Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Nurse Education in Practice 52 (2021) 103041

Contents lists available at ScienceDirect

Nurse Education in Practice

journal homepage: www.elsevier.com/locate/issn/14715953

COVID-19 knowledge, attitude, and precautionary practices among health professional students in Oman☆

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ARTICLE INFO

Keywords:
Nurses
Nursing
Students
COVID-19
Oman

ABSTRACT

Assessing knowledge, attitude, and practices of healthcare students regarding any infectious outbreak became a fundamental step to set an effective plan related to their preparedness. The purpose of this study was to assess COVID-19 knowledge, attitude, and precautionary practices among health professional students in Oman. Data were collected using the Web-based survey method. The sample was recruited from the largest college of Medicine in Oman, while the nursing sample was recruited from two different nursing colleges in Oman. The study tool was developed based on the most recent advisory COVID-19 recommendations from the WHO and the CDC. A total of 222 students filled the survey, of which 55% were medical students and 59.9% were females. The mean knowledge score was 16.5 (*SD* = 4.2), which represents 66% of the highest possible score, with 25.7% were classified as 'excellent knowledge'. Participants reported a high level of public precautionary practices (M = 44.1, *SD* = 5.0), which represents 84.6% of the highest score, with 61.3% were classified as 'high compliance. The mean attitude score was 40.3 (SD = 5.9), which represents 67% of the highest possible score. According to the classification categories, most students (81%, n = 180) expressed a positive attitude toward COVID-19. More efforts should be done toward preparing the healthcare students to deal with the outbreak. Preparing healthcare students with the right knowledge, attitude, and precautionary practices during the COVID-19 outbreak is very essential to patient and public safety. Healthcare students can play a major role in increasing public awareness about COVID-19 precautionary practices.

1. Background and significance

The outbreak of coronavirus disease 2019 (COVID-19) appeared last December 2019, in Wuhan, China and has become an extremely challenging health problem, not only in China but also worldwide (Phelan et al., 2020). At the end of January 2020, the World Health Organization (WHO) officially declared a novel coronavirus outbreak a public health emergency of international concern (PHEIC), WHO's highest level of alarm. In March 11, the WHO declared that the outbreak has reached the pandemic level (WHO, 2020a). The estimates based-population for COVID19 is huge in most of the affected countries and contributed to increased mortality, morbidity, respiratory failure, shock and prolonged hospitalization, especially for those categorized as developed. Whereas, the picture in less developed countries is not clear because of lack of accurate reporting system (Shen et al., 2020). According to the situational report published by the WHO on August 16, 2020, there were more than 21.29 million confirmed cases, with 761,779 deaths globally (WHO, 2020c). In the same report, the USA was reported to have the highest number of cases in the world, with an estimated 5.25 million confirmed cases including 167,201 deaths (WHO, 2020c). In the Eastern Mediterranean region, the situation was also catastrophic, with more than 1.72 million cases confirmed and 45,704 deaths (WHO, 2020c).

The WHO announced "COVID-19" as the official name Coronavirus disease on 11 February 2020 (WHO, 2021). The reason for the name of the Coronavirus because of the outer edge of envelope proteins, which similar to the crown and a coronaviridae subfamily, positive-sense RNA

☆ All authors report no conflicts of interest relevant to this article.

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https://doi.org/10.1016/j.nepr.2021.103041
Received 19 September 2020; Received in revised form 23 February 2021; Accepted 22 March 2021
Available online 25 March 2021

viruses (Cui et al., 2019). Coronaviruses are affecting all age groups, but elderly people are more at risk for the infection (Law et al., 2020). The signs and symptoms may appear 2–14 days after acquiring the virus. Patients show a wide range of signs and symptoms such as loss of taste and smell, fever or chills, muscle or body aches, difficulty breathing and congestion or runny nose (CDC, 2021b) According to the available evidence, COVID-19 is transmitted primarily by respiratory droplets and direct contact with infected people secretions such as saliva, respiratory secretions, which are expelled when an infected person talks, sneezes, or coughs (CDC, 2021b). The virus can be diagnosed by using an RT-PCR test (CDC, 2021a).

The spread of the pandemic has created drastic challenges and changes in all aspects of life, especially in health professionals' education. One of the most important challenges is the preparedness and willingness of health professional students to work in infectious disease outbreaks (Cervera-Gasch et al., 2020). Therefore, assessing knowledge, attitude and practices of health professionals regarding any infectious outbreak has become a fundamental step to setting an effective plan related to their preparedness. The initial research on COVID-19 has demonstrated that during unexpected natural crises and infectious diseases, health-care professionals will make every effort to participate in the efforts to control the outbreak and reduce the complications, but the less consciousness of the risk of the infection (Wu and McGoogan, 2020). In fact, the initial COVID-19 report from 44,672 infected cases from China showed 3.8% prevalence rate among healthcare personnel (Wu and McGoogan, 2020). The WHO stressed the importance of protecting healthcare providers from COVID-19 and considered it as a major focus of efforts against this pandemic (WHO, 2020d).

For any infectious disease outbreak, the standard precautions are considered the first-line defense of controlling the outbreak. The Centre for Disease Control and Prevention periodically updates standard infection control guidelines, which detail principal practices that are applied to protect the health professional teams and patients from infections (O'Hara et al., 2018). Results from previous research in Middle East countries showed suboptimal knowledge among health-care professional students about standard precautions (AL-Rawajfah and Tubaishat, 2015; Khubrani et al., 2018; Nasiri et al., 2019). Therefore, it is important to assess the students' preparedness level, in terms of knowledge, attitude and practices regarding any emerging infectious outbreak.

Sultanate Oman is one of the Arab countries that has been affected by the outbreak of COVID-19 and the situation is becoming more challenging. On February 24, 2020, the Ministry of Health (MOH) announced the first case. As of August 15, 2020, the MOH announced that there were 82,924 confirmed cases and 562 deaths (MOH Sultanate of Oman, 2020). A recent descriptive analysis study of MERS-CoV cases was performed in Oman and reported 13 confirmed cases of MERS-CoV and in 23% of them were due to transmission in health-care facilities. Several factors were contributed to these transmissions, such as delays in suspicion and case detection, environmental contamination, overcrowding, lack of equipment and lack of awareness of infection control practices (Al Awaidy et al., 2020). Therefore, all possible initiatives must be taken to reduce the outbreak of the infection among health-care providers, by knowing the risk factors of infection and use the appropriate measures (Zhang et al., 2020).

In Oman, health professional education started in the early 1980s where the first health sciences institute governed by the Ministry of Health was rolled out. The program graduated nurses and other health professional at the diploma level. The first bachelor's Medical program was started at Sultan Qaboos University in 1986, whereas the first Bachelor's nursing program was started in 2001 at the same university (Al Maqbali et al., 2019). Now a day, Oman has two Bachelor's medical programs with about 2000 enrolled students. For nursing, there are four bachelor programs with about 3000 students (unpublished data). In Oman, no studies have been conducted to assess health-care professional students' knowledge, attitude and practices related to the emerging COVID-19 pandemic. This study aimed to assess COVID-19 knowledge, attitude and precautionary practices among health professional students in Oman.

2. Methods

This study used a cross-sectional, descriptive design. The study involved data collection using the Web-based survey method.

2.1. Settings and sampling

The sample of this study was recruited from the largest college of medicine in Oman, at Sultan Qaboos University while the nursing sample was recruited from two different colleges that award the bachelor's degree of nursing, in Muscat, Oman, one of which is at Sultan Qaboos University. They amounted to 222 professional students who agreed and were willing to participate in the study. As a rule of thumb in literature reviews, a sample size of 200–300 was considered adequate for proper analysis (Polit and Beck, 2017). The survey was designed to be filled only once to prevent duplication of responses. No specific inclusion criteria were used, other than being active students in the medical or nursing programs.

The study was ethically approved by the ethical approval body in the principal investigator's affiliated institution. On the front page of the survey, participants were given a full explanation about the study and they were asked to voluntarily click on "Entering" bottom at the survey face page to start answering the survey questions. The study was anonymous, and no identification data have been collected from the students.

2.2. Study instrument

The study used prepared self-reported questionnaires, based on the most recent available COVID-19 information and public preventive guidelines and recommendations of the WHO 2020 and the CDC 2020 (CDC, 2020; WHO, 2020b). The survey has four parts. The first part was related to students' demographics, such as age, gender, the program, academic level and other related variables. The second part was related to COVID-19 knowledge, which included 25 questions with the response options 'true', 'false', or 'I don't know'. The 'I don't know' option was added to reduce the possibility of guessing the answer but was considered as an incorrect answer when computing the total knowledge score. Questions were related to cause and clinical manifestations, diagnosis and prevention and treatment of COVID-19.

The third part was related to attitudes towards COVID-19, which included 12 items with a 5-point Likert scale ranging from 5 (strongly agree) to 1 (strongly disagree). No total score is assumed. The fourth part was related to precautionary practices, which included 13 items with a 4-point Likert scale ranging from 1 (never) to 4 (always), with a total score ranging from 13 to 52, where the higher score represents higher precautionary behavior. The items were built based on the advisory public recommendations from the WHO and the CDC (CDC, 2020; WHO, 2020b). The intention was to assess how health-care students are reacting to public recommendations for controlling COVID-19. The study tool was reviewed and validated for content by two professors of infectious diseases and an infection control background. The tool was reviewed by only three experts because they are the only experts who were ready for the review at the time of tool development. A pilot sample of 10% (n = 21) of the total sample was used as pilot testing. The reliability coefficients for knowledge, attitude and practice subscale were 0.68, 0.73 and 0.79, respectively. To maintain a larger sample size, the pilot responses were included in the final analysis as well. All items were in the English language as it is the instructional language for both medical and nursing courses. Using the current study sample, the internal consistency coefficients were 0.76, 0.79, 0.79, for knowledge, attitude and practice subscales, respectively.

3. Data analysis

Data were analyzed using SPSS®-PC Version 23. To describe the study sample, descriptive statistics, including frequencies, percentages, means and standard deviations, were used. No missing data for any of the study variables were found. According to previous similar research (AL-Rawajfah and Tubaishat, 2015; Caliskan et al., 2020; Taghrir et al., 2020), the total knowledge score was classified as 'unsatisfactory' (< 50th percentile, 0–12), 'satisfactory' (50th and 75th percentiles, 13–18) and 'excellent' (>75th percentile, 19–25). Whereas, the total attitude score was categorized as 'positive attitude (> 50th percentile, 12–35) and 'negative attitude (≤50 percentile, 36–60), taking in consideration that negative items were reverse coded. Finally, the total practice score was classified as 'low compliance' (<50th percentile, 13–33), 'moderate compliance'' (50th and 75th percentiles, 34–43) and 'high compliance'' (>75th percentile, 44–52).

Independent *t*-test and one-way ANOVA were used to compare mean total knowledge, attitude and practice scores across different variables. Assumption of normality was checked before running the analysis and no serious violation was found. Finally, Pearson's correlation was used to test for possible association between the total knowledge and practice scores.

4. Results

4.1. Sample characteristics

A total of 222 students completed the electronic survey, with a mean age of 21.9 (*SD* = 2.4) years for all of the respondents. Of the total sample, 55% (n = 122) were medical students. Most participants 59.9% (n = 133) were female students. Most (68.9%, n = 153) of the students were senior students (third year or above). Most (52.7%, n = 117) of the participants had a family member or friend infected with COVID-19. Further, most (64.9%, n = 144) reported that their college provided them with enough information about COVID-19 and how to deal with it. Only a small portion (4.5%, n = 10) of the students reported that they were very well-prepared to deal with COVID-19 cases. Most (46.4%, n = 103) of the students reported that social media and unofficial (public) internet websites were their first source of information about COVID-19 (Table 1).

Table 1
Sample characteristics of the participating students, N = 222.

Characteristic	Number of students (%) N = 222
Mean of age (SD)	21.9 (2.4)
Mean GPA (SD)	3.0 (0.57)
Gender	
Female	133 (59.9)
Male	89 (40.1)
Academic program	
Medical	122 (55)
Nursing	100 (45)
Academic level	
1st year	30 (13.5)
2nd year	39 (17.6)
3rd year	30 (13.5)
4th year	57 (25.7)
5th year	41 (18.5)
6th year or above	25 (11.2)
Do you have any of your family member or a friend infected with COVID-19	
Yes	117 (52.7)
No	105 (47.3)
Did your college provide you with enough information about COVID-19 and how to deal with it?	
Yes	144 (64.9)
No	78 (35.1)
On a scale 1 – 10, to which degree you are satisfy with actions taken by your college related to COVID-19	
1 – 3	54 (24.3)
4 – 7	111 (50)
8 – 10	57 (25.7)
Would you like to attend formal lectures related to COVID-19?	
Yes	69 (31.1)
No	153 (68.9)
How well prepared do you think you are to deal with COVID-19 or similar pandemic	
Not at all prepared	22 (9.9)
Somewhat prepared	118 (53.2)
Well prepared	82 (36.9)
Frist source of information about COVID-19 for the students	
Social media and unofficial websites	103 (46,4)
Family members, colleagues and friends	83 (37.4)
Official website (the College, the Ministry of Health)	19 (8.6)
Scientific databases and journals	17 (7.6)

4.2. COVID-19 knowledge

Total COVID-19 knowledge scores for the participating students ranged from 5 to 24, with a mean score of 16.5 (*SD* = 4.2), which represents 66.0% of the highest possible score. Out of the 222 students who completed the survey, 1% (n = 2) scored the highest score. The 25th, 50th, 75th and 90th percentiles for the students' knowledge scores were, 14, 17, 20 and 22, respectively. Based on the classification categories of the knowledge level, 22.5% (n = 50) were 'unsatisfactory', 51.8% (n = 115) were 'satisfactory' and 25.7% (n = 57) were 'excellent'. Table 2 summarizes frequencies of correct and incorrect answers by the students.

4.3. Attitude toward COVID-19

The total attitude scores for the students ranged from 24 to 54, with a mean score of 40.3 (SD = 5.9), which represents 67% of the highest possible score. According to the classification categories, most students (81%, n = 180) expressed a positive attitude toward COVID-19, whereas the remaining were expressed a negative attitude. The students expressed different perceptions of COVID-19 infection. For example, 40.1% of students perceived COVID-19 as a fatal disease for all affected people. Likewise, 58.5% believed that infected persons should be isolated in health-care settings. Further, most (84.7%) of the students expressed their worries about spreading the infection to their family. Although most (72%) students expressed their willingness to take the COVID-19 vaccine once it is available, 16.7% were undecided about this issue and 10% of students were not willing to take the vaccine (data not shown in table).

4.4. Precautionary practices

Students reported a high level of public precautionary practices (M = 44.1, *SD* = 5.0), which represents 84.6% of the highest score. According to the practice categories, most students (61.3%, n = 163) were 'high compliance'. Whereas, 33% and 5% were classified as 'moderate compliance' and 'low compliance', respectively. Table 3 presents frequencies of the reported compliance with precautionary practices of COVID-19.

4.5. Comparison of knowledge and public precautionary practices across different variables

The total knowledge and practice scores were compared among nursing and medical students. The results showed that medical students scored higher COVID-19 knowledge level (M = 17.9, SD = 3.6), than nursing students (M = 14.7, SD = 4.2, $p < 0.01$). Likewise, medical students reported a higher level of public precautionary practices (M = 45.1, SD = 4.1), than nursing students (M = 43.0, SD = 5.8, $p < 0.01$).

Table 2
Frequencies and percentages of the answers of the knowledge items, N = 222.

No.	Item	Correct answer	Incorrect answer
Causes and clinical manifestations			
1.	The causative agent of COVID-19.	200 (90.1)	22 (9.9)
2.	The similarity of COVID-19 with the Seasonal Flu.	100 (45)	122 (55)
3.	The transmission of COVID-19.	140 (63.1)	82 (36.9)
4.	The complicated pneumonia of COVID-19.	150 (67.6)	72 (32.4)
5.	The common symptom of COVID-19.	123 (55.4)	99 (44.6)
6.	The incubation period of COVID-19.	131 (59.0)	91 (41.0)
7.	When to seek help when direct contact with a suspected case.	176 (79.3)	46 (20.7)
Diagnosis and prevention			
8.	The diagnosis of COVID-19 by the PCR	201 (90.5)	21 (9.5)
9.	Fever as a diagnostic symptom of COVID-19.	184 (82.9)	38 (17.1)
10.	High risk group of COVID-19.	211 (95.0)	11 (5.0)
11.	Who should wear masks to prevent the spread of the infection.	196 (88.3)	26 (11.7)
12.	The risk of young adults and children for the infection.	117 (52.7)	105 (47.3)
13.	The use of the regular mask to prevent the infection.	189 (85.1)	33 (14.9)
14.	Only sick people should wear a mask for prevention.	142 (64.0)	82 (36.0)
15.	The use of fabric masks to prevent the infection.	170 (76.6)	52 (23.4)
16.	The use of N95 mask.	60 (27.0)	162 (73.0)
17.	Hand sanitizer to prevent the infection.	178 (80.2)	44 (19.8)
18.	The availability of Vaccine for prevention.	174 (78.4)	48 (21.6)
Treatment			
19.	Indication of hospitalization	169 (76.1)	53 (23.9)
20.	The availability approved Drug for treatment	161 (72.5)	61 (27.5)
21.	The use of Antiviral medications.	119 (53.6)	103 (46.4)
22.	The use of Dexamethasone.	35 (15.8)	187 (84.2)
23.	The use of Hydroxychloroquine.	63 (28.4)	159 (71.6)
24.	The use of supportive treatment.	179 (80.6)	43 (19.4)
25.	The approximate mortality rate in Oman.	88 (39.6)	134 (60.4)

Table 3
Frequencies and percentages of the reported precautionary practices, N = 222.

Precautionary practices	Nevern (%)	Rarely n (%)	Sometimes n (%)	Always n (%)
I practice social distancing, at least 1 m when around other people	0 (0.0)	9 (4.1)	92 (41.4)	121 (54.5)
I wear a mask/face cover when I am in public areas around other people	4 (1.8)	7 (3.2)	28 (12.6)	183 (82.4)
I stay at home as much as possible	3 (1.4)	12 (5.4)	46 (20.7)	161 (72.5)
I avoid shaking hands when greeting others.	2 (0.9)	13 (5.9)	48 (21.6)	159 (71.6)
I wash my hand or using disinfectants after visiting public areas	4 (1.8)	4 (1.8)	37 (16.7)	177 (79.7)
I avoid touching my face and mask.	1 (0.5)	19 (8.6)	98 (44.1)	104 (46.8)
I closely monitor the COVID-19 symptoms of the people around me.	13 (5.9)	35 (15.8)	88 (39.6)	86 (38.7)
I pay attention to balanced diet.	11 (5)	36 (16.2)	111 (50.0)	64 (28.8)
I clean my personals (e.g., phone) after using it in public areas around other people	29 (13.1)	55 (24.8)	71 (32.0)	67 (30.2)
I Avoid using public transportation	10 (4.5)	10 (4.5)	18 (8.1)	184 (82.9)
I get enough sleep time (8 h sleep)	5 (2.3)	32 (14.4)	100 (45)	85 (38.3)
I make sure to be physically active	8 (3.6)	35 (15.8)	116 (52.3)	63 (28.4)
I encourage people around me to follow the COVID-19 precautionary guidance	4 (1.8)	11 (5)	58 (26.1)	149 (67.1)

Students who expressed their interest in attending formal lectures about COVID-19 reported higher precautionary practices (M = 44.7, SD = 4.8), than those who were not interested (M = 42.9, SD = 5.4, $p < 0.013$). Likewise, students who reported a higher level of satisfaction with the college actions in relation to COVID-19 also reported a higher level of precautionary practice (M = 45.5, SD = 5.0) than students with a lower level of satisfaction (M = 42.9, SD = 5.1, $p = 0.018$). Further, the knowledge and practice levels were statistically different across the different academic levels of the students (F = 2.44, $p = 0.035$) and (F = 2.70, $p = 0.023$), respectively (Table 4). Finally, Pearson's correlation showed a significant positive relationship between the total knowledge and precautionary practices score ($r = 0.52$, $p < 0.001$), as well as with attitude total score ($r = 0.43$, $p < 0.001$). Moreover, there was a significant positive relationship between the total attitude score and the total precautionary practices score ($r = 0.35$, $p < 0.001$).

5. Discussion

The current study revealed important results related to health-care students' knowledge, attitudes and precautionary practices related to COVID-19. Although the findings are specific to the current COVID-19 pandemic, they can also be applicable to possible similar future infectious disease pandemics. The study revealed that the overall knowledge of the health-care students about the current COVID-19 is not optimal, as only about one-quarter of the sample scored more than 75% of the maximum score. The overall knowledge score in the current study is lower than scores reported from other countries in the region, such as Jordan (Khasawneh et al., 2020), Turkey (Caliskan et al., 2020) and Iran (Taghrir et al., 2020), but still very close to other results in the region, such as Saudi Arabia (Begum, 2020; Mohsin et al., 2020) and Egypt (Hamza et al., 2020). The difference in the knowledge score can be attributed to using different items related to COVID-19. In the current study, we have asked very specialized questions related to diagnosis and available treatment options. Also, in the current study, we have not applied specific exclusion criteria and students from all academic levels have participated in the study. In fact, about half (44.6%) of the participating students were junior students, which means that they have less exposure to pathophysiology and treatment options of COVID and similar conditions. Furthermore, with the switching to remote teaching methods, health-care students have become more independent self-leaners. Indeed, most students (46.4%) depend on social media and public Websites as the first source of information about COVID-19. Although social media is considered convenient and accessible to most of the students, the information posted on it may not be accurate and could mislead the students. Similar results were reported in Jordan and Egypt (Hamza et al., 2020; Khasawneh et al., 2020), where health-care students reported that social media is their major source of information about COVID-19.

The current study revealed that medical students showed higher COVID-19 knowledge levels than nursing students. The study showed that a small portion (9%) of medical students were in the unsatisfactory knowledge level category, compared with 33% for nursing students in the same category ($\chi^2 = 32.8$, $p < 0.001$). Medical students were found to have higher COVID-19 knowledge level than other health-care students (Modi et al., 2020). As mentioned before, in the current study, we have included items related to the available treatment options, which are mostly likely of more interest to medical students than nursing students. For example, in the current study, most (60.1%) of medical students correctly answered the question related to the use of antiviral therapy in treating COVID-19, compared with 45% of nursing students ($\chi^2 = 5.4$, $p = 0.02$). With a lot of uncertainty related to the treatment options available for COVID-19, health-care students become sources of information for the public. Therefore, it is important that health-care students, including nursing students, keep abreast of the latest updates

Table 4
Factors associated with total knowledge and practice scores.

Variable	Knowledge M (SD)	*t*	*p*	Attitude M (SD)	*t*	*p*	Practices M (SD)	*t*	*p*
Program									
Nursing	14.7 (4.2)	6.20	0.001	39.3 (6.8)	2.30	0.02	43.0 (5.8)	3.20	0.002
Medical	17.9 (3.6)			41.1 (4.9)			45.1 (4.1)		
Gender									
Male	16.4 (4.6)	0.22	0.83	41.1 (5.7)	2.50	0.01	44.1 (5.3)	0.05	0.99
Female	16.5 (3.9)			39.1 (6.0)			44.1 (4.9)		
Academic level									
Juniors	15.1 (4.0)	2.5	0.01	38.6 (5.4)	2.90	0.004	43.1 (5.2)	2.10	0.034
Seniors	16.5 (4.0)			41.0 (5.9)			44.6 (4.9)		
Infected family member/ friend									
Yes	16.7 (4.1)	0.87	0.39	39.9 (5.6)	0.9	0.40	44.2 (5.2)	0.13	0.99
No	16.2 (4.2)			40.6 (6.2)			44.1 (4.8)		
The college provide enough information about COVID-19									
Yes	16.9 (4.5)	1.20	0.22	39.4 (6.1)	3.0	0.003	444.7 (5.4)	0.96	0.34
No	16.6 (4.0)			41.8 (5.2)			43.7 (4.8)		
Would you like to attend formal lectures about COVID-19									
Yes	16.7 (4.2)	1.36	0.17	40.7 (6.1)	1.8	0.08	44.7 (4.8)	2.6	0.013
No	15.9 (4.1)			39.2 (5.3)			42.9 (5.4)		
Level of satisfaction with actions taken by the college		**F (*df*)**	***p***		**F (*df*)**	***p***		**F (*df*)**	***p***
1–3	16.9 (4.4)	0.33 (2)	0.69	40.2 (4.5)	0.142	0.868	42.9 (5.1)	3.90	0.022
4–7	16.3 (4.2)			40.5 (6.4)			44.0 (5.2)		
8–10	16.5 (3.9)			39.9 (6.0)			45.5 (4.3)		
Perceived level of preparedness to deal with COVID-19									
Not at all prepared	17.7 (4.6)	2.40 (2)	0.09	41.8 (5.1)	2.1	0.13	44.2 (3.4)	0.7 (2)	0.50
Somewhat prepared	16.1 (3.8)			40.6 (5.5)			44.5 (4.5)		
Well prepared	15.6 (4.2)			39.3 (6.5)			43.6 (6.1)		

df for all *t*-test comparisons = 221.

and available treatment options and obtain the information from reliable resources.

The current study revealed different perceptions and attitudes toward COVID-19. For example, less than half (40.1%) of the participating students believe that COVID-19 is a fatal condition. This result is unlike results reported from other health-care students around the world, such as Jordan (Khasawneh et al., 2020) and Turkey (Caliskan et al., 2020) and many other countries where most the participants believed that COVID-19 is a fatal condition. Although the difference in attitude towards COVID-19 can vary from one culture to another, the attitude can be linked to the level of the knowledge available among the students. For example, in the current study most (60.4%) students were unable to answer correctly the reported mortality rate of COVID-19 in Oman, which may reflect their underestimating the fatal effect of this infectious condition. Therefore, enhancing their knowledge could result in an appropriate attitude toward this infectious condition, which in turn can enhance the awareness and precautionary practices among the students and the public.

The current study revealed that the students reported a good level of public precautionary practices. This finding is consistent with other studies around the globe (Hamza et al., 2020; Modi et al., 2020). Previous research (Byszewski et al., 2012; Tagawa, 2016) has shown that health-care students perceived themselves as role models in compliance with health-care instructions. Furthermore, the current study demonstrated a significant relationship between knowledge and precautionary practices ($r = 0.52$). Indeed, this conclusion is supported by the other piece of finding from the current study, which indicates that medical students demonstrated higher levels of precautionary practices than nursing students. This emphasizes the importance of improving the knowledge of health-care students to act correctly and even to positively influence the public.

6. Limitations

This study was conducted very early during the announcement of the pandemic. Therefore, the results from this study should be taken in this context. For example, at the time of data collection, there was no vaccine available and no clear answer about the time frame for making the vaccine possible. Further, to shorten the time of the tool development the tool was validated by thee experts, it would be better to consider validating the tool by a larger number of experts (5 – 10) which will make it possible to report the content validity index for the tool. Future research may be considered to report detailed information about the psychometric properties of the tool and to conduct further advance psychometric analyses. Finally, this study used the convenient sampling technique to recruit the participants. With a convenient sample, the generalizability of the results should be taken within the context of the study condition.

7. Implication for practice

The results from the current study suggested different implications for practice at the educational level. These recommendations are applicable at local and international levels. First, health professional educators should be respondents to any pandemic and set plans related to students' education. Updating students with the most reliable information about the pandemic should be a priority for health professional educators. Moreover, this study demonstrated that medical students had better knowledge, attitude and precautionary practices than nursing students. This suggests that health professional educators should consider educational methods that enhance the knowledge exchange among different health professional students. Developing interprofessional educational sessions or methods (e.g., interprofessional simulation, interprofessional case-study discussion, interprofessional courses), are known educational methods that enhance the knowledge and experiences exchange among the students.

Finally, enhancing positive attitude and compliance with the recommended practices among health professional students is essential to strengthening their role in society against the pandemic. Health professional students are the future healthcare providers. Therefore, health professional educators are responsible for cultivating the role-model behaviors of the students about public health issues. This will enhance public awareness about the recommended practices against the pandemic.

8. Conclusion

In conclusion, this study revealed important findings that should inform health professional educators, in Oman and similar countries. Health professional students demonstrated high COVID-19 knowledge, yet, not the optimal level. Medical students demonstrated higher knowledge, attitude and practice levels than nursing students. Further, junior students demonstrate less COVID-19 knowledge, attitude and compliance with precautionary practices than senior students These results suggest considering methods to enhance the knowledge exchange among medical and nursing students and even among students from different academic levels. Finally, there is a significant positive relationship between students' knowledge, attitude and precautionary practices. These results should inform the health professional educators about their responsibility of working on these factors to enhance the role of health professional students against this pandemic.

Funding

This work didn't receive any funding.

CRediT authorship contribution statement

Omar Al-Rawajfah: Is the principle investigator and responsible for data collection and drafting the manuscript and the corresponding author. **Khalid A. Al-Mugeed**: Contributed to tool development, Discussion and reviewing of the manuscript. **Fawwaz Alaloul**: Contributed to tool development, Data collection, Writing and reviewing the manuscript. **Hajar Al-Rajaibi**: Contributed to data collection, Writing and reviewing the manuscript. **Omar Al Omari**: Contributed to data collection.

Declaration of Competing Interest

No potential conflict of interest can be reported related to this work.

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