

Original Article

## Understanding Knowledge and Behaviors Related To the Covid-19 Epidemic in Medical Students in Morocco

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### ABSTRACT

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**Introduction:** The coronavirus (COVID-19) pandemic is accompanied with increasing morbidity and mortality and has impacted the lives of people worldwide. Health care personnel including medical school students are at high risk of exposure and transmission of the coronavirus. Our aim is to study the knowledge and behavior of medical students in Morocco towards COVID-19 to have protection for themselves, their work colleagues.

**Methods:** Cross-sectional and descriptive-analytical study in November 2021 among medical students, conducted by a self-administered questionnaire, stratified sampling on years of study was performed.

**Results:** 300 students responded with a 75% response rate, with a mean age of  $21.3 \pm 1.4$  years. The majority 189 (63%) were female, about 207(69 %) of the respondents had good knowledge (GK) and 174 (60%) had good behaviors (GB) using a point varying of 8 to 10 out of 10 and using a point varying of 40 to 60 out of 60 in each case. To combat the COVID-19 pandemic, 76.7% of the study participants improved their regular hand washing, and 94.7% of them used a face mask since the outbreak; There was a significant difference between hand washing with soap and water and COVID infection (p value = 0.002). The prevalence of anti-coronavirus vaccination was 87.7% (95 % CI 83.4, 90.9).

**Conclusion:** Medical students showed a satisfactory level of knowledge and adherence to the recommendations for protection against COVID-19 and they must also be prepared with medical awareness, an appropriate attitude and good precautionary measures In the event of an emergency.

### Introduction

The COVID-19 pandemic, caused by the SARS-COV2 virus, has become a significant global public health concern due to its potentially fatal nature. The virus spreads

through human-to-human transmission and has led to the implementation of confinement measures and various treatment approaches for patients. Previous outbreaks of related coronaviruses, such as SARS-COV in 2003 and MERS-COV in 2009, have also drawn

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considerable attention. To control the spread of COVID-19, important measures have been taken to minimize person-to-person transmission, including hand washing, wearing face masks, social distancing, and isolating confirmed cases. However, despite numerous studies on the virological characteristics and clinical consequences of COVID-19, there remains a lack of research focusing on the knowledge, perceived severity, and controllability of the disease within affected communities. It is crucial to assess public knowledge and behaviors, especially given the prevalence of misconceptions and misinformation on social media about disease transmission and acquisition methods. Such assessments have proven beneficial during previous viral outbreaks like SARS, MERS, and Ebola, guiding health professionals, service providers, and medical students towards best behaviors.<sup>1-14</sup>

Despite the existing research on various aspects of COVID-19, there is a noticeable gap in our understanding of the knowledge, behaviors, and precautionary measures related to the disease among medical students in Casablanca, Morocco. While much attention has been given to virological and clinical aspects, little focus has been placed on evaluating the perceptions and behaviors of medical students during the pandemic. Understanding the level of knowledge and behaviors of this particular group is essential, as medical students play a crucial role in providing healthcare and public awareness. This gap in research prompts the need for a study that addresses the specific knowledge gaps and behavioral patterns among medical students in relation to COVID-19.

Given the lack of comprehensive research on the knowledge and behaviors of medical

students regarding COVID-19, conducting a study in Casablanca, Morocco, serves several important purposes. Firstly, this research aims to assess the level of understanding among medical students about COVID-19 and its potential severity, thereby identifying any misconceptions that may exist. Secondly, it seeks to determine the extent to which medical students are adopting and practicing precautionary measures recommended by health authorities. Understanding their adherence to behaviors such as hand hygiene, mask-wearing, social distancing, and isolation of confirmed cases is vital for shaping effective public health interventions. Additionally, this study is motivated by the active involvement of medical students in volunteering and assisting their communities during the pandemic. By gaining insights into their knowledge and behaviors, we can further enhance their role in disseminating accurate information and promoting preventive measures.

This survey aimed to assess knowledge, behaviors, and precautionary measures regarding COVID-19 during the epidemic among medical students in Casablanca, Morocco.

## **Methods**

A cross-sectional and descriptive-analytical study was made in 2021 among students of the Faculty of Medicine and Pharmacy of Casablanca (FMPC), using a questionnaire distributed in paper format. Stratified sampling over the 3rd, 4th and 5th years of study was carried out.

The sample size considering a frequency of the knowledge of Covid 19 of 50% in the absence of a precise value, we used the sample size

calculation formula for cross-sectional studies of Epi info software, with a precision of 0.05 % and a risk Alpha=0.05 which gives a sample size of 384 persons.

Criteria for inclusion of students were 3rd, 4th and 5th year students who were members of randomly selected internship groups. Free and informed consent was obtained verbally from students before they completed the questionnaires.

The questionnaire consists of four components: the baseline characteristics of respondents; Comprehension of COVID-19, i.e. clinical presentation, risk factors, transmission and prevention; knowledge and behaviors of medical students to avoid transmission and subsequent disease of coronavirus, as well as vaccination and its adverse effects perceived by vaccinated students. We used the questionnaire used in the study carried out in Northern Nigeria and adapted it to our Moroccan student context.<sup>15</sup>

The scored responses were added together and used to calculate entire score for knowledge, and behaviors for all respondents. Thresholds were set to distinguish between respondents with good knowledge and behaviors from those that did not. The questions with which we calculated the knowledge score were 10, incorrect answers receive 0 points and the correct one receive 1 point and we decided to conclude to Score ranges of 1-4, 5-7, 8-10, correspond to weak, average, and good knowledge, respectively.

Concerning the good behaviors towards the covid 19 we had 14 questions with 9 answer varying from always to never disagree for questions and we awarded 6 , 4, 2, 0 to always, sometimes, rarely and never respectively , for the remaining 5 questions; incorrect answers

receive 0 points and correct answers receive 1 point and we decided to conclude to Score ranges of 1-19, 20-39, 40-60, correspond to weak, average, and good behaviors, respectively.

The baseline characteristics data were synthesized utilizing the descriptive presentation. Some questions were analyzed using simple frequency tables.

Statistical analysis was conducted using Jamovi 1.6.15 software. The alpha risk has been set at 5%. For quantitative variables we used the mean and standard deviation, and for qualitative variables we used percentages. For analytical analysis we used the Chi square test. Ethical considerations: Data collection was carried out with due regard for the overall ethical rules governing confidentiality and data protection specific to participants.

## Results

We calculated Cronbach's alpha internal reliability, which was 94% for our questionnaire.

## Participants

A total of 300 responses were received from participating students with a response rate of 78%, with a mean age of 21.3±1.4 years. The majority 189 (63%) of the respondents were females. The majority of student were originally from Morocco, totaling 273 students (91%). (Table 1)

On the fear assessment, more than a quarter (29%) had a remarkable fear, i.e., 7 till 10 out of 10 and 134 (44.7%) confirm to having recently changing their habits for fear of contracting the virus.

## Knowledge of medical students about COVID-19

Concerning the clinical signs with which the covid 19 manifests itself, the most frequent cited by the students: fever in 282(94%), general weakness in 280 (93.3%), cough in 269(89.7%). (Figure 1)

Of those surveyed, 207(69%) had good knowledge (GK) using a point varying of 8 to 10 out of 10, and 86(28%) had average knowledge.

Among medical students 133(44.3%) believed that there is a treatment for covid, 251(83.7%) believed that hand washing for 20

seconds prevents transmission, and 285(95%) considered that sneezing or coughing into your arm/elbow can prevent the virus from spreading.

Out of the respondents 291 (97%) knew that the virus can be transmitted by holding hands, and 293 (97.7%) Knew that maintaining a safe distance of at least one meter can protect against transmission of the virus, finally all the students agree that touching the face with the hands can transmit the covid 19 virus. (Table 2)

Table 1. Demographic characteristics of participants

	University years study			TOTAL
	3rd year N (%)	4th year N (%)	5th year N (%)	
Age				
Mean±SD	20.2±0.9	21.2±0.9	22.4±1.1	21.3±1.4
Sexe				
Female	69 (68)	54 (65)	66 (57)	189 (63)
Male	32 (32)	29 (35)	50 (43)	111 (37)
Country of origin				
Morocco	94 (93)	71 (85)	108 (93)	273 (91)
Other countries	7 (7)	12 (15)	8 (7)	27 (9)

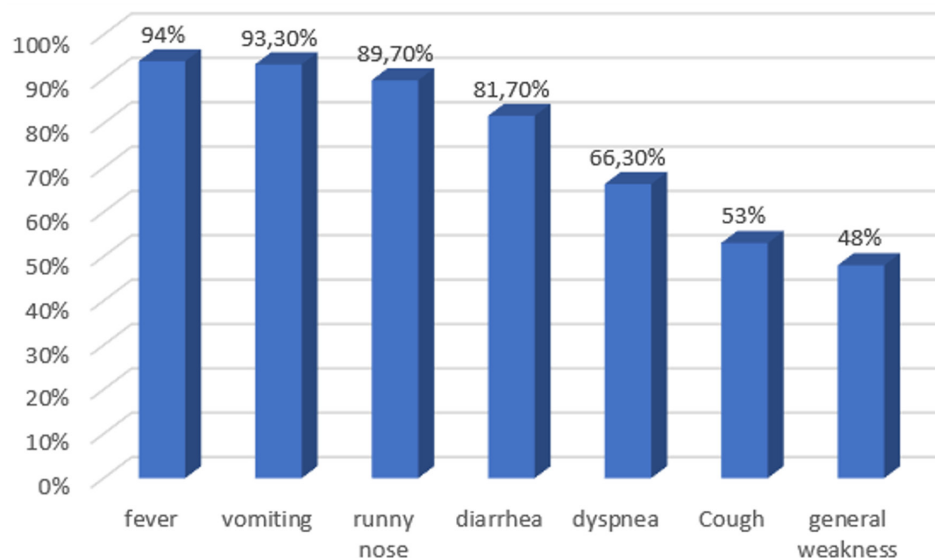


Figure 1. Clinical signs of Covid 19

**Behaviors of COVID-19 prevention measures by medical students**

Out of the respondents 174(60%) had good behaviors (GB) using a point varying of 40 to 60 out of 60, and 110(38%) had average behaviors.

In our study regarding behaviors in the prevention of covid,141(47.0%) of the students confirmed always washing their hands for 20s, 105(35.0) rarely maintaining a safe distance, and 206(68.7) always using a face mask since the beginning of the outbreak. (Table 3)

Only 118 (39,3%) of the students prefer to go to the hospital and 120(40%) prefer not to do anything if they had a contact with a subject suspected of being ill. On the other side, they advise their families affected by covid 19 to consult in the hospital in 247(82,3%).

**Vaccination**

A prevalence of confirmed COVID infection among students from the onset of the pandemic to our study was 40.7% with CI= [35.3-46.3] and the prevalence of anti-covid vaccination

Table 2. Medical students' knowledge regarding COVID-19

	Correct answer n (%)
Is there a treatment for COVID 19?	133 (44.3)
Washing your hands for 20 seconds can prevent the virus?	251 (83.7)
Did you know that sneezing or coughing into your arm/elbow can prevent the virus from spreading?	285 (95.0)
Did you know that the virus can be transmitted by shaking hands?	291 (97.0)
Did you know that keeping a safe distance of at least one meter will protect you from the virus?	293 (97.7)
Did you know that touching your face can transmit the virus?	300 (100.0)
Do you feel that staying home can reduce the risk of infection?	275 (91.7)
Good Knowledge corresponds to 6/7 answers to the questions above	255 (85.0)
Do you believe that staying at home can reduce the risk of infection	275 (91.7)
Do you think that covid 19 can be avoided?	206 (68.7)
Do you think COVID 19 is a serious disease?	153 (51.0)
Would you travel to a high-risk area for business/pleasure?	110 (36.7)

Table 3. Behaviors of COVID-19 prevention measures by medical students

	Always n (%)	Sometimes n (%)	Rarely n (%)	Never n (%)
Wash your hands for 20 seconds?	141 (47.0)	134 (44.7)	22 (7.3)	3 (1.0)
Are you sneezing in your arm/elbow?	176 (58.7)	91 (30.3)	24 (8.0)	9 (3.0)
Do you avoid handshaking when greeting?	63 (21.0)	132 (44.0)	85 (28.3)	20 (6.7)
Do you maintain a distance of at least one meter when meeting others to protect yourself from the virus?	32 (10.7)	122 (40.7)	105 (35.0)	41 (13.7)
Do you avoid touching your face?	89 (29.7)	135 (45.0)	54 (18.0)	22 (7.3)
Do you stay at home often enough?	35 (11.7)	131 (43.7)	92 (30.7)	42 (14.0)
How often do you wash and disinfect surfaces?	96 (32.0)	134 (44.7)	63 (21.0)	7 (2.3)
Do you walk away from someone who is coughing or sneezing?	170 (56.7)	85 (28.3)	41 (13.7)	4 (1.3)
How often have you used a face mask since the beginning of the epidemic?	206 (68.7)	78 (26.0)	14 (4.7)	2 (0.7)

was 87.7% (95 % CI 83.4, 90.9) and 66 (23%) of them mentioned that they had experienced adverse events related to the vaccination.

Among the adverse events, pain at the injection site was the most frequent in 39(59%) of cases, followed by a weakness in half of the cases, and a fever was reported in 22(33%) of the vaccinees. (Figure 2)

### Relationship between knowledge and behavior scores and baseline characteristics:

Among students with good knowledge, 46%

were women and 61% were Moroccan, while among those with good behavior, 42% were women and 54% were Moroccan.( Table 4)

### Hand cleaning with soap and water by medical students and contracting covid 19

About 63% of the participants confirming the use of soap and water did not contract covid as opposed to the 38 % who doesn't use it, P value=0.002.

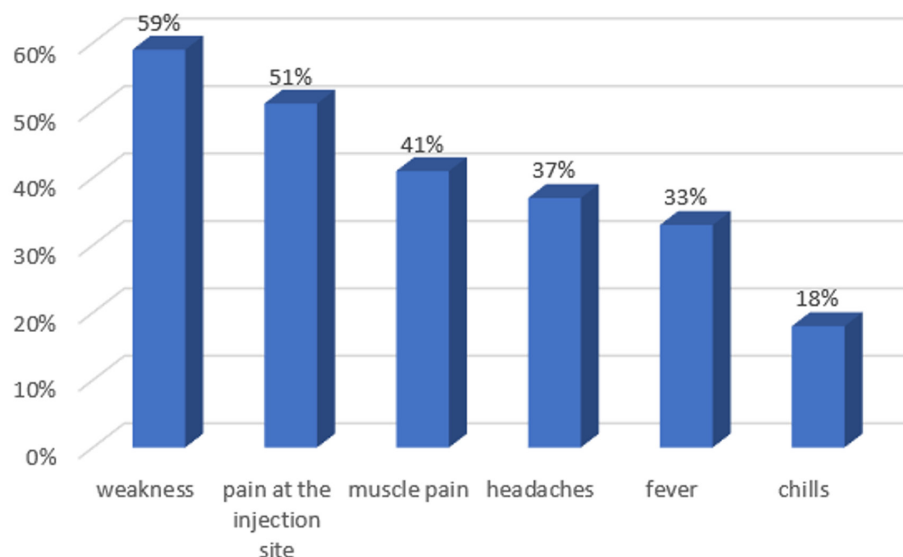


Figure 2. Undesirable Effects after Vaccination

Table 4. The relationship between knowledge, and behavior scores with baseline characteristics

	Age Mean±Sd	Gender Female n (%)	Country of origin: Morocco n (%)
Knowledge			
Good	21.4±1.3	138 (46)	183 (61)
Average	21.2±1.4	49 (16.3)	83 (27)
Weak	20.9±0.6	2 (0.7)	7 (2)
Behaviors			
Good	21.2±1.4	122 (42)	156 (54)
Average	20.9±1.6	62 (21)	102 (35)
Weak	21.2±1.4	1 (0.3)	5 (2)

## Discussion

Since the beginning of our work, several studies have been published on the understanding, knowledge and behaviors relating to COVID-19. Many surveys were cross sectional investigations and were realized in different populations such as the general public, pharmacists, dentists, healthcare workers and undergraduate or postgraduate students.<sup>16-18</sup>

The present descriptive survey assessed the awareness and behaviors of medical students in Morocco relating COVID-19. Medical students in Morocco showed expected levels of knowledge and attitude regarding COVID-19 and reported good precautionary measures. Participants were observed to have a high level of knowledge 256 (69%) concerning COVID-19. Participants also identified good prevention behaviors.

Of all medical students, 133 (44.3%) believe that there is a treatment for covid, Of the 300 respondents, 251 (83.7%) believe that hand washing for 20 seconds prevents transmission, on the other side, 258 (95%) sneezing or coughing into your arm/elbow can prevent the virus from spreading. In another study conducted in Jordan among medical students a minor portion of students (19.3%) thought that the facemasks protected against COVID-19 infection, 60.6% agreed that only those infected with COVID-19 should use facemasks to minimize the risk of transmission.<sup>19</sup>

Medical student involvement in the delivery of patient care, in addition to the high transmissibility of diseases that are the cause of pandemics, increase the risk for this sub-population to contract and transmit the disease. During pandemics such as COVID-19, health

systems are under great tension, and the lack of health care providers (HCPs) may result in the involvement of less experienced HCPs such as medical students. In addition, medical students are often consulted by family and friends for health care advice, and they have been shown to have better health care knowledge than students in other fields, which is more advanced in higher-level medical students.<sup>20-22</sup> Out of the respondents 291 (97%) know that the virus can be transmitted by holding hands, and 293(97.7%) Know that maintaining a safe distance of at least one meter can protect against spread of the virus, finally all the students agree that touching the face with the hands can transmit the covid 19 virus.

In the present study the medical students demonstrated good knowledge of covid 19, concerning the disease manifestation where fever in 94%, general weakness in 93.3%, cough in 89.7%.

Outbreaks of new infectious pathogens whose consequences are poorly understood are often associated with enormous public fear.<sup>23</sup>

In our study a minority of respondents (29%) had a pronounced fear, i.e., 7 to 10 out of 10 and (44.7%) acknowledged to having changed their behavior recently for worrying about being infected with the virus. these numbers are still lower compared to a study done in Nigeria majority of respondents (63.5%) had pronounced fear i.e. 7/10 and 56% agreed that they had changed their behavior recently for fear of contracting the virus.<sup>15</sup>

Measuring knowledge about precautionary measures for contracting the disease is the first step in the educational process to prevent covid 19, which have been proven to affect future behavior.<sup>24</sup> Although precautionary measures such as hand washing (91.7%)

was applicated in the most of the time and staying at home (55.4%) were adopted by participants, the majority of students (95,6%) considered wearing a face mask sometimes to always since the beginning of the epidemic, which is relatively high compared to a study done in Nigeria where only 20% sometimes used facemask since the beginning of the pandemic.<sup>15</sup>

There was a significant association between hand washing with soap and water and the risk to contract the disease P value=0.002 Indeed, 161 (63%) of the participants confirming the use of soap and water did not contract covid as opposed to the 62% who became infected.

In December 2020, the US Food and Drug Administration issued an Emergency use approval for Pfizer-BioNTech (BNT162b2) COVID-19 vaccine and Moderna COVID-19 vaccine (mRNA-1273), later named Comirnaty and Spikevax, respectively.[25,26] Both messenger RNA (mRNA) vaccines were also approved by the European Medicines Agency by January 6, 2021.<sup>27,28</sup>

In our study 263 (87.7%) of the students reported that they had been vaccinated, and 66 (23%) of them mentioned that they had experienced adverse events related to the vaccination, and that can be related to the obligations that the students of medicine had to be able to pass the stage in the hospital by protecting themselves in addition to the practical measures of prevention, by the vaccination anti covid.

In another study conducted in Adama hospital medical college for healthcare workers (HCWs), the overall symptom ratio after the first administration of ChAdOx1 nCoV was 84.3% after vaccination.<sup>29</sup>

To date, all available data on the side effects of the COVID-19 vaccine have been published

in studies funded by the manufacturer, in accordance with pharmaceutical authority guidelines, and monitored by third parties.<sup>30</sup>

The complete safety of AstraZeneca's COVID-19 vaccine [ChAdOx1nCoV-19 Corona Virus Vaccine (Recombinant)] is based on an interim analysis of combined data from 1 four clinical trials conducted in the United Kingdom, Brazil and South Africa. Approximately 2/3 of those vaccinated experienced mild side effects. No serious side effects were caused by the vaccine under study.<sup>31</sup>

## Conclusion

In general, medical students in Morocco showed expected levels of knowledge and attitude regarding COVID-19 and reported good precautionary measures. Health policy makers should have strategies in place to maintain their medical students informed about new issues in public health. Students also need to be correctly guided to the information sources appropriate during these times. In the event of an emergency, students must also be prepared with medical awareness, an appropriate attitude and good precautionary measures.

## References

1. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. *J Autoimmun* 2020;109:102433. <https://doi.org/10.1016/j.jaut.2020.102433>.
2. Kannan S, Ali PSS, Sheeza A, Hemalatha K. COVID-19 (Novel Coronavirus



- 2019) – recent trends 2019:6.
3. Forni G, Mantovani A. COVID-19 vaccines: where we stand and challenges ahead. *Cell Death Differ* 2021;28:626–39. <https://doi.org/10.1038/s41418-020-00720-9>.
  4. Huynh G, Nguyen MQ, Tran TT, Nguyen VT, Nguyen TV, Do THT, et al. Knowledge, Attitude, and Behaviors s Regarding COVID-19 Among Chronic Illness Patients at Outpatient Departments in Ho Chi Minh City, Vietnam. *Risk Manag Healthc Policy* 2020;13:1571–8. <https://doi.org/10.2147/RMHP.S268876>.
  5. Alshammari TM, Altebainawi AF, Alenzi KA. Importance of early precautionary actions in avoiding the spread of COVID-19: Saudi Arabia as an Example. *Saudi Pharm J SPJ* 2020;28:898–902. <https://doi.org/10.1016/j.jsps.2020.05.005>.
  6. Bazaid AS, Aldarhami A, Binsaleh NK, Sherwani S, Althomali OW. Knowledge and behaviors of personal protective measures during the COVID-19 pandemic: A cross-sectional study in Saudi Arabia. *PloS One* 2020;15:e0243695. <https://doi.org/10.1371/journal.pone.0243695>.
  7. Imran E, Khurshid Z, Adanir N, Ashi H, Almarzouki N, Baeshen HA. Dental Practitioners’ Knowledge, Attitude and Behaviors s for Mouthwash Use Amidst the COVID-19 Pandemic. *Risk Manag Healthc Policy* 2021;14:605–18. <https://doi.org/10.2147/RMHP.S287547>.
  8. Aldarhami A, Bazaid AS, Althomali OW, Binsaleh NK. Public Perceptions and Commitment to Social Distancing “Staying-at-Home” During COVID-19 Pandemic: A National Survey in Saudi Arabia. *Int J Gen Med* 2020;Volume 13:677–86. <https://doi.org/10.2147/IJGM.S269716>.
  9. Chan JF-W, Kok K-H, Zhu Z, Chu H, To KK-W, Yuan S, et al. Genomic characterization of the 2019 novel human-pathogenic coronavirus isolated from a patient with atypical pneumonia after visiting Wuhan. *Emerg Microbes Infect* 2020;9:221–36. <https://doi.org/10.1080/22221751.2020.1719902>.
  10. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet Lond Engl* 2020;395:497–506. [https://doi.org/10.1016/S0140-6736\(20\)30183-5](https://doi.org/10.1016/S0140-6736(20)30183-5).
  11. Geldsetzer P. Knowledge and Perceptions of COVID-19 Among the General Public in the United States and the United Kingdom: A Cross-sectional Online Survey. *Ann Intern Med* 2020;173:157–60. <https://doi.org/10.7326/M20-0912>.
  12. Blendon RJ, Benson JM, DesRoches CM, Raleigh E, Taylor-Clark K. The public’s response to severe acute respiratory syndrome in Toronto and the United States. *Clin Infect Dis Off Publ Infect Dis Soc Am* 2004;38:925–31. <https://doi.org/10.1086/382355>.
  13. Almutairi KM, Al Helih EM, Moussa M, Boshaiqah AE, Saleh Alajilan A, Vinluan JM, et al. Awareness, Attitudes, and Behaviors s Related to Coronavirus Pandemic Among Public in Saudi Arabia. *Fam Community Health*

- 2015;38:332–40. <https://doi.org/10.1097/FCH.0000000000000082>.
14. Kobayashi M, Beer KD, Bjork A, Chatham-Stephens K, Cherry CC, Arzoaquoi S, et al. Community Knowledge, Attitudes, and Behaviors s Regarding Ebola Virus Disease - Five Counties, Liberia, September-October, 2014. *MMWR Morb Mortal Wkly Rep* 2015;64:714–8.
15. Habib MA, Dayyab FM, Iliyasu G, Habib AG. Knowledge, attitude and behaviors survey of COVID-19 pandemic in Northern Nigeria. *PloS One* 2021;16:e0245176. <https://doi.org/10.1371/journal.pone.0245176>.
16. Consolo U, Bellini P, Bencivenni D, Iani C, Checchi V. Epidemiological Aspects and Psychological Reactions to COVID-19 of Dental Practitioners in the Northern Italy Districts of Modena and Reggio Emilia. *Int J Environ Res Public Health* 2020;17:E3459. <https://doi.org/10.3390/ijerph17103459>.
17. Papagiannis D, Malli F, Raptis DG, Papathanasiou IV, Fradelos EC, Daniil Z, et al. Assessment of Knowledge, Attitudes, and Behaviors s towards New Coronavirus (SARS-CoV-2) of Health Care Professionals in Greece before the Outbreak Period. *Int J Environ Res Public Health* 2020;17:E4925. <https://doi.org/10.3390/ijerph17144925>.
18. Peng Y, Pei C, Zheng Y, Wang J, Zhang K, Zheng Z, et al. A cross-sectional survey of knowledge, attitude and behaviors associated with COVID-19 among undergraduate students in China. *BMC Public Health* 2020;20:1292. <https://doi.org/10.1186/s12889-020-09392-z>.
19. Khasawneh AI, Humeidan AA, Alsulaiman JW, Bloukh S, Ramadan M, Al-Shatanawi TN, et al. Medical Students and COVID-19: Knowledge, Attitudes, and Precautionary Measures. A Descriptive Study From Jordan. *Front Public Health* 2020;8:253. <https://doi.org/10.3389/fpubh.2020.00253>.
20. Ashley N. Plaster, Julia E. Painter, Dylan H. Tjersland. University Students' Knowledge, Attitudes, and Sources of Information About Zika Virus - PubMed n.d. <https://pubmed.ncbi.nlm.nih.gov/29318503/> (accessed August 4, 2022).
21. Jairoun A, Hassan N, Ali A, Jairoun O, Shahwan M. Knowledge, attitude and behaviors of antibiotic use among university students: a cross sectional study in UAE. *BMC Public Health* 2019;19:518. <https://doi.org/10.1186/s12889-019-6878-y>.
22. Maggie B, Benjamin B. Hayes, Jean Jacques Maury. Evaluation of Medical Students' Knowledge, Attitudes, and Personal Behaviors s of Sun Protection and Skin Self-examination | Cancer Screening, Prevention, Control | *JAMA Dermatology* | *JAMA Network* n.d. <https://jamanetwork.com/journals/jamadermatology/fullarticle/403902> (accessed August 4, 2022).
23. Person B, Sy F, Holton K, Govert B, Liang A, Garza B, et al. Fear and Stigma: The Epidemic within the SARS Outbreak. *Emerg Infect Dis* 2004;10:358–63. <https://doi.org/10.3201/eid1002.030750>.
24. Alfahan A, Alhabib S, Abdulmajeed I,

- Rahman S, Bamuhair S. In the era of corona virus: health care professionals' knowledge, attitudes, and behaviors of hand hygiene in Saudi primary care centers: a cross-sectional study. *J Community Hosp Intern Med Perspect* 2016;6:10.3402/jchimp.v6.32151. <https://doi.org/10.3402/jchimp.v6.32151>.
25. Commissioner O of the. Comirnaty and Pfizer-BioNTech COVID-19 Vaccine. FDA 2022.
26. Commissioner O of the. Spikevax and Moderna COVID-19 Vaccine. FDA 2022.
27. EMA. Comirnaty. Eur Med Agency 2020. <https://www.ema.europa.eu/en/medicines/human/EPAR/comirnaty> (accessed August 5, 2022).
28. EMA. Spikevax (previously COVID-19 Vaccine Moderna). Eur Med Agency 2021. <https://www.ema.europa.eu/en/medicines/human/EPAR/spikevax> (accessed August 5, 2022).
29. Jarso G, Gebi W, Abdo M, Lemma M, Abebe E, Lemessa B, et al. Prevalence of COVID-19 Vaccine Side Effects among Early-Vaccinated Healthcare Workers in Eastern Ethiopia. *Ethiop J Health Sci* 2022;32:473–84. <https://doi.org/10.4314/ejhs.v32i3.2>.
30. Pfizer-BioNTech COVID-19 Vaccine Reactions & Adverse Events | CDC 2022. <https://www.cdc.gov/vaccines/covid-19/info-by-product/pfizer/reactogenicity.html> (accessed August 5, 2022).
31. Voysey M, Clemens SAC, Madhi SA, Weckx LY, Folegatti PM, Aley PK, et al. Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK. *Lancet Lond Engl* 2021;397:99–111. [https://doi.org/10.1016/S0140-6736\(20\)32661-1](https://doi.org/10.1016/S0140-6736(20)32661-1).