Article

Internship preparedness among students in healthcare-related fields in the COVID-19 era: Exploring the attitude and knowledge in Saudi Arabia

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Abstract

Background: In the COVID-19 era, efforts are being made to increase awareness among students and enhance best practices to mitigate the outbreak. To that end, the overarching aims of this study were to understand students' attitude toward and knowledge of COVID-19 and examine the predictors of their attitude toward hand hygiene.

Design and Methods: This cross-sectional survey study, conducted in Saudi Arabia, enrolled interns from diverse healthcare-related fields. The questionnaire was divided into three sections: sociodemographic data, knowledge of COVID-19, and attitude toward hand hygiene. The data was expressed as median and interquartile range (IQR).

Results: In all, 371 responses were analyzed. The median knowledge score was 20, which was considered good. There were no statistically significant differences across age, hospital setting, or gender. Of the 254 respondents who had attended an educational session, 167 (65%) had a good knowledge score and 83 (33%) had a moderate score, compared with only four (2%) who had a poor score. The cumulative median score of the respondents' attitudes was 6 (IQR [2]), which reflects a suboptimal attitude - only 38 (22%) reported a good attitude. The predicted effect of knowledge on attitude (good/suboptimal) was statistically significant (p=0.02) using univariate logistic regression.

Conclusions: The results suggest a strong need to encourage the current training program that targets hand hygiene practices among students in healthcare-related fields, especially prior to the internship year.

Introduction

The coronavirus disease (COVID-19), which has been declared a pandemic, has a high rate of infection and mortality.[1] It can now be said that previous outbreaks of coronavirus infections, such as the severe acute respiratory syndrome-coronavirus (SARS-CoV) and the Middle East respiratory syndrome-coronavirus (MERS-CoV), showed symptoms similar to COVID-19.[2]

Although the transmission of COVID-19 is yet to be understood completely, it is believed to be transmitted primarily *via* large respiratory droplets or direct or indirect contact with a contaminated surface.[3,4] The rapid and wide-ranging spread of COVID-19 has become a major public concern.[5] Moreover, healthcare-related settings can potentially lead to cross-contamination in the absence of adequate precautions and appropriate attitudes. In a historic decision, the Kingdom of Saudi Arabia mandated precautionary procedures and instructions in line with the World Health Organization (WHO) guidelines to increase awareness and prevent the spread of COVID-19.[6] However, the extent and depth of the knowledge and understanding of COVID-19 and compliance with best practices among interns in healthcare-related fields, such as attitude toward hand hygiene, remain unclear.

Students who do their internship in healthcare-related arenas have to transition from attending only educational sessions to demonstrating appropriate clinical responsibilities. Hospital settings carry the risk of cross-transmission of COVID-19, and hence, compliance with hand hygiene and subsequent control prevention is required.[7] Hand hygiene has been identified as a measure to prevent the transmission of microorganisms; it is recognized as a potential factor in reducing healthcare-related infections. WHO reported that hand hygiene is a major preventative strategy - an essential method for preventing infection transmission between healthcare workers and patients.[8,9] Few studies, however, focus on interns' knowledge of COVID-19 and their attitude toward hand hygiene in Saudi Arabian universities. Previous studies have reported that healthcare workers tend to have good knowledge of and a positive attitude toward COVID-19;[7,10-12] However, a study by Nair *et al*.[8] showed that only 9% of Indian nursing and medical students had good knowledge of hand hygiene, and most of the study participants had a suboptimal attitude, which influences the prevalence of infectious diseases.

Understanding students' perceptions of and attitudes toward infectious disease threats can contribute to determining the knowledge gaps in public health awareness campaigns that need to be addressed. Considering the inevitable exposure of interns in healthcare-related fields to patients, it is imperative to assess their knowledge of and attitudes toward infectious diseases during the internship year. Therefore, the purpose of this study was two-fold:

first, to explore interns' knowledge of COVID-19 and attitudes toward hand hygiene, and second, to examine the association between their attitude toward and knowledge of COVID-19. The findings of this study, through an estimation of students' self-prevention behavior, provide fundamental knowledge for the prevention and control of healthcare-related infections. Identifying any potential gaps in the knowledge of and attitude toward COVID-19 will help educators design appropriate education reform focusing on these aspects among interns in healthcare-related fields

Design and Methods

Study design and participants

In this cross-sectional study, a survey was conducted to investigate the attitude toward and knowledge of COVID-19 among interns in healthcare-related fields. The targeted population comprised students commencing their internship year in the clinical or university hospital setting between May and July 2020 in Saudi Arabia. The research method applied was quantitative in nature. After a structured survey development process, a survey was generated and distributed, using an online system (Google Forms), to all interns in Saudi Arabian universities. The sample size was calculated based on the conservative assumption, including a 5% margin of error, a confidence interval of 95%, and an estimated population of 10,532 students. The sample size calculation showed that this study required 371 respondents. Accordingly, 371 responses were analyzed.

Study procedures

After obtaining consent from the interns, they were asked to complete the online survey, which required approximately seven to 10 minutes. To maximize the response rate, a first set of e-mails had been sent to them with a description of the study and a link to the survey. This had been followed by a biweekly reminder regarding participation in the survey.

Measuring instrument

The self-administered questionnaire covered three sections related to sociodemographic data, knowledge of COVID-19, and attitude toward hand hygiene.

Sociodemographic data

This section of the questionnaire to determine the respondents' demographic variables comprised seven questions on gender, age, university name, study program, current training setting (inpatient or outpatient), and grade point average (GPA). The respondents were also asked whether or not they had received education related to COVID-19.

Level of COVID-19 knowledge and attitude questionnaire

To assess COVID-19 knowledge and attitude, a self-rating questionnaire related to the disease and attitude, which had been validated previously,[5,8,13] was adapted and used in this study. Twenty-five questions were posed to assess the respondents' COVID-19 knowledge in different domains: three on the disease's causes and basic knowledge, three on the symptoms and incubation period, three regarding diagnosis, two on transmission, six concerning public prevention, six specifics to prevention among medical professionals, two regarding treatment. Some were true/false questions, and the others multiple-choice ones with an additional option of "I don't know." Each correct answer was assigned 1 point, while an incorrect answer/I don't know was assigned 0. The composite and total knowledge scores, which ranged from 0 to

25, were converted into percentages. The respondents who obtained a knowledge score of 75% or above were deemed to have a good level of knowledge, while 50−75% was considered moderate and less than 50% was considered a low level of knowledge. Attitude toward hand hygiene was assessed through 10 items, which were validated previously.[8] The respondents were asked to give an answer on a 7-point Likert-type scale, ranging from "strongly agree" to "strongly disagree." Each answer indicating a negative attitude was assigned 0, and each indicating an appropriate or a positive attitude 1 point. The total score was calculated by adding the individual scores of the 10 items, which ranged from 0 to 10, and the total scores were converted into a percentile - a score above 75% was designated as indicating a good attitude, while a score less than 75% was considered as indicating a suboptimal attitude.[8] A pilot study was conducted, among a group of 30, to examine the reliability of the attitude and knowledge items using Cronbach's alpha; the results yielded good reliability (alpha >0.80).

Ethical considerations

Prior to data collection, ethical approval was obtained from the Institutional Review Board committee of Princess Nourah Bint Abdulrahman University, Saudi Arabia. In the online survey, all respondents were asked to check a statement of informed consent before proceeding; once they had provided consent, they were given access to the survey. All of the information was kept confidential and anonymous.

Statistical analysis

The Shapiro-Wilk test was performed to test the normality assumption of the data. None of the major outcomes followed a normal distribution; therefore, the data was presented as median (MED)-interquartile range (IQR) for continuous variables and frequency and percentage (%) for categorical variables. Only complete responses were included in the analysis. The Kruskal-Wallis test and chi-squared test were conducted, as appropriate, for comparison of knowledge scores between categories. Univariate logistic regression and Spearman's rank correlation tests were performed to examine the association between respondents' COVID-19 knowledge and their attitude (good/suboptimal). Statistical significance was set at a level of p≤0.05. The data was analyzed using Stata version 16 (Stata Corp LP, College Station, TX, USA).

Results

Sociodemographic characteristics

This study had a total of 376 respondents; from these, five were excluded because of incomplete information, leaving 371 (98.7%). Figure 1 shows the distribution of respondents, who completed the survey, in universities across Saudi Arabia. A majority (73.5%) were female, and 74.6% were between the ages of 18 and 25. Approximately 32% of the respondents had never had any educational session on COVID-19. Most of the respondents were in the respiratory therapy field (20.80%), followed by applied medical sciences (nutrition, public health) (18.23%), rehabilitation sciences (18%), medicine (14%), radiological sciences (13%), nursing (11%), and dentistry (4%). The results revealed that 67% of the respondents were working in both inpatient and outpatient settings, followed by 25% who were working only in an inpatient setting and 8% only in an outpatient setting.
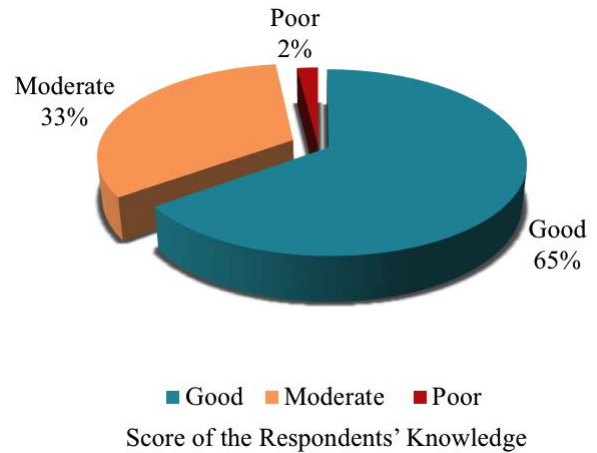
Knowledge of COVID-19

The median score of knowledge was 20 (IQR [3]); there was no statistically significant difference across age, hospital setting, or gender (Table 1). The knowledge categories are presented in Figure 2 - there

was a significant difference (p=0.0001) between their percentages. Out of the total respondents, 243 had a good knowledge score, 121 had a moderate knowledge score, and seven reported a poor knowledge score equivalent to 38%. The results showed that 254 respondents had attended an educational session on COVID-19. Of these, 167 (65%) had a good knowledge score and 83 (33%) had a moderate score,

compared with only four (2%) who had a poor score. Table 1 presents a pairwise comparison of the differences between the knowledge scores across the fields, and shows that the medicine respondents reported a significantly higher mean score of knowledge (p=0.01) compared with their counterparts in others, except dentistry where there was no significant difference (p=0.14); in terms
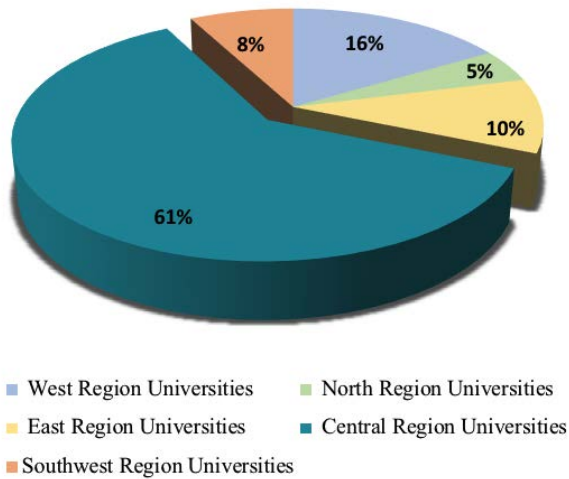
Figure 1. Distribution of the respondents across Saudi Arabian universities. The figure depicts the percentage-wise distribution of respondents, who completed the survey, in universities across Saudi Arabia. Most of those who completed the survey were from universities in the central region.

Figure 2. Respondents' COVID-19 knowledge score break-up. The figure illustrates a significant difference (p=0.0001) between the percentages of the knowledge categories. Of the total respondents, 243 had a good knowledge score, 121 had a moderate knowledge score, and seven had a poor knowledge percentage equivalent to 38%.

Table 1. Sociodemographic characteristics of the respondents (n=371).

Characteristics	Frequency (%)	Knowledge		Attitude	
		MED(IQR)	p-value	MED(IQR)	p-value
Gender					
Male	89 (26)	20 (3)	0.81	6 (2)	0.83
Female	273 (74)	19 (3)		6 (2)	
Age categories					
18–25	351 (95)	20 (3)	0.79	6 (2)	0.3051
Over 25	20 (5)	20 (3)		7 (3)	
Fields					
Medicine	55 (15) **	20 (3)		6 (2)	
Nursing	42 (11)	19.5 (2)		6 (2)	
Applied medical sciences	64 (17)	19 (2)		5 (2)	
Respiratory therapy	75 (20)	19 (3)	0.05*	6 (3)	0.73
Pharmacy	7 (2)	18 (5)		7 (3)	
Dentistry	13 (4)	20 (1)		6 (4)	
Rehabilitation sciences	69 (19)	20 (3)		6 (2)	
Radiological sciences	46 (12)	19 (3)		6 (3)	
Attended educational session					
Yes	254 (68)	20 (3)	1.17	6 (2)	0.15
No	117 (32)	19 (3)		5 (2)	
Grade point average (GPA)					
100–90	165 (44)#	20 (3)		6 (2)	
89–80	153 (42)	20 (2)	0.05*	6 (2)	0.9
≤79	53 (15)	19 (5)		6 (2)	
Hospital setting					
Inpatient and outpatient	247 (67%)	20 (3)		6 (2)	
Only outpatient	30 (8%)	19 (2)	0.5	6 (2)	0.9
Only inpatient	94 (25%)	19 (4)		6 (2)	

*p≤0.05 is considered significant; data is presented as median (MED) and interquartile range (IQR: Q3–Q1); **medicine is significantly different than the other fields (p=0.01); #significant difference between 100–90 and ≤79 (p=0.01); MED, median; IQR, interquartile range

of academic achievement, as presented by GPA, there is a significant difference in the knowledge scores GPA ([GPA: 90–100] *vs* [GPA: ≤79], p=0.01]). Multinomial logistic regression showed that none of the sociodemographic variables (age, gender, GPA, field, and hospital setting) were associated with the knowledge categories.

Attitude and associated knowledge

The cumulative score of the respondents' attitudes was 6 (IQR [2]) - out of the total 371, only 38 (22%) reported a good attitude, while 288 (78%) showed a suboptimal attitude. The statistically significant differences between the knowledge scores of the respondents in the two attitude groups are reported in Table 2. There was no significant difference in attitudes across the fields. Using Spearman's rank correlation (r_s), the data indicated a significant positive correlation between knowledge scores and attitude (good/suboptimal) (r_s = 0.11, p=0.03). As can be seen in Table 3, the predicted effect of knowledge on attitude (good/suboptimal) using univariate logistic regression showed a likelihood ratio chi^2 of 5.10 with a p-value of 0.02. These findings indicate that the model, as a whole, fit significantly, and for every unit increase in knowledge, the log odds of having a good attitude (*versus* suboptimal) increased by 0.12.

Discussion

The results of this study are significant in at least two major aspects: students' knowledge and attitudes. The empirical findings indicated that the majority of respondents had good knowledge of COVID-19. Although some variability was detected in the knowledge score based on the field, the results showed that the medicine respondents had a higher knowledge score than their counterparts

in nursing, applied medical sciences, respiratory therapy, pharmacy, rehabilitation sciences, and radiological sciences; the lone exception was dentistry, where there were no significant differences. With respect to attitude, most of the respondents demonstrated a suboptimal attitude toward hand hygiene. In response to attitude items, only 41.08% of the respondents reported feeling frustrated when others neglected hand hygiene; most (82.70%) were reluctant to ask others to practice hand hygiene. The overall response to the item "I feel guilty if I neglect hand hygiene" was extremely negative, with only 18.92% admitting that they felt guilty. A minority of the respondents (22.16%) felt that adhering to hand hygiene with the current setup was easy. While exploring the association between knowledge and attitude, a significant association was observed between COVID-19 knowledge and attitude scores, which explains the findings of this study.

This study found that a high response from interns indicated good knowledge - this shows that there was no significant difference in COVID-19 knowledge based on age, gender, field, or hospital setting. This finding is similar to the result of Olum *et al.*,[11] who found the level of COVID-19 knowledge to be similar irrespective of age, gender, academic qualification, or profession. This finding could be attributed to multidimensional factors. A study by Abdelhafiz *et al.*[2] demonstrated that the internet is the most important source of information, since high knowledge was attributed to social media, besides news media, radio, and newspapers. It is essential to note that the Ministry of Health (MOH) and universities started using different means of communication - television, street ads, mobile messages, and governmental campaigns - to educate the public about COVID-19, which may explain the respondents' knowledge score.[2] The MOH's assertive actions to tackle the disease may have positively impacted students' pandemic coping strategy. The MOH has offered telehealth services, including mobile applications (*e.g.*, Seha, Tawakklana, and Mawid) as well as online consultations and prescription refills.[13] The availability

Table 2. Comparison of knowledge and sociodemographic scores of the respondents in the two attitude groups (n=371).

Variable	Good attitude n= 82 Frequency (%)	Suboptimal attitude n= 288 Frequency (%)	p-value
Age categories			
18–25	77 (92%)	274 (95%)	0.3
>26	6 (7%)	14 (5%)	
Hospital setting*			
Inpatient and outpatient	53 (64%)	194 (67%)	
Only outpatient	23 (28%)	71 (25%)	0.83
Only inpatient	7 (8%)	23 (8%)	
Grade point average (GPA)*			
100–90	37 (44.5%)	128 (44.4%)	
89–80	37 (44.6%)	116 (40.3%)	0.5
≤ 79	9 (11%)	44 (15%)	
Gender *			
Female	60 (22%)	213 (78%)	0.7
Male	23 (24%)	75 (77%)	

Table 3. The association between respondents' COVID-19 knowledge and (n=371).

Variable	Frequency (%)	MED(IQR)	p-value	Univariate logistic regression OR (95% CI)	p-value
Suboptimal attitude	288 (78%)	19 (3)		Ref 1.13 (1.01-1.26)	0.02*
Good attitude	82 (22%)	20 (3)	0.03	Ref 1.13 (1.01-1.26)	0.02*

The Mann-Whitney U test was performed for the analysis; *p-value ≤0.05 is considered significant; MED, median; IQR, interquartile range.

of such services is considered to be an ideal that may enhance students' knowledge and coping strategy.[14] This suggests that stakeholders should consider the different forms of media and campaigns about COVID-19 for disseminating knowledge. Our results diverge from those of a previous study, by Al-Hanawi *et al*., that showed that the level of COVID-19 knowledge is different based on age, gender, income, and education level in the population of Saudi Arabia[6] - their research revealed that men reported less knowledge of, less optimistic attitudes toward, and fewer good practices related to COVID-19 than women did; it also found that older adults are likely to have better knowledge and practices than younger people do. In contrast, our study was unable to demonstrate that gender and age predict the knowledge. These differences could be attributed to different methodological and sample sizes.

These findings could be attributed to modern learning approaches and student self-efficacy. Self-efficacy is conceptualized as an individual's belief in the capabilities and skills required to produce the desired outcomes.[15] Bandura's social cognitive theory recognizes academic self-efficacy as a force of the learning system that influences an individual's development.[16,17] Academic self-efficacy may moderate students' e-learning experiences and heavily impact their conceptual thinking and knowledge of COVID-19. On the other hand, mobile learning (M-learning) is a process of learning through a mobile device which is being used to enhance students' knowledge of the COVID-19 pandemic.[18–20] It has been reported that 81.8% students expressed that it was possible to improve knowledge in their field of study through M-learning.[19] Remote learning - which has increased during the ongoing pandemic to meet medical students' needs - provides a level of flexibility that promotes students' self-paced learning.[21] Therefore, the level of COVID-19 knowledge reported in this study could be explained by implementing remote learning, which may facilitate access to the required information. Regarding the field, the present study revealed that most of the medicine respondents had a high level of COVID-19 knowledge. This is in contrast to a study conducted in Jordan, which showed that there was no difference between the average knowledge of medical and non-medical students.[22] In accordance with our findings, previous studies too have shown that medical students have a high level of knowledge and preventive behavior.[12,22] It can be inferred that these differences may be related to the greater experience of medical students, since they have direct contact with patients. Nevertheless, periodic educational sessions must be conducted across all healthcare-related fields. Our study highlights some potential factors that may influence students' knowledge. First, in terms of the educational session's impact, a majority of those who attended the periodic lecture on COVID-19 had a good knowledge score, in comparison to their counterparts. Second, academic achievement, which is reflected in the GPA, may also play a role, as a clear difference between the knowledge scores based on the respondents' GPA was observed.

Although this study shows high COVID-19 knowledge among interns, items with negative responses are worth mentioning as well. It was revealed that 82.75% of the respondents did not know what kind of a virus caused COVID-19. Coronaviruses form a large family of viruses, and in the initial days of the outbreak, the disease-causing virus had numerous provisional names before being given an official one. It is perhaps for this reason that the majority of them were confused about the virus's name. Furthermore, most of the respondents (56.06%) had the mistaken notion that the disease could be treated with the usual antiviral drugs. To date, there is no specific antiviral treatment or proven or registered therapeutics for COVID-19, though a number of therapeutics are under investigation, and some clinical trials are underway.[23] The observed increase in incorrect answers could be attrib-

uted to conflicting findings in the literature. Moreover, this study found that 68.46% of the respondents did not know the correct distance that should be maintained between a suspected patient and others to avoid transmission. Regarding attitude toward hand hygiene, the study found that the vast majority of respondents had a suboptimal attitude. These findings are in line with a study conducted in India among medical and nursing students, showing that most of them had a poor attitude toward hand hygiene.[8] The present study's respondents' suboptimal attitude can be explained by the theory of reasoned action; based on it,[24] it can be said that students' attitudes are reflected in their beliefs about the importance of hand hygiene. The lack of proper educational training and students' neglect of the MOH recommendations may explain the reported finding. It is worth mentioning that the vast majority of the responses to some of the attitude items were suboptimal. Specifically, around 83% of the respondents reported that they were reluctant to ask others to clean their hands; the most striking observation was that 81.08% of the respondents did not feel guilty about neglecting hand hygiene. Moreover, they did not seem to realize their role in preventing further spread of the disease by reminding others to wash their hands. It is imperative to note that the majority of the respondents claimed that adherence to hand hygiene was not easy for them, and that they did not feel frustrated with others neglecting it either. The overall response reflected a suboptimal attitude and lack of adherence to hand hygiene, which highlights the need to emphasize training courses and periodic educational sessions. Understanding the expected outcomes of adherence to protective strategies, including hand hygiene, can reduce the risk of infection in hospitals. Proper hand hygiene is the simplest essential technique for controlling the spread of COVID-19, and it should be encouraged to keep the environment safe. Our study also found a positive correlation between the respondents' knowledge of and attitude toward COVID-19. The relatively good correlation between knowledge and attitude was previously highlighted by Zhang *et al*., who showed that healthcare workers' positive attitude toward COVID-19 is represented by good knowledge; their findings suggested that high knowledge impacted individuals' actions to reduce the risk of infection in contaminated environments, and their adherence to protective strategies.[25] It should, however, be mentioned that the present study has several limitations. First, a descriptive cross-sectional survey does not imply causation; this study did not consider the possible changes in the respondents' knowledge and attitudes over time. Second, the findings relied on a self-reported survey, which may represent a reporting bias. Third, the survey distribution using an online system allowed only those who had internet access to participate. Finally, the majority of the respondents were from universities in the central region, which makes it difficult to generalize the findings to all students.

Conclusions

In the present study, the overarching findings were that interns in healthcare-related fields showed moderate knowledge of COVID-19, with an overall average score of 76% for correct answers. The overall attitude was suboptimal, indicating inappropriate hand hygiene adherence; compliance with hand hygiene was not significantly different across fields, and the overall attitude was <75% among the majority of the interns. Medicine interns reported a higher knowledge score than their counterparts in nursing, applied medical sciences, rehabilitation sciences, respiratory therapy, and radiological sciences. Furthermore, the good attitude among the applied medical sciences and respiratory therapy interns

was higher (19%) than that of their counterparts in other fields: medicine (15%), nursing (12%), radiological sciences (12%), rehabilitation sciences (18%), and dentistry (3%). These results indicate that knowledge was significantly associated with the interns' attitudes toward hand hygiene. Though preliminary, this finding suggests that there is an urgent need to encourage the current training program that targets hand hygiene practices among students in healthcare-related fields, especially prior to the internship year. The norm of continuous monitoring of hand hygiene performance should be increased among students. This study urges educational and training development centers to encourage the appropriate attitude and adherence to hand hygiene, which plays a significant role in curbing the spread of COVID-19.

References

1. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. Acta Bio-Medica Ate-nei Parm 2020;91:157–60.
2. Abdelhafiz AS, Mohammed Z, Ibrahim ME, et al. Knowledge, perceptions, and attitude of Egyptians towards the novel coronavirus disease (COVID-19). J Com-munity Health 2020;45:881-90.
3. Bartoszko JJ, Farooqi MAM, Alhazzani W, Loeb M. Medical masks vs N95 res-pirators for preventing COVID-19 in healthcare workers: a systematic review and meta-analysis of randomized trials. Influenza Other Respir Viruses 2020;14:365–73.
4. AL-Rasheedi M, Alhazmi Y, Ali AlM, et al. Public and healthcare providers awareness of Coronavirus (COVID-19) in Qassim Region, Saudi Arabia. Saudi J Biol Sci 2020;24:90-8
5. Modi PD, Nair G, Uppe A, et al. COVID-19 awareness among healthcare students and professionals in Mumbai Metropolitan Region: a questionnaire-based survey. Cureus 2020;12:e7514.
6. Al-Hanawi MK, Angawi K, Alshareef N, et al. Knowledge, attitude and practice toward COVID-19 among the public in the Kingdom of Saudi Arabia: a cross-sectional study. Front Public Health 2020;8:217.
7. Huynh G, Nguyen TNH, Tran VK, et al. Knowledge and attitude toward COVID-19 among healthcare workers at District 2 Hospital, Ho Chi Minh City. Asian Pac J Trop Med 2020;13:260.
8. Nair SS, Hanumantappa R, Hiremath SG, et al. Knowledge, attitude, and practice of hand hygiene among medical and nursing students at a tertiary health care centre in Raichur, India. ISRN Preve Med 2014;2014:e608927.
9. Al Mutairi SM, Alotaibi A, Kofi M, et al. To what extent the hand hygiene among health care workers become the core of best practice in the COVID-19 era? Int Arch Nurs Health Care 2020;6:1-12.
10. Shi Y, Wang J, Yang Y, et al. Knowledge and attitudes of medical staff in Chinese psychiatric hospitals regarding COVID-19. Brain Behav Immun-Health 2020;100064.
11. Olum R, Chekwech G, Wekha G, et al. Coronavirus disease-2019: Knowledge, atti-tude, and practices of health care workers at Makerere University Teaching Hospitals, Uganda. Front Public Health 2020;8:181.
12. Taghrir MH, Borazjani R, Shiraly R. COVID-19 and Iranian medical students: a sur-vey on their related-knowledge, preventive behaviors and risk perception. Arch Iran Med 2020;23:249-54.
13. Alghamdi SM, Alqahtani JS, Aldhahir AM. Current status of telehealth in Saudi Arabia during COVID-19. J Fam Community Med 2020;27:208.
14. Keshvardoost S, Bahaadinbeigy K, Fatehi F. Role of telehealth in the management of COVID-19: lessons learned from previous SARS, MERS, and Ebola outbreaks. Tele-med E-Health 2020;26:850–2.
15. Bandura A. Social foundations of thought and action. Englewood Cliffs NJ; 1986.
16. Zimmerman J. Coronavirus and the great online-learning experiment. Chron High Educ 2020. Available from: https://www.chronicle.com/article/coronavirus-and-the-great-online-learning-experiment/
17. Zimmerman BJ, Bandura A, Martinez-Pons M. Self-motivation for academic at-tainment: the role of self-efficacy beliefs and personal goal setting. Am Educ Res J 1992;29:663–76.
18. Naciri A, Baba MA, Achbani A, et al. Mobile learning in higher education: una-voidable alternative during COVID-19.

Aquademia 2020;4:ep20016.

19. Biswas B, Roy SK, Roy F. Students perception of mobile learning during COVID-19 in Bangladesh: university student perspective. Aquademia 2020;4:ep20023.

20. Klímová B. Mobile learning in medical education. J Med Syst 2018;42:194.

21. Shahrvini B, Baxter SL, Coffey CS, et al. Pre-clinical remote undergraduate medical education during the COVID-19 pandemic: a survey study. BMC Med Educ 2021;21:13.

22. Alzoubi H, Alnawaiseh N, Al-Mnayyis A, et al. COVID-19 – knowledge, attitude and practice among medical and non-med-ical university students in Jordan. J Pure Appl Microbiol 2020;14:17-24.

23. Sanders JM, Monogue ML, Jodlowski TZ, et al. Pharmacologic treatments for corona-virus disease 2019 (COVID-19): a review. JAMA 2020;323:1824–36.

24. Bagozzi R. Attitude formation under the theory of reasoned action and a purposeful be-haviour reformulation. Br J Soc Psychol 1986;25:95-107.

25. Zhang M, Zhou M, Tang F, et al. Knowledge, attitude, and practice regarding COVID-19 among healthcare workers in Henan, China. J Hosp Infect 2020;105:183-7.