diseased individuals. For a system to function efficiently, it needs support of people who are working at the background or providing assistance to the health care professionals (HCPs) [2, 3]. For any nation, the allied health care professionals (AHPs) are an indispensable component in the Health care delivery system. They continued to act as a backbone in the present pandemic situation by providing constant support to the frontline HCPs. AHPs play role in disease identification, evaluating the parameters which assist in obtaining a diagnosis and providing rehabilitation services [4, 5]. Broadly speaking they are non-nurse, non-physician health care providers, including physical therapists, occupational therapists, nutritionists, dieticians, speech pathologists, dental technicians, dental assistants, diagnostic medical personnel, imaging specialists, physician assistants, and many more [4]. Any disparity in coordination while following the protocols and recommendations between the HCPs and AHPs can result in severe consequences [6]. With the constant rise in COVID-19 cases, the AHPs are stressed and show signs of burnout, because of the overload and fear of the unknown [7]. In this difficult time, they have to provide care to the patients by keeping themselves safe.

COVID-19 has been declared a pandemic on 11 march 2020 by the World Health Organization (WHO) [8]. It is believed to be caused by severe acute respiratory syndrome corona virus-2 (SARS-CoV-2) [9]. The disease can be asymptomatic in its initial phase to symptoms ranging from fever, dry cough, shortness of breath, headache, diarrhoea and vomiting [9, 10]. Furthermore, an alteration or loss in taste sensation and perception of smell has been recognized as a common clinical presentation [11]. COVID-19 has the potential of being transmitted from one person to another through direct or contact transmission [10]. The other routes of transmission can be fecal-oral, saliva and aerosol. In case of indirect transmission, it occurs via airborne and fomites [12, 13]. It is believed to be transmitted via inanimate objects as the virus can stay alive on these objects from hours to days [14]. Although the case fatality rate is 3.4%, which is comparatively less than past epidemics such as the severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV), it has claimed more lives all around the world [15].

Saudi Arabia (KSA) had witnessed an epidemic of MERS-CoV in 2012 and subsequently government had made policies and procedure to combat the disease [16]. Similarly, in the early days of COVID-19,

advisories and guidelines were issued to counteract this pandemic situation [17–19]. Globally, AHPs such as diagnostic personal at screening or imaging specialist who are processing the radiographs and dental technicians are working at the same pace with the HCPs or dental health care professionals (DHCPs). Nonetheless, the role of other AHPs such as nutritionists and dieticians during and post COVID-19 in providing counselling to the diseased individuals are noteworthy [20]. In the present COVID-19 era, it is important to assess the knowledge and attitude of the health services provided by the allied healthcare professionals (AHPs) as they play a pivotal role against COVID-19 along with other healthcare workers. To the best of our knowledge, none of the research papers have exclusively assessed the knowledge and attitude of AHPs about COVID-19. Thus, the aim of the study was to assess the knowledge and attitude of AHPs towards COVID-19 across KSA.

## 2. Materials and methods

### 2.1. Study population

A cross-sectional study was conducted in the month of April 2020 across KSA with the help of a Qualtrics online survey tool. The study was approved by the local ethical board of Jouf University (14-07/21). Out of 236 questionnaires only 195 were considered for analysis. Forty-one responses were not included in the study as it was incompletely filled; hence the response rate was calculated as 82.6%.

### 2.2. Data collection

The questionnaire was prepared by modifying the questions taken from studies done to assess the knowledge, attitude, and practice (KAP) about COVID-19 on a Chinese resident [21] and KAP about MERS-CoV [22] as well as adopting the recommendations of Meng et al. [10]. The questionnaire was prepared in two languages (Arabic and English) as per the need of the native speakers and international communities. It was forward and backward translated by two professional bilingual translators with an internal consistency coefficient of 0.83, showing a perfect agreement (English to Arabic and Arabic to English). To carry out this process a committee was formed which had scrutinized the procedure at every step. The initial questionnaire was distributed to 10 participants to check its test-retest reliability and obtained

a score of 0.80, indicating a good reliability. These responses were not included in the final study sample. As per the result of pilot study the final questionnaire was prepared for survey. The questionnaire consisted of three segments namely demographic data, knowledge domain and attitude domain. There were 15 questions in the knowledge domain and 14 questions in the attitude domain, where all questions were closed ended. The knowledge domain questions were assessed with three given options as “Yes”, “No” and “I don’t know”. Whereas, the attitude domain questions were assessed on a 5-point Likert’s scale from “strongly agree” to “strongly disagree”. Participants were given a choice to voluntarily participate in the study and their identity was kept anonymous.

### 2.3. Data analysis

In the knowledge domain for every correct answer a count of “1” was given whereas the wrong answer received “0”. Here, the least possible score was “0” and the maximum attainable score was “15”. Similarly, in the attitude domain the “strongly agree” response received a tally of “5” and subsequently the “strongly disagree” the code was “1”. For the negatively worded questions, codes were flipped in both the domains. For this domain the lowest obtainable score was “14” and the maximal achievable score was “70”.

Later, the score obtained from each question were added to calculate the gross score of each domain for every respondent. Finally, the modified bloom’s cut-off was used to create three-point ordinal scales of the gross score of each domain [23]. Accordingly, the knowledge domain was categorized as good ( $\geq 80\%$  total score i.e.12–15), moderate (60%–79% total score i.e.9–11) and poor knowledge ( $<60\%$  total score i.e. $\leq 8$ ). Likewise, attitude domain had categories as good ( $\geq 80\%$  total score i.e. 56–70), moderate (60%–79% total score i.e.42–55) and poor attitude ( $<60\%$  total score i.e. $\leq 41$ ). The data was analyzed via using SPSS software version 21. For univariate analysis, chi-square test was used and multivariate logistic regression was employed for variable showed significant results in previous analysis.

## 3. Results

A total of 195 respondents participated in the study, of which 68.7% were male and 31.3% were female.

About half (50.3%) of the respondents were in the age group of 31–40 years. The maximum responses for the survey were gathered from the northern region (34.9%) whereas the eastern region of KSA (5.1%) contributed the least. The majority of our respondents had a bachelor’s degree (47.2%) and AHPs with more than 10 years of experience constituted maximum (35.4 %) in the sample. AHPs working in the governmental sector represented in high number (84.6%) compared to their private contemporaries. Considering the nature of work set-up, AHPs engaged in regional hospitals (52.8%) outsourced their counterparts by participating in large numbers. On comparing the preferred source of information, the Ministry of Health (MOH) website was found to be trending compared to the other sources (Table 1).

The assessment of knowledge domain was done with 15 questions. More than half of the respondents (52.8%) displayed a moderate level of knowledge, whereas about 32.8% showed good knowledge. Majority of respondents gave an incorrect response for two questions which dealt with nomenclature (63.07%) and regulation regarding hand hygiene (91.8%). For the remaining questions, they responded well with outstanding response for question related to disease transmission (97.4%) and presenting symptoms (99%) (Table 2).

For evaluating the attitude domain, 14 questions were asked from the AHPs. The majority (80%) showed good attitude whereas only 2.1% had poor attitude. A large part of the questions were answered correctly and a phenomenal response were observed for question referring to the identification of precipitating factors (Strongly agree – 82.6%) and PPEs (Strongly agree–81.5%). The negatively worded questions were answered incorrectly (Table 3).

With regards to the knowledge domain, except source of information ( $P < 0.001$ ), no other independent factors were found to have significant association. For the sake of better statistical interpretation, the moderate and poor levels of attitude scores were combined resulting in overall attitude score into dichotomous variable. AHPs working in governmental organization were found to have significantly ( $P < 0.05$ ) higher than then their contemporary working in a private setup (Table 4).

Significant results of univariate analysis for attitude domain were subjected to multivariate logistic regression. The AHPs working in private organization displayed a 2.8 times higher risk of having moderate/poor attitude in reference to employees of a governmental organization (Table 5).

Table 1  
Sample characteristics

Variable	Responses	f (%)
Sample size (n)	195	
Demographic and biographic data		
Age	20–30 years	57 (29.2)
	31–40 years	98 (50.3)
	41–50 years	32 (16.4)
	≥51 years	8 (4.1)
Gender	Male	134 (68.7)
	Female	61 (31.3)
Nationality	Saudi	151 (77.4)
	Non-Saudi	44 (22.6)
Region of Saudi Arabia	Central region (Riyadh, Qassim)	40 (20.5)
	Eastern region (Dammam, Jubail, Hassa and others)	10 (5.1)
	Western region (Makkah, Jeddah, Taif and Madinah)	42 (21.5)
	Northern region (Hail, Aljouf, Tabouk and Arar)	68 (34.9)
	Southern region (Assir, Jazan, Najran, Baha)	35 (17.9)
Education and work-related data		
Educational level	Intern	17 (8.7)
	Diploma degree/Associate college	34 (17.4)
	Bachelor's degree	92 (47.2)
	Master's degree	34 (17.4)
	Doctorate/PhD	18 (9.2)
Work experience	1–3 years	58 (29.7)
	4–6 years	34 (17.4)
	7–10 years	34 (17.4)
	More than 10 years	69 (35.4)
Nature of organization	Government	165 (84.6)
	Private	30 (15.4)
Type of work setup	Non-academic	
	Private clinic	8 (4.1)
	Primary healthcare center	14 (7.2)
	Regional/Public hospital	103 (52.8)
	Specialized hospital/Referral center	7 (3.6)
	Private hospital or medical complex	17 (8.7)
	Military hospital/Medical Clinic	36 (18.5)
	Academic	
	University hospital/Clinic	10 (5.1)
Source of information <sup>€</sup>	Social media	94 (48.2)
	Professional colleague	25 (12.8)
	Ministry of Health website	157 (80.5)
	Journals	47 (24.1)

Note: €responses are not mutually exclusive.

#### 4. Discussion

Presently, the cases of COVID-19 are tremendously increasing across the globe. It is noteworthy that collective efforts of public, government, HCPs along with AHPs can taper the condition [24]. Until now, none of the studies have exclusively focused AHPs' knowledge and attitude about COVID-19. Only few studies have assessed the knowledge and attitude regarding COVID 19 of DHCPs, and HCPs along with AHPs [3, 25–29]. Thus, a direct comparison cannot be made. Although, relevant questions and segment of previous studies dealing with AHPs has been discussed and compared in the present study.

The AHPs in the current study demonstrated a moderate knowledge (52.8%) and good attitude (80%) towards the COVID-19. An interesting finding in the present study is that the AHPs rely more on the MOH website (80.5%) compared to other sources such as social media. It is contrary to the findings of studies done with Vietnam and Pakistan HCPs [25, 29] where social media was the most preferred source of information. Although social media helps in fast propagation of information but it has a potential to spread news which is otherwise not correct [30]. Hence, a closed watch with logic is must to follow the norms propagated with social media. In our study majority of the respondent referred MOH

Table 2  
Descriptive analysis of questions pertaining to the knowledge domain

Category of information	Question	Response <i>f</i> (%)		
		Yes	No	I don't know
Nomenclature/Identification of causative organism	*COVID-19 is known as SARSCoV-2.	72 (36.9)	72 (36.9)	51 (26.2)
	Coronavirus is the causative organism responsible for Middle East respiratory syndrome (MERS), severe acute respiratory syndrome (SARS) and coronavirus disease 2019 (COVID-19).	144 (73.8)	23 (11.8)	28 (14.4)
Origin of infection	In COVID-19, the Chinese horseshoe bats are the most probable origin.	127 (65.1)	23 (11.8)	45 (23.1)
	*The main source of COVID-19 is a plant.	2 (1)	168 (86.2)	25 (12.8)
Transmission	Does COVID-19 have any intermediate host?	81 (41.5)	44 (22.6)	70 (35.9)
	COVID-19 is transmitted by close contact with an infected person or animal.	164 (84.1)	24 (12.3)	7 (3.6)
Symptoms of infection	COVID-19 can be transmitted from respiratory droplets and contact.	190 (97.4)	1 (0.5)	4 (21.)
	The incubation time for the virus is 1–14 days.	192 (98.5)	2 (1)	1 (0.5)
High-risk group	Fever, dry cough, and shortness of breath are the hallmark symptoms of COVID-19.	193 (99)	1 (0.5)	1 (0.5)
	People with co-morbidity (Diabetes Mellitus and other chronic diseases) are more likely to be infected with COVID-19.	152 (77.9)	31 (15.9)	12 (6.2)
Prognosis	COVID-19 has a lower fatality rate than MERS–CoV.	114 (58.5)	42 (21.5)	39 (20)
Investigation	PCR can be used to diagnose COVID-19.	143 (73.3)	9 (4.6)	43 (22.1)
Treatment	*Antibiotics are the first line of treatment.	33 (16.9)	128 (65.6)	34 (17.4)
Prevention	*As per the guidelines issued from the health authorities, washing hands with soap and water for at least 30 seconds can help prevent COVID-19.	177 (90.8)	16 (8.2)	2 (1)
	*Vaccination of COVID-19 is available in the market.	6 (3.1)	179 (91.8)	10 (5.1)
Total knowledge score		<b>Poor</b> 28 (14.4)	<b>Moderate</b> 103 (52.8)	<b>Good</b> 64 (32.8)

Note: \* Negatively worded question.

Table 3  
Descriptive analysis of questions pertaining to the attitude domain

Category of information	Question	Response n (%)					
		SD	D	N	A	SA	
Awareness about COVID-19	Health care professionals must acknowledge themselves with all the information about COVID-19.	8 (4.1)	1 (0.5)	7 (3.6)	52 (26.7)	127 (65.1)	
	Any related information about COVID-19 should be disseminated among peers and other health care workers.	7 (3.6)	2 (1)	15 (7.7)	64 (32.8)	107 (54.9)	
Precipitating factor	To comply with any local restrictions on travel, movement or large gatherings is one of the important ways of prevention.	4 (2.1)	1 (0.5)	3 (1.5)	26 (13.3)	161 (82.6)	
Symptoms Infection control protocol	People with fever, cough and difficulty breathing should seek medical attention.	6 (3.1)	1 (0.5)	5 (2.6)	37 (19)	146 (74.9)	
	Prevalence of COVID-19 can be reduced by active participation of health care workers in a hospital infection control program.	4 (2.1)	10 (5.1)	17 (8.7)	75 (38.5)	89 (45.6)	
	Transmission of COVID-19 infection can be prevented using universal precautions given by CDC and WHO.	5 (2.6)	4 (2.1)	12 (6.2)	64 (32.8)	110 (56.4)	
	*Using N95 masks by undiagnosed patients is critically important.	14 (7.2)	30 (15.4)	26 (13.3)	59 (30.3)	66 (33.8)	
	Gowns, gloves, mask, and goggles must be used when dealing with COVID-19 patients.	3 (1.5)	0	3 (1.5)	30 (15.4)	159 (81.5)	
	*Especially during the outbreak of COVID-19, every patient coming to the hospital should be considered as infectious and all standard protocols should be adopted.	6 (3.1)	10 (5.1)	9 (4.6)	46 (23.6)	124 (63.6)	
	Notify the receiving area about the patient's diagnosis and necessary precautions should be taken as soon as possible before the patient's arrival.	3 (1.5)	0	7 (3.6)	46 (23.6)	139 (71.3)	
	Health care professionals who transport patients should wear appropriate personal protective equipment and perform hand hygiene afterwards.	4 (2.1)	3 (1.5)	2 (1)	25 (12.8)	161 (82.6)	
	Prevention	It is important to stay more than 1 meter (3 feet) away from a person who is sick.	5 (2.6)	4 (2.1)	4 (2.1)	42 (21.5)	140 (71.8)
	Treatment	Only suspected cases of COVID-19 patients should be kept in isolation.	8 (4.1)	16 (8.2)	17 (8.7)	42 (21.5)	112 (57.4)
Intensive and emergency treatment should be given to diagnosed patients.		4 (2.1)	7 (3.6)	22 (11.3)	48 (24.6)	114 (58.5)	
Total attitude score		<b>Poor</b> 4 (2.1)	<b>Moderate</b> 35 (17.9)		<b>Good</b> 156 (80)		

Note: SD - Strongly disagree, D – Disagree, N - Neutral, A – Agree, SA – Strongly agree. \* Negatively worded question.

Table 4  
Frequency distribution of knowledge and attitude scores among the independent variables

Parameters	Knowledge			Total N = 195	P-value <sup>‡</sup>	Attitude		Total N = 195	P-value <sup>‡</sup>
	Good n = 64	Moderate n = 103	Poor n = 28			Good n = 156	Moderate n = 39		
<b>Nationality</b>									
Saudi	48 (31.8)	79 (52.3)	24 (15.9)	151	0.510	128(84.8)	23(15.2)	151	0.002**
Non-Saudi	16 (36.4)	24 (54.5)	4 (9.1)	44		28(63.6)	16(36.4)	44	
<b>Gender</b>									
Male	50(37.3)	67(50)	17(12.7)	134	0.128	109(81.3)	25(18.7)	134	0.487
Female	14(23)	36(59)	11(18)	61		47(77)	14(23)	61	
<b>Age</b>									
20–30 years	19 (33.3)	26(45.6)	12(21.1)	57	0.115	45(78.9)	12(21.1)	57	0.166
31–40 years	31 (31.6)	52(53.1)	15(15.3)	98		80(81.6)	18(18.4)	98	
41–50 years	12 (37.5)	20(62.5)	0(0)	32		27(84.4)	5(15.6)	32	
51–60 years	2 (25)	5(62.5)	1(12.5)	8		4(50)	4(50)	8	
<b>Educational level<sup>¶</sup></b>									
Intern	7(41.2)	6(35.3)	4(23.5)	17	0.278	14(82.4)	3(17.6)	17	0.844
Diploma	10(29.4)	19(55.9)	5(14.7)	34		28(82.4)	6(17.6)	34	
Bachelor	28(30.4)	49(53.3)	15(16.3)	92		75(81.5)	17(18.5)	92	
Master	9(26.5)	21(61.8)	4(11.8)	34		26(76.5)	8(23.5)	34	
Doctorate/PhD	10(55.6)	8(44.4)	0(0)	18		13(72.2)	5(27.8)	18	
<b>Region you work in</b>									
Central region	12(30)	22(55)	6(15)	40	0.818	35(87.5)	5(12.5)	40	0.105
Eastern region	1(10)	8(80)	1(10)	10		7(70)	3(30)	10	
Western region	16(38.1)	21(50)	5(11.9)	42		28(66.7)	14(33.3)	42	
Northern region	24(35.3)	33(48.5)	11(16.2)	68		56(82.4)	12(17.6)	68	
Southern region	11(31.4)	19(54.3)	5(14.3)	35		30(85.7)	5(14.3)	35	
<b>Organization setup</b>									
Government	52(31.5)	92(55.8)	21(12.7)	165	0.117	137(83)	28(17)	165	0.013*
Private	12(40)	11(36.7)	7(23.3)	30		19(63.3)	11(36.7)	30	
<b>Work experience</b>									
1–3 years	20(34.5)	26(44.8)	12(20.7)	58	0.643	44(75.9)	14(24.1)	58	0.634
4–6 years	11(32.4)	19(55.9)	4(11.8)	34		28(82.4)	6(17.6)	34	
7–10 years	12(35.3)	17(50)	5(14.7)	34		26(76.5)	8(23.5)	34	
More than 10 years	21(30.4)	41(59.4)	7(10.1)	69		58(84.1)	11(15.9)	69	
<b>Source of knowledge</b>									
Only one source	31(30.1)	48(46.6)	24(23.3)	103	<0.001	78(75.7)	25(24.3)	103	0.115
More than one source	33(35.9)	55(59.8)	4(4.3)	92		78(84.8)	14(15.2)	92	

‡Chi-Square test; ¶Fisher’s exact test; \*P < 0.05; \*\*P < 0.01.

Table 5

Multivariate logistic analysis to assess factors associated with moderate/poor attitude

Parameters	Odds ratio	95% CI		P-value
		Lower	Upper	
<b>Nationality</b>				
Saudi	Ref			
Non-Saudi	3.171	1.465	6.866	0.003**
<b>Organization setup</b>				
Government	Ref			
Private	2.821	1.178	6.758	0.020*

Note: CI – Confidence interval; \*P < 0.05; \*\*P < 0.01; Ref – Reference category.

website for information which shows a unanimous spread of information throughout the country. This dissemination of information by MOH was not only restricted to the HCWs, but also the general public

was being constantly informed through the website and awareness campaigns [31].

In the knowledge domain, pertaining to the questions related to nomenclature and origin of the disease, respondent have correctly answered the question in majority of the cases. Incorrect responses were received for question related to the virus and disease identification pertaining to SARS CoV-2 and COVID-19 respectively. The probable reason could be the constant update in the taxonomy based on the evidences gathered by researches in this field. On January 12 2020 WHO named the virus novel coronavirus 2019 (2019-nCoV) [9]. Later, the name of the virus was renamed to severe acute respiratory syndrome coronavirus 2 (SARS CoV-2) in a consensus statement of the International Committee on Taxonomy of Viruses [32]. On February 11 2020,

to avoid any inaccuracy and stigma, the disease was named coronavirus disease 2019 (COVID-19) [9]. Therefore, it seems logical that the AHPs might have been confused with the nomenclature and have responded incorrectly. Questions pertaining route of transmission were correctly answered by most of the respondents. The main route of disease transmission is supposed to be through respiratory droplets via direct or contact transmission [12], although with emerging evidences fecal-oral, saliva, aerosols as well as airborne and fomite transmissions are gaining attention [12, 13]. The aerosols measuring <5 microns remain disseminated especially in the closed environment with improper ventilation for a longer period of time, hence are supposed to be more infectious in the medical setup [11]. The knowledge of AHPs about the route of transmission for COVID-19 was consistent with other studies [26–28, 33]. Questions about the symptoms and recognizing patients at higher risk, has shown excellent correct response rate of 99%. Another study carried out with Egyptian population had a response rate of 95%, which is comparable [28]. This is considerably important for AHPs to be updated with the knowledge about this aspect as it will help them to screen the patients as well as plan the treatment accordingly. The common symptoms associated with COVID-19 include fever, cough, shortness of breath, myalgia, headache, vomiting and diarrhoea [9, 10]. It has been reported that elder age group and patients with systemic illness are more prone for COVID-19 [10, 34]. In a study done on Saudi Arabian population, it was found that the patient affected by COVID-19 has shown clinical manifestation of fever (85.6%), cough (89.4%), and sore throat (81.6%). The other symptoms were runny nose (72%), myalgia (28.6%), headache (27.3%), and gastrointestinal symptoms (14.3%) [35]. In the same study 20.1% of the patient who had co-morbidity were affected by COVID-19 [35]. As far as questions related to prognosis and treatment were concerned, the case fatality rate of COVID-19 is lower than SARS and MERS [15] and it was correctly answered by majority of the respondents. Regarding the antibiotics been the first line of treatment, was answered correctly. As a matter of fact, it is a viral infection and antibiotics can play a role only to prevent bacterial superinfections. Presently, many antiviral drugs, plasma therapy, and corticosteroids are given as symptomatic treatment [36]. Knowing the causative agent as virus, many antiviral drug therapies have been proposed but to conclude affirmatively as a curative agent, none of them have claimed as the pro-

phylactic/curative antiviral drug [37]. The AHPs have responded correctly to the availability of the vaccines. Vaccines for COVID-19 are currently not available on the market, although in many countries vaccines are under the phase III trial, i.e. human trial are ongoing, whereas in Russia the vaccine has been registered although the trial is still ongoing [38]. For the prevention of disease transmission, WHO and centre of disease control (CDC) guidelines have identified the practice of hand hygiene of utmost importance [39, 40]. The knowledge of AHPs regarding the question about duration of performing hand hygiene is not adequate. According to WHO, it should be at done for least 40 second with soap and water when the hands are visibly soiled. The technique adopted for this is equally important as it includes five specific movements ensuring that every aspect of hand is disinfected [39–41]. When visible dirt is not seen, the hand rub technique can be followed for 20 seconds with 60%–80% alcohol-based hand sanitizer [39, 40]. Thus, the time duration needs to be emphasized to the AHPs. An important finding for this present study is that none of the independent variables such as age, gender, region, education, educational level and years of experience have affected the knowledge outcome. The knowledge level of AHPs about COVID 19 was similar all around KSA.

The AHPs have attained a good (80%) attitude scores towards COVID-19 which portrays that they are fighting the disease with a positive attitude. Display of such attitude is must to overcome any disease. It has been reported that person with positive attitude and positive behaviors have a better tendency for coping strategies [42]. Attitude score of the present study were similar to few [28] and less compared with the study done on Nepalese HCPs [27].

It is noteworthy that AHPs are well aware that they should attain knowledge about the COVID-19 and disseminate among peers so that they should remain updated with the current norms. It shows zeal among them to combat the disease with updated knowledge. The AHPs are well aware about the protocol of travel restriction and large gathering. As per the WHO, the patients are supposed to be in quarantine for about 14 days if they had travelled internationally or locally or they have come in close contact to the COVID-19 positive patient [43]. As far as the large gathering is concerned, the protocol of safe distancing is compromised leading to spread of the disease. Hence, recommendations and advisory were published not to gather in a crowded area [43, 44]. Interestingly, the AHPs have shown a good attitude towards the



infection control protocol. The results were similar with other countries [25] and better than few others [27]. Few questions related to infection control has been overestimated and overrated by the AHPs such as the usage of N95 respirators by undiagnosed patients of COVID-19. Over usage of respirators or other personal protective equipment (PPEs) can lead to shortage and hence it cannot be provided to the needy [45]. Hence, judicious usage of mask is a crucial. Although, as per the new evidence of airborne transmission, WHO advised to wear a mask, perform social distancing and follow hand hygiene measure to curb the disease spread [46]. The AHPs are well aware that they have to follow the infection control protocol and guidelines issued by WHO, CDC as well as local body i.e. MOH. Strict compliance with the measures will help in complete rehabilitation of the patient and lessen the chance of AHPs from getting infected. As reported in a study in Saudi Arabia, 12.5% of COVID-19 patients were working in a health care facility [35]. Hence, it is important to understand that the HCPs along with AHPs are at higher risk of getting this disease. Any disparity to follow infection control protocol can lead to grave consequences for the health care machinery. Regarding treatment, the AHPs are well-aware about the criteria for a patient to be advised for isolation or admit in intensive care unit. This shows a positive attitude and correct approach for the treatment. An important point to be addressed is the attitude of AHPs working in a private setup, as they were shown to have 2.8 times risk for possessing a moderate/poor attitude in comparison to AHPs working in a governmental setup. However, the level of knowledge of AHPs working in both the sets up was similar. In a study done on Saudi Arabian hospitals, it was found that there is a significant association between attitudes towards healthcare service quality and hospital performance [47].

The present study has a few limitations. Since the study was conducted online in a period where the country was facing lockdown, a face-to-face survey would have excluded the potential bias of misinformation. In the background of the current survey results, continuing professional development program (CPD) can be conducted to bridge the gap between existing and the required knowledge. Based on these findings, a recommendation can be made which would be helpful for the AHPs to work with a scientific background by protecting the patients as well as themselves.

## 5. Conclusions

The allied healthcare professionals have shown moderate knowledge and good attitude towards COVID-19. The knowledge of the AHPs can be enhanced by conducting continuing professional development program. Furthermore, strategic planning should be implemented for the private hospitals to enhance the attitude of AHPs.

## Author contributions

Conceptualization, D.S., A.A.A, K.C.S. and M.G.S; methodology, D.S., A.A.A, K.C.S. and M.G.S; software, K.C.S. and A.F.S.; validation, K.C.S., D.S. and A.F.S.; M.K.A formal analysis, K.C.S.; investigation, K.C.S., K.A and A.F.S.; resources, A.A.A, K.C.S. and M.G.S; data curation, D.S; K.C.S. and M.G.S; writing—original draft preparation, D.S. and K.C.S.; writing—review and editing, D.S., A.A.A, K.C.S., A.F.S., K.A., M.G.S;M.K.A visualization, K.C.S., A.A.A, and M.G.S; supervision, K.C.S; project administration, M.G.S;M.K.A funding acquisition, A.A.A. All authors have read and agreed to the publish the final version of the manuscript.

## Conflict of interest

The authors declare no conflict of interest.

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