



Knowledge, Attitude, and Practice Towards COVID-19 Among Healthcare Students in Vietnam

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Background: Healthcare students are a force that will aid healthcare workers in responding to the COVID-19 pandemic. This study aims to evaluate the knowledge, attitude, and preventive practices (KAP) towards COVID-19 for this population in Vietnam.

Methods: An online-based cross-sectional survey was considered with all students at the University of Medicine and Pharmacy in Ho Chi Minh City (UMP), Vietnam, between June and August 2020. A structured questionnaire was used to assess KAP towards COVID-19 with response having considerable data missing in the areas of KAP being excluded from the analysis. All data were analysed by using STATA 14 software, to determine the factors associated with preventive practices, and a multivariable regression analysis was performed, along with odds ratio (OR) and 95% confidence interval (95% CI).

Results: A total of 2351 eligible participants completed the survey, 65.6% of whom were female, and their mean age was 21.9 years old (SD = 2.7). Almost all had sufficient knowledge (86.6%) and good preventive practice (92.8%) towards COVID-19; however, there was also a rather low level of positive attitude recorded, at 68.8%. The multivariable logistic regression analysis showed that the female participants, and the receiving of information from the official websites, reported a significantly higher level of good practice. Besides, students who had a high level of sufficient knowledge and positive attitude towards COVID-19 were more likely to have good preventive practices (All $p < 0.001$).

Conclusion: The findings demonstrated good preventive practice towards COVID-19; however, sufficient knowledge and positive attitude were lower. Therefore, it is an identified requirement to continue with additional education and training strategies to offer a better understanding and positive viewpoint of the pandemic for all students, including healthcare students.

Keywords: attitude, COVID-19, knowledge, practice, healthcare students, Vietnam

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Introduction

The coronavirus disease 2019 (COVID-19), caused by the causative agent confirmed as Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), which has had a major negative impact across fields, such as business, health and education.¹ Since the beginning of the pandemic, over 199 million confirmed cases, and 4.2 million deaths, have been reported globally, as of 3rd August 2021.² In Vietnam, a total of 174,461 confirmed cases and 2071 cases related deaths were recorded.³

The virus is considered highly contagious and easily transmitted by close contact with both symptomatic and asymptomatic individuals through respiratory

droplets with infected persons or by contact with contaminated objects and surfaces, which lead to the numbers of new cases and deaths, which appear to be continuing to increase in Vietnam.^{4,5} A previous study showed that approximately 31% of persons infected with SARS-CoV-2 being asymptomatic.⁶ In symptomatic patients, most people develop mild or moderate symptoms (40%) such as fever, dry cough, myalgia, fatigue and so on, but about 15% develop severe symptoms that require oxygen support, with 5% having a critical disease including complications such as respiratory failure, acute respiratory distress syndrome (ARDS), sepsis and septic shock, thromboembolism and multiorgan failure.⁷

Until now, there has not been any reported treatment for infected patients and they continue to manage symptoms through therapeutic means.⁸ The virus has affected all age groups, but older patients, smokers and those with underlying noncommunicable diseases such as hypertension, diabetes, cardiac or chronic lung disease and cancer, have been identified as at a high-risk of severe illness and death.⁹ The incubation period is on average from 5 to 7 days, but it can be up to 14 days.¹⁰ During the pre-symptomatic period, from 1 to 3 days before manifestation, some infected individuals could be contagious.¹¹ Therefore, applying preventive measures, such as identifying and isolating suspected cases, lockdowns or limiting travel, as well as setting guidelines including washing hands, wearing masks, social distancing and avoiding crowded places are the best method to control the widespread of the virus.¹²

Consequently, public awareness and adherence to the recommendations are playing an essential role in preventing the spread in communities, which requires a high level of knowledge, attitudes, and practices (KAP) relating to the disease. However, some explored the knowledge, attitude and behaviour assessment of students, which showed an inadequate level of knowledge, attitude, and practices. Results found that sufficient knowledge ranged from 56.5% to 82.34% but had a lack of awareness about mode of transmission of the illness (41.8%) and adherence preventive practice (80%).^{13–15} Moreover, our previous studies conducted in the first stage of the pandemic showed that only 41% students had good practices and the overall rate of good knowledge and positive attitude was 49% and 26.1%, respectively.¹⁶ In fact, healthcare workers are the primary force to take care of COVID-19 patients, so they are ultimately considered at higher risk of infection compared to the normal population. Additionally,

the COVID-19 pandemic requires collaborative teamwork by all healthcare providers, including medical students, in providing care to patients; thus, it is essential to ensure that medical students have a good knowledge and practices regarding COVID-19 to support the health force to respond to public health issues. This study aims to evaluate medical students' KAP towards COVID-19, which is an important insight into proper health education to guide suitable educational interventions.

Materials and Methods

Study Design and Participants

An online-based cross-sectional survey was conducted using convenience sampling with all students at the University of Medicine and Pharmacy in Ho Chi Minh City (UMP), between June and August 2020 via a structured questionnaire. A sample size was based on the estimated prevalence of good practices at 41% with an alpha of 5% and 95% confidence level.¹⁶ Taking into consideration around 10% of incomplete data, the minimum sample size was 414. All participants were informed that their participation was voluntary and completed the consent form before taking part in the study.

Inclusion and Exclusion Criteria

All students were included in the study during the period of the survey. Students who did not complete the survey, having received a maximum of four reminder emails or identified as missing any questions in the areas of KAP, were excluded from the study.

Data Collection Procedures

From a list of all students at UMP, a letter was sent to everyone, via email, to inform them of the aims of the study and to recruit the participants, in which the students could agree to participate by clicking on a link and using an access code to ensure only invited individuals had the ability to access the online form and perform the survey once. All students were volunteers and there were weekly reminder emails sent to participants if they did not complete the survey. A maximum of four reminder emails within the period of the survey was sent.

Measures

The structured questionnaire relating to knowledge, attitude, and practices, which was estimated in the previous study of Huynh et al, included 6 items about COVID-19 knowledge,

8 items focused on attitude, and 8 items for evaluating COVID-19 preventative practices.¹⁷ Additionally, socio-demographics were added to the questionnaire (Appendix 1).

Each knowledge item had two options of yes/no, with each correct answer being given one point. A sufficient knowledge was defined when the total knowledge points achieved 5 points or higher and less than 5 points indicated insufficient knowledge. For each attitude item, the points were calculated according to a 5 point Likert Scale, in which the points from 1 to 3 showed a negative attitude, and the positive attitude was recorded as 4 points and higher, having 1 point per positive response. An overall attitude was computed, answers that achieved from 7 or higher were considered as a positive attitude, and less than 7 was marked as a negative attitude.

For assessing practices, each item had a choice of yes/no, having 1 point per good practice, with a good practice resulting from an overall score of 7 points or higher, and under 7 points was categorized as poor practices.

Statistical Analysis

All data was analysed by using STATA 14 software. Frequencies and percentages were used to describe socio-demographics, sufficient knowledge, positive attitude, and good practices. Chi-square and the *t*-test were performed in the univariable analysis, and following this, a multivariable regression analysis was done to determine the factors associated with preventive practices, odds ratio (OR), along with 95% confidence interval (95% CI), the significance level was set at 5%.

Ethics Approval

Our research complied with the Declaration of Helsinki, and all procedures performed in this study involving participants were in accordance with the ethical standards of the Research Ethics Committee at the University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam (No: 375/HĐĐĐ-ĐHYD signed on 02/06/2020). Informed consent was obtained from all participants included in the study.

Results

All students were invited to participate, of which 2435 accepted; however, there were 84 responses with considerable data missing in the areas of knowledge, attitude, and practice, so they were excluded from this analysis. This resulted in a total of 2351 participants, with complete answers, which were considered in the study. Overall, 2351 students completed the questionnaires, with a mean age of (21.9±2.7). Students who were female accounted for

Table 1 Baseline Characteristics of Participants (N=2351)

Characteristics	N (%)
Age (mean±SD) (years)	21.9± 2.7
Gender	
Male	809 (34.4)
Female	1542 (65.6)
Specialty	
Medicine	384 (16.3)
Dentistry	163 (6.9)
Pharmacy	641(27.3)
Traditional medicine	244 (10.4)
Nursing - medical engineering	729 (31.0)
Public health	190 (8.1)
Level of education	
Undergraduate	2270 (96.6)
Postgraduate	81 (3.4)
Internship at the hospital	
Yes	1887 (80.3)
No	464 (19.7)
Living conditions	
With family/relatives	1589 (67.6)
With friends	656 (27.9)
Alone	106 (4.5)
Source of COVID-19 information (yes)	
Social media	2013 (85.6)
Websites of hospital/Health Ministry/WHO	1947 (82.8)
Training courses toward COVID-19	1808 (76.9)
Local government	561 (23.8)
Relatives	477 (20.3)

65.6%. Most of them were students of Nursing – medical engineering and Pharmacy (31.0% and 27.3%, respectively). The majority of them were undergraduates (96.6%) and had internships at a hospital (80.3%). More than two-thirds (67.6%) of students were living with family/relatives. The main source of COVID-19 information was social media (85.6%), and websites of hospitals, the Ministry of Health or WHO (82.8%) (Table 1).

Table 2 describes COVID-19 knowledge. A high rate of students (86.6%) had sufficient knowledge, with the majority of them (more than 80%) knowing the pathogens, the way of COVID-19 transmission, common signs, specific treatment, medication, as well as being aware of preventive measures, including wearing masks, hand washing, surface cleaning and keeping personal distance from others. Also, there remained a lower level of

Table 2 Knowledge Toward COVID-19 (N=2351)

Question (Correct Answer)	N (%)
Caused by SARS- CoV-2 (yes)	2060 (87.6)
Transmission by close contact with an infected person through droplets (yes)	2287 (97.3)
Common signs (Fever or Cough or fatigue or sputum production or shortness of breath) (yes)	2299 (97.8)
Specific treatment medication (No)	2182 (92.8)
Prevention of infection (Wear mask, hand washing, surfaces cleaning, keep distance from others) (yes)	2203 (93.7)
People with chronic illness at high risk of severity and death (yes)	1625 (69.1)
Overall knowledge toward COVID-19 (Sufficient)	2037 (86.6)

Table 3 Attitude Toward COVID-19 (N=2351)

Question	N (%)
I think I will probably get illness	1407 (59.9)
I am worried one of my family members may get an infection	1656 (70.4)
If getting COVID-19, I will accept isolation in health facilities	2275(96.8)
Transmission of COVID-19 can be prevented by washing hands with soap frequently and wearing mask	2241(95.3)
Prevalence of COVID-19 infection can be reduced by the active participants of health care workers in hospital infection control programs	2227(94.7)
If a COVID-19 vaccine was available, I would have it	1958 (83.3)
COVID-19 patients should be kept in isolation	2260 (96.1)
I am ready to participate in the team volunteering to support the health force	2029 (86.3)
Overall attitude toward COVID-19 (Positive)	1618 (68.8)

knowledge about patient groups that are at a high risk of severe illness and death (69.1%).

Table 3 shows a rate of positive attitude, which accounted for 68.8%, with most of them ready to participate in anti-epidemic roles when mobilized (86.3%), accepting isolation if they contract COVID-19 (96.8%), preventing the spread of COVID-19 by washing hands and wearing a mask (95.3%), the hospital infection control programs can reduce the number of COVID-19 cases (94.7%), students have already got a vaccination (83.3%), and a patient should be kept in isolation if contracting COVID-19 (96.1%). A lower rate was recorded

for attitudes towards the likelihood of their family members becoming infected (70.4%) and had a positive attitude towards probably getting ill from COVID-19 (59.9%).

The COVID-19 preventive practice is presented in Table 4. There was a high rate of good practices (92.8%), with over 90% of respondents answering all questions correctly, including washing hands, wearing masks, social distancing, and following the guidelines of the Ministry of Health if suspected of having the Covid-19 infection.

Table 5 reports the factors associated with practices towards COVID-19 in the bivariate analysis. There was

Table 4 Practices of Medical Students Toward COVID-19 (N=2351)

Question (Correct Answer)	N (%)
Washing hands frequently (yes)	2223 (94.6)
Washing hands with soap and water or alcohol hand sanitizer (yes)	2218 (94.3)
Average time for washing hands \geq 20 seconds (yes)	2269 (96.5)
Wearing mask when in public or exposing with others (yes)	2313 (98.4)
Wearing mask cover my mouth and nose (yes)	2119 (90.1)
Adhering to social distancing properly according to the Ministry of Health's instructions (yes)	2256 (96.2)
Avoiding unnecessary travel and staying away from large groups of people (yes)	2287 (97.3)
Following the guidelines of the Ministry of Health if a suspected Covid-19 infection (yes)	2201 (93.6)
Overall practice toward COVID-19 (Good)	2177 (92.8)

Table 5 Results of Logistic Regression Factors Associated with Practice Regarding COVID-19 (N= 2351)

Variables	Practice Toward COVID-19		p
	Yes, n (%) 2177 (92.8%)	No, n (%) 169 (7.2%)	
Age (mean±SD) (years)	21.9 ± 2.7	21.9 ± 2.5	0.918*
Gender			0.000**
Male	717(32.9)	92(54.4)	
Female	1460(67.1)	77(45.6)	
Specialty			0.309
Medicine	355(16.3)	29(17.2)	
Dentistry	148(6.8)	15(8.9)	
Pharmacy	606(27.8)	33(19.5)	
Traditional medicine	224(10.3)	20(11.8)	
Nursing - medical engineering	669(30.7)	57(33.7)	
Public health	175(8.1)	15(8.9)	
Level of education			0.942
Undergraduate	2102 (96.6)	163(96.5)	
Postgraduate	75(3.4)	6(3.5)	
Internship at the hospital			0.375
Yes	1742(80.1)	140(82.8)	
No	435(19.9)	29(17.2)	
Living conditions			0.653
With family/relatives	1466(67.3)	119(70.4)	
With friends	613(28.2)	42(24.8)	
Alone	98(4.5)	8(4.7)	
Source of COVID-19 information (Yes)			0.001**
Training courses toward COVID-19	1693(93.8)	112(6.2)	
Television/ Newspaper	1864(92.8)	144(7.2)	0.882
Relatives	450(94.3)	27(5.6)	0.144
Local government	535(95.4)	26(4.6)	0.007**
Websites of hospital/ Ministry of Health/ WHO	1835(94.5)	107(5.5)	0.000**
Knowledge			0.000**
Sufficient	1936 (88.9)	97 (57.4)	
Insufficient	241(11.1)	72 (42.6)	
Attitude			0.000**
Positive	1557 (71.5)	57 (33.7)	
Negative	620(28.5)	112 (66.3)	

Note: *t-test; **Indicates statistically significant.

a relationship between prevention practices and gender, source of information, knowledge and attitude regarding COVID-19 ($p < 0.05$).

The factors associated with practices towards COVID-19, in the multivariate logistic regression analysis, are reported in Table 6. Participants who were

female and receiving information from the websites of hospital/Ministry of Health/WHO, reported significantly higher levels of good practices (OR 1.9 95% CI: 1.35–2.67, and OR 2.3; 95% CI: 1.57–3.28, respectively, all $p < 0.001$). Besides, students who recorded a sufficient level of knowledge and positive attitude toward

Table 6 Multivariable Logistic Regression of Factors Associated with Practice Regarding COVID-19 (N= 2351)

Variables	Practice Toward COVID-19		Adjusted OR (95% CI)	p
	Yes, n (%) 2177 (92.8%)	No, n (%) 169 (7.2%)		
Gender				
Male	717(32.9)	92(54.4)	Ref	
Female	1460(67.1)	77(45.6)	1.9 (1.35–2.67)	0.000**
Source of COVID-19 information				
Training courses toward COVID-19 (Yes)	1693(93.8)	112(6.2)	1.4 (0.95–1.99)	0.090
Local government (Yes)	535(95.4)	26(4.6)	1.4 (0.85–2.12)	0.209
Websites of hospital/ Ministry of Health/ WHO (Yes)	1835(94.5)	107(5.5)	2.3 (1.57–3.28)	0.000**
Knowledge				
Insufficient	241(11.1)	72 (42.6)	Ref	
Sufficient	1936 (88.9)	97 (57.4)	4.4 (2.82–5.68)	0.000**
Attitude				
Negative	620(28.5)	112 (66.3)	Ref	
Positive	1557 (71.5)	57 (33.7)	4.0 (3.09–6.35)	0.000**

Note: **Indicates statistically significant.

COVID-19, were more likely to have good preventive practices (OR 4.4 95% CI: 2.82–5.68, and OR 4.0 95% CI: 3.09–6.35, respectively, all $p < 0.001$).

Discussion

Since the emergence of the pandemic, students have been directed to follow the guidelines of the Ministry of Health, with modules focusing on COVID-19 being delivered to all students. This permitted the delivery of enhanced knowledge and practices to all students to prevent potential spreading of COVID-19 within the university. In this context, the pandemic has continued to cripple Vietnam; therefore, we conducted this study to highlight the level of KAP towards COVID-19, which is important when looking at ways to suggest recommendations to improve these areas. Of the 2351 students who finished the questionnaire, most of them were female, studying Nursing - medical engineering and Pharmacy and had an internship at a hospital. Generally, almost all students had a high level of knowledge, positive attitudes, and good practices, but some key areas of knowledge need to be improved.

In terms of knowledge toward COVID-19, the majority of them had sufficient knowledge. This finding is higher than our previous studies^{16,18} and Mohsin et al recorded only 65.7% of students had good knowledge¹³ but lower than studies conducted in Pakistan where 93.3% had good knowledge.¹⁹ Such figures showed that the study modules relating to COVID-19 at the university have provided effective information about the

disease (the pathogen, common signs, and the way of COVID-19 transmission) and the guidelines for prevention, such as wearing masks, hand washing, surface cleaning and keeping distance from others. Encouragingly, over 90% of students were aware of specific treatment and medication. These results are higher than our prior studies, which found that under two-thirds of healthcare workers and patients had good knowledge about treatment.^{17,18} By contrast, Mohsin et al showed a lack of awareness about the mode of transmission of the illness.¹³ It can thus be suggested that medical students have sufficient knowledge to support healthcare systems as a response to the ongoing pandemic. However, there is still a low level of knowledge about people at high risk of severe illness and death (69.1%). This differs from the findings presented in prior studies.^{16,20} These findings suggested that students need to improve this aspect of their knowledge because they are considered one of the main forces to increase awareness about the disease among families and the community, in particular, patients with underlying conditions are more likely to experience severe illness or death, so they need to be protected.

On the other hand, this study found about two-thirds of participants had a positive attitude. These results were better than prior studies.¹⁶ The large majority of them had a positive attitude in adherence to preventive practices, such as washing hands and wearing a mask (95.3%), accepting isolation if contracting COVID-19 (96.8%), and awareness of the importance of infection control programs, which are all important to reduce the number of cases (94.7%). These findings

suggested that they had a positive attitude towards preventive measures delivered by the Ministry of Health, to control the virus spreading. Besides, a high rate of students are willing to receive the vaccine (83.3%). This outcome is higher than previous studies, which showed a larger number of students and healthcare workers refused to be vaccinated.^{21,22} It is possible, therefore, that recommendations from health educators may be having an effect in promoting vaccine uptake among medical students, and it can be a strong predictor of intention to get the vaccine in the future. Moreover, most of them are ready to participate in anti-epidemic programs when mobilized (86.3%). Students are an important force to assist healthcare workers in the context that the cases of COVID-19 are continuing to increase in the South of Vietnam. One unanticipated finding was that a remarkable rate of students believed that they, and their families, are not likely to be infected (59.9% and 70.4%, respectively). These results are higher than the earlier study¹⁶ but lower than healthcare worker's study.¹⁷ Zhang et al showed that when healthcare workers know the risk factors of infection, they will follow the appropriate measures.²³ However, Wu et al's study in the first period of the pandemic showed that a healthcare force would make an effort to control the outbreak, but they were less concerned about the risk of personal infection.²⁴ It should be considered due to students are at high risk of being infected with the disease, as well as transmitting the virus to others, because of the sense of invulnerability.²⁵

For assessing the practices, this study showed that most of the students had good levels of practice, with all correct answers achieving over 90%, including washing hands, wearing masks, social distancing, and following the guidelines of the Ministry of Health, if suspected of having a Covid-19 infection. This finding is in line with those of our previous studies,^{16,26} which showed that most students were wearing face masks and washing hands frequently with hand sanitizer. In particular, the average time for washing hands has improved since the previous study.^{16,18} Notably, females receiving information from the websites reported significantly higher levels of good practices (OR 1.9 95% CI: 1.35–2.67, and OR 2.3; 95% CI: 1.57–3.28, respectively, all $p < 0.001$). This study is in line with a study conducted on Iranian students showed that women were more likely to have awareness toward the virus²⁷ and our previous study.¹⁸ Moreover, this study indicated that knowledge and attitude had a significant relationship to good practices. This is according to a survey in Oman that showed the importance of good knowledge, attitude and precautionary practices to protect

patients and public safety.²⁸ In general, therefore, it seems that medical students should continue to enhance knowledge and attitudes, which plays an important role to increase adherence to self-precautionary practices, as well as passing on knowledge to family, friends or relatives to assist in the fight against this pandemic. Besides, the behaviour practices can change over time, so an investigation needs to be conducted to assess frequency of the level of KAP towards COVID-19 to develop strategies to tackle the transmission of the disease.

This study should consider some limitations. First, this study was conducted on a convenience sample, and the data was collected via an online survey, so it should be considered when interpreting the findings of this study, as well as our sample population may not represent all students in this sector of education. Second, a cross-sectional observational study was used that does not conclude any cause–effect relationship.

Conclusion

As the pandemic continues to occur around the world, this can result in an overload of a country's health system. The health students would be mobilized to support to fight the pandemic and arranged as high-risk subjects. The findings demonstrated good preventive practice towards COVID-19; however, sufficient knowledge and positive attitude were lower. Therefore, it is a firm requirement to keep on with further education and training strategies to get a better understanding and positive way of looking at the pandemic for all healthcare students.

Data Sharing Statement

Available upon request to the first author.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agreed to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no conflicts of interest for this work.

References

- World Health Organization. Impact of COVID-19 on people's livelihoods, their health and our food systems; 2020. Available from: <http://www.who.int/news/item/13-10-2020-impact-of-covid-19-on-people's-livelihoods-their-health-and-our-food-systems>. Accessed August 13, 2021.
- World Health Organization. WHO Coronavirus (COVID-19) dashboard; 2021. Available from: <https://covid19.who.int/>. Accessed August 13, 2021.
- World Health Organization. Viet Nam situation; 2021. Available from: <https://covid19.who.int/region/wpro/country/vn>. Accessed August 13, 2021.
- Somsen GA, van Rijn C, Koopij S, Bem RA, Bonn D. Small droplet aerosols in poorly ventilated spaces and SARS-CoV-2 transmission. *Lancet Respir Med*. 2020;8(7):658–659. doi:10.1016/S2213-2600(20)30245-9
- Ong SWX, Tan YK, Chia PY, et al. Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient. *JAMA*. 2020;323(16):1610–1612. doi:10.1001/jama.2020.3227
- Buitrago-Garcia D, Egli-Gany D, Counotte MJ, et al. Occurrence and transmission potential of asymptomatic and presymptomatic SARS-CoV-2 infections: a living systematic review and meta-analysis. *PLoS Med*. 2020;17(9):e1003346. doi:10.1371/journal.pmed.1003346
- The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The epidemiological characteristics of an outbreak of 2019 novel Coronavirus Diseases (COVID-19) — China, 2020. *China CDC Weekly*. 2020;2(8):113–122. doi:10.46234/ccdcw2020.032
- U.S. Food and Drug Administration. Coronavirus Disease 2019 (COVID-19); 2020. Available from: <https://www.fda.gov/emergency-preparedness-and-response/counterterrorism-and-emerging-threats/coronavirus-disease-2019-covid-19>. Accessed August 13, 2021.
- Alqahtani JS, Oyelade T, Aldhahir AM, et al. Prevalence, severity and mortality associated with COPD and smoking in patients with COVID-19: a rapid systematic review and meta-analysis. *PLoS One*. 2020;15(5):e0233147. doi:10.1371/journal.pone.0233147
- Lauer SA, Grantz KH, Bi Q, et al. The incubation period of Coronavirus Disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. *Ann Intern Med*. 2020;172(9):577–582. doi:10.7326/M20-0504
- Kimball A, Hatfield KM, Arons M, et al. Asymptomatic and presymptomatic SARS-CoV-2 infections in residents of a long-term care skilled nursing facility - King County, Washington, March 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(13):377–381. doi:10.1585/mmwr.mm6913e1
- World Health Organization. Coronavirus disease (COVID-19) advice for the public; 2021. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public>. Accessed August 13, 2021.
- Mohsin SF, Agwan MA, Alsuwaydani ZA. Knowledge towards COVID-19 among healthcare students in the central region of Saudi Arabia: a cross-sectional observational study. *Postgrad Med J*. 2021;97(1149):448–451.
- Noreen K, Rubab Z-E, Umar M, et al. Knowledge, attitudes, and practices against the growing threat of COVID-19 among medical students of Pakistan. *PLoS One*. 2020;15(12):e0243696. doi:10.1371/journal.pone.0243696
- Olaimat AN, Aolymat I, Shahbaz HM, Holley RA. Knowledge and information sources about COVID-19 among university students in Jordan: a cross-sectional study. *Front Public Health*. 2020;8:254. doi:10.3389/fpubh.2020.00254
- Huynh G, Nguyen TV, Do TTH, et al. Factors relating to preventive practices of health science students during the early stage of the COVID-19 pandemic. *MedPharmRes*. 2020;4(4):27–32. doi:10.32895/UMP.MPR.4.4.5
- Huynh G, Nguyen TN, Tran VK, Vo KN, Vo VT, Pham LA. Knowledge and attitude toward COVID-19 among healthcare workers at district 2 hospital, Ho Chi Minh City. *Asian Pac J Trop Med*. 2020;13(6):260–265. doi:10.4103/1995-7645.280396
- Huynh G, Nguyen MQ, Tran TT, et al. Knowledge, attitude, and practices regarding COVID-19 among chronic illness patients at outpatient departments in Ho Chi Minh City, Vietnam. *Risk Manag Healthc Policy*. 2020;13:1571–1578. doi:10.2147/RMHP.S268876
- Ladiwala ZFR, Dhillon RA, Zahid I, et al. Knowledge, attitude and perception of Pakistanis towards COVID-19; a large cross-sectional survey. *BMC Public Health*. 2021;21(1):21. doi:10.1186/s12889-020-10083-y
- Huynh G, Nguyen TV, Nguyen DD, Lam QM, Pham TN, Nguyen HTN. Knowledge about COVID-19, beliefs and vaccination acceptance against COVID-19 among high-risk people in Ho Chi Minh City, Vietnam. *Infect Drug Resist*. 2021;14:1773–1780. doi:10.2147/IDR.S308446
- Huynh G, Tran TT, Nguyen HT, Pham LA. COVID-19 vaccination intention among healthcare workers in Vietnam. *Asian Pac J Trop Med*. 2021;14(4):159–164. doi:10.4103/1995-7645.312513
- Manning ML, Gerolamo AM, Marino MA, Hanson-Zalot ME, Pogorzelska-Maziarz M. COVID-19 vaccination readiness among nurse faculty and student nurses. *Nurs Outlook*. 2021. doi:10.1016/j.outlook.2021.01.019
- 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(2):183–187. doi:10.1016/j.jhin.2020.04.012
- Wu Z, McGoogan JM. Characteristics of and important lessons from the Coronavirus Disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese center for disease control and prevention. *JAMA*. 2020;323(13):1239–1242. doi:10.1001/jama.2020.2648
- Guilamo-Ramos V, Benzekri A, Thimm-Kaiser M, Hidalgo A, Perlman DC. Reconsidering assumptions of adolescent and young adult SARS-CoV-2 transmission dynamics. *Clin Infect Dis*. 2020;73(S2):ciaa1348.
- Hamza MS, Badary OA, Elmazar MM. Cross-sectional study on awareness and knowledge of COVID-19 among senior pharmacy students. *J Community Health*. 2021;46(1):139–146. doi:10.1007/s10900-020-00859-z
- Taghrir MH, Borazjani R, Shiraly R. COVID-19 and Iranian medical students; a survey on their related-knowledge, preventive behaviors and risk Perception. *Arch Iran Med*. 2020;23(4):249–254. doi:10.34172/aim.2020.06
- Al-Rawajfah OM, Al-Mugeed KA, Alaloul F, Al-Rajaibi HM, Al Omari O. COVID-19. knowledge, attitude, and precautionary practices among health professional students in Oman. *Nurse Educ Pract*. 2021;52:103041. doi:10.1016/j.nepr.2021.103041

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