

RESEARCH ARTICLE

Knowledge, attitude, and practice of undergraduate medical students in Indonesia on the COVID-19 prevention

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Keywords

Attitude • COVID-19 • Knowledge • Practice • Undergraduate medical students

Summary

Background. *Coronavirus Disease 2019 (COVID-19) caused a global pandemic since March 2020. Undergraduate medical students were encouraged to educate Indonesian society about COVID-19. This study aimed to evaluate the knowledge, attitude, and practice of Indonesian students on COVID-19 prevention.*

Methods. *An online cross-sectional study was conducted online between August 22 and September 2, 2020, with a minimum sample size of 1,068 subjects. The questionnaire was sent to 86 Faculty of Medicine (FoM) in Indonesia. The questionnaire consisted of knowledge, attitude, and practice section, with the scores above median were considered as sufficient knowledge, positive attitude, and positive practice. Association between knowledge, attitude, and practice, which were dependent variables, with gender, year of study, location of FoM, and source of information, which were independent variables, were tested using Chi-Square Test. Corre-*

lation among knowledge, attitude, and practice scores was tested using Spearman Rank Test.

Results. *Among 1,390 participated students, 51.4, 55.7, and 56.3% had sufficient knowledge, positive attitude, and, positive practice, respectively. There were associations between knowledge and gender ($p = 0.005$), year of study ($p = 0.000$), location of FoM ($p = 0.000$), and source of information ($p = 0.000$); between attitude and gender ($p = 0.022$), year of study ($p = 0.004$), and source of information ($p = 0.015$); and between practice and gender ($p = 0.000$) and source of information ($p = 0.000$). There were weak correlations between knowledge and attitude ($r = 0.246$, $p < 0.001$); and between attitude and practice ($r = 0.272$, $p < 0.001$).*

Conclusions. *Half of Indonesian medical students showed sufficient knowledge, positive attitude, and positive practice on COVID-19 prevention. Hence, improvement towards COVID-19 prevention is required.*

Introduction

Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by a newly discovered coronavirus, Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2). COVID-19 was presumed to be originated from the fish market in the central Chinese city of Wuhan, Hubei province, in late December 2019 and has spread to several surrounding countries very rapidly [1, 2]. World Health Organization (WHO) declared this outbreak as a pandemic on March 11, 2020 [3]. Based on the latest data from February 6, 2021, there were 1.134.854 confirmed positive cases of COVID-19 in Indonesia, with a total number of deaths of 31.202. Indonesia still becomes the country with the highest number of cases in Southeast Asia [4].

SARS-CoV-2 is transmitted through droplets from an infected person. This droplet can infect the mucosa of the mouth, nose, or conjunctiva of the eye [5]. The most common symptoms are fever, dry cough, and malaise [6]. Due to the rapid spread and no specific treatment in place, several local governments in Indonesia set Large Scale-Social Restrictions [7].

News about COVID-19 is always broadcasted every day with the latest updated information. Various media with various credibility might mask the actual information about COVID-19. This often results in a lot of misinformation, stigma, or public panic [8]. All healthcare workers were mobilized to deal with COVID-19 patients. Education and Culture Minister also encouraged university student to join the volunteer to prevent COVID-19 transmission [9]. Many undergraduate medical students, who would later be referred to as students, took the initiative to volunteer this program for providing counseling, information, and education about COVID-19 in order to solve misinformation circulating in the community [10]. This initiative of students to a pandemic situation encouraged them to know the essential information about COVID-19 to be role models in implementing COVID-19 prevention for the society.

Therefore, the objective research of this study was meant to explore the knowledge, attitude, and practice among medical students about preventing COVID-19 transmission. By this finding, we can measure the capability of medical students regarding a new outbreak

and can provide the policymakers to encourage the students to contribute to new outbreaks such as COVID-19. There has been no study investigating knowledge, attitude, and practice about COVID-19 prevention only among the medical students in Indonesia to date.

Methods

This cross-sectional study used an online questionnaire distributed between August 22nd to September 2nd, 2020, to all Faculty of Medicines (FoM) in Indonesia. The questionnaire was created with Google form and distributed to representatives of each FoM via LINE, Whatsapp, and Instagram, then distributed to each batch via group chat. The subjects of this study were 1st, 2nd, and 3rd-year undergraduate medical students' batch 2019/2020 in Indonesia. All subjects were given information about the purpose of the study, confidentiality clauses, and informed consent forms. Subjects who agreed the informed consent were included in this study. The exclusion criteria were the non-response subjects and those who were not completely fulfilling the questionnaire would automatically not be submitted by the system. The required sample size was 1068 calculated for descriptive formula with confidence level of 95 and 3% margin of error. The measured variables were knowledge, attitude, and practice for dependent variables and gender, year of study, location of FoM, and source of information for independent variables.

The questionnaire consisted of respondent's characteristic, 15 knowledge questions, 12 attitude statements, and eight practice statements. Questionnaire for Knowledge assessment were multiple choices, containing aspects of epidemiology, risk factors, transmission, clinical manifestations, diagnosis, prevention, and stigma. Each correct answer was given a score of 1 and 0 for an incorrect answer, with the total score being 15. Attitude and practice were measured using five-point Likert scale (strongly agree = 5, agree = 4, neutral = 3, disagree = 2, strongly disagree = 1 for positive attitude; very frequently = 5, frequently = 4, occasionally = 3, rarely = 2, never = 1 for positive practice; in case of negative attitude and practice, reverse scoring was used). The total score for attitude and practice were 60 and 45, respectively.

Knowledge score was categorized as sufficient (if \geq median) and insufficient (if $<$ median). Attitude and practice scores were categorized as positive (if \geq median) and negative (if $<$ median). The questionnaire's validity was tested using the Pearson correlation product moment test, and the reliability test used Cronbach's Alpha test. The questionnaire had done the face validity and content validity with the research team consisted of two internists and two epidemiologists. This questionnaire has an adequate reliability and internal consistency for the practice statements, with the α Cronbach was 0.771. Data were presented descriptively and analyzed using IBM-SPSS version 25. The normality distribution of numerical data was tested using the Kolmogorov Smirnov Test. Numerical data were presented with median

and interquartile range (IQR). Categorical data were presented with frequency and proportion. Data were analyzed with Chi-Square Test to elaborate association between knowledge, attitude, and practice with gender, year of study, location of FoM, and source of information; and with Spearman's Rank Test to elaborate correlation between the scores of knowledge, attitude, and practice. p -value < 0.05 was considered statistically significant.

This study has been approved by the Health Research Ethics of Universitas Padjadjaran Bandung with the ethical number 578/UN6.KEP/EC/2020.

Results

Between August 22nd to September 2nd, 2020, from 86 out of 88 FoM in Indonesia, 1,390 students responded and agreed to join this study. Almost three-quarters of respondents were female. All respondents were distributed into all years (years 1-3). Half of them were residing outside of Java Island. The majority got information about COVID-19 from unofficial sources (Tab. I).

Median (IQR) score of knowledge, attitude, and practice were 9 (9-12), 50 (47-52), and 33 (31-36), respectively. More than half of the respondents had a sufficient level of knowledge, positive attitude, and positive practice toward COVID-19 prevention (Tab. II).

Tab. I. Characteristics of undergraduate medical students (n = 1,390)

Variables	N, %
Gender	
Female	978 (70.4)
Male	412 (29.6)
Year of study	
1st-year	502 (36.1)
2nd-year	441 (31.7)
3rd-year	447 (32.2)
Location of faculty of Medicine	
Outside Java island	739 (53.2)
Java island	651 (46.8)
Source of information	
Unofficial sources	929 (66.8)
Official sources	461 (33.2)

Tab. II. Knowledge, attitude, and practice of undergraduate medical students on COVID-19 prevention.

Knowledge	
Score (median (IQR))	9 (9-12)
Sufficient (n, %)	715 (51.4)
Insufficient (n, %)	675 (48.6)
Attitude	
Score (median, IQR)	50 (47-52)
Positive (n, %)	774 (55.7)
Negative (n, %)	616 (44.3)
Practice	
Score (median (IQR))	33 (31-36)
Positive (n, %)	782 (56.3)
Negative (n, %)	608 (43.7)

Tab. III. Comparisons between knowledge, attitude, and practice with characteristic variables (n = 1,390).

Variables	Knowledge			Attitude			Practice		
	Sufficient (n, %)	Insufficient (n, %)	P-value	Positive (n, %)	Negative (n, %)	P-value	Positive (n, %)	Negative (n, %)	P-value
Gender									
Female	527 (53.9)	451 (46.1)	0.005	564 (57.7)	414 (42.3)	0.022	589 (60.2)	389 (39.8)	0.000
Male	188 (45.6)	224 (54.4)		210 (51.0)	202 (49.0)		200 (48.5)	212 (51.5)	
Year of study									
1st-year	215 (42.8)	287 (57.2)	0.000	253 (50.4)	249 (49.6)	0.004	297 (59.2)	205 (40.8)	0.200
2nd-year	231 (52.4)	210 (47.6)		248 (56.2)	193 (43.8)		253 (57.4)	188 (42.6)	
3rd-year	269 (60.2)	178 (39.8)		273 (61.1)	174 (38.9)		239 (53.5)	208 (46.5)	
Location of faculty of Medicine									
Java island	369 (56.7)	282 (43.3)	0.000	359 (55.1)	292 (44.9)	0.705	364 (55.9)	287 (44.1)	0.549
Outside of Java island	346 (46.8)	393 (53.2)		415 (56.2)	324 (43.8)		425 (57.5)	314 (42.5)	
Source of information									
Unofficial sources	443 (47.7)	486 (52.3)	0.000	496 (53.4)	433 (46.6)	0.015	492 (53.0)	437 (47.0)	0.000
Official sources	272 (59.0)	189 (41.0)		278 (60.3)	183 (39.7)		297 (64.4)	164 (35.6)	

All statistical testing used Chi-Square.

With respect to the knowledge, there were associations between knowledge and gender, year of study, location of FoM, and source of information (Tab. III). More than 60% of students answered the questions correctly on the aspects of risk factors, transmission, clinical manifestations, prevention, and stigma, except for epidemiology and diagnosis aspects (Tab. IV). With

regards to the attitude, there were associations between attitude and gender, year of study, and source of information (Tab. III). Almost two-third of the students answered the questions correctly on the aspects of risk factors, transmission, clinical manifestations, diagnosis, and prevention, except for epidemiology and stigma aspects (Tab. IV). Related to the practice, there were

Tab. IV. Responses to knowledge and attitude (n = 1,390).

Knowledge		Attitude	
Aspects and questions	Correct (n, %)	Aspects and statements	Positive (n, %)
Epidemiology		Epidemiology	
Definition of COVID-19 death	865 (62.33)	Suitability of daily case reports of COVID-19	465 (33.5)
Aims of flattening the curve	283 (20.34)	Updating the number of deaths in suspected case daily	1,232 (88.6)
Risk factors		Risk factors	
Highest risk group for containing severe COVID-19	1,205 (86.69)	Not visiting grandparents if having respiratory symptoms	1,314 (94.5)
Transmission		Transmission	
Main route of transmission of COVID-19	1,192 (85.76)	Keeping social distancing outside	1,299 (93.5)
Clinical manifestations		Clinical manifestations	
Incubation period of COVID-19	1,240 (89.21)	Isolation if have COVID-19 symptoms	1,311 (94.3)
Main clinical manifestations of COVID-19	1,258 (90.5)	Diagnosis	
Diagnosis		COVID-19 screening by rapid test antibody	1,288 (92.7)
Category of suspect case	844 (60.71)	Prevention	
Category of probable case	542 (38.99)	Going outside during the rise of COVID-19 cases	842 (60.4%)
Category of close contact	868 (62.45)	Medical mask for elderly when going outside	977 (70.3%)
Category of confirmed case	1,131 (81.37)	Using mask when going outside	1,291 (92.9)
Prevention		Stigma	
Application of new normal	975 (70.14)	Refusing COVID-19 corpse	959 (69.0)
Preventive actions to limit COVID-19 transmission	830 (59.71)	Opening up to doctors if having COVID-19 symptoms	1,337 (96.2)
Application of large scale-social restrictions	1,073 (77.19)	COVID-19 confirmation in the whole family if 1 of their member was contracted	432 (31.1)
Criteria for restricting large-scale social restrictions	939 (67.55)		
Stigma			
Efforts to reduce stigma of COVID-19	1,097 (78.92)		

Tab. V. Responses to practice (n = 1,390).

Statements	Positive (n,%)
Giving health education about COVID-19	1,032 (74.2)
Disinfecting frequently used stuff	1,157 (83.2)
Washing hands with WHO 6 steps	1,312 (94.4)
Covering nose and mouth when sneezing or coughing	1,301 (93.6)
Touching face when hands are not washed	977 (70.3)
Eating healthy food	1,138 (81.9)
Interacting with someone who does not live with	797 (57.3)
Going outside from house	711 (51.2)

associations between practice with gender and the source of information (Tab. III). Seven out of 10 students answered the questions correctly, except for interacting with someone who did not live with and going outside from house (Tab. V).

We also elaborated the correlation among these three variables (knowledge, attitude, and practice). We found that there were weak correlations between the score of knowledge and that of attitude ($r = 0.246$, $p < 0.001$) and between the score of attitude and that of practice ($r = 0.272$, $p < 0.001$), but there was no correlation between the score of knowledge and that of practice ($r = 0.02$, $p = 0.93$).

Discussion

To our knowledge, this is the first study conducted on all undergraduate medical students throughout Indonesia about COVID-19 prevention. This study was conducted in mid-2020, five months after the COVID-19 pandemic was announced. We managed to contact 86 out of 88 FoM across Indonesia, 651 (46.8%) of the respondents resided in Java island and 739 (53.2%) of them lived outside of Java island. We classified this categorization because Java island has around half of all FoM in Indonesia. Also, since the first COVID-19 case in Indonesia arose at one spot in Java island, making the pandemic situation in Indonesia was more pronounced in many provinces in Java island [11]. Seven out of ten respondents were female. All respondents were distributed almost equally into all year of studies. The respondents mostly got information about COVID-19 from unofficial sources. In this study, half (51.4%) of students had sufficient knowledge. This finding was lower than similar studies conducted in India, Iran, Iraq, and Uganda, where 92.7, 79.6, 91.8, and 91% of medical students had sufficient knowledge on the COVID-19, respectively [12-15]. These major differences might be due to the differences in the format of the answer to knowledge questions, in which this study was using multiple choice format. We chose this approach because this format has distractor options and therefore it can evaluate the knowledge of the students more.

Out of 15 questions related to the knowledge about COVID-19, most of the students understood about the

highest risk group for containing severe COVID-19, the main route for transmission, the incubation period of COVID-19, the main clinical symptoms of COVID-19, and how to reduce the stigma of COVID-19. However, more than 60% of them answered incorrectly on the aspects of epidemiology and diagnosis, especially on the questions about flattening the curve and criteria of probable case, respectively. This information implies the necessity of education to the students about the operational definition for surveillance and the epidemiologic aspect in preventing COVID-19.

Furthermore on the knowledge, there were associations between knowledge about COVID-19 and gender, year of study, location of FoM, and source of information. Study in India did not find an association between knowledge about COVID-19 and gender among medical students [12]. Likewise, study in Iran did not find association between knowledge and gender, but found association between knowledge and source of information [13]. Study in Iraq also did not find association between knowledge and gender, but showed an association between knowledge and year of study [14].

Study in Uganda also did not find association between knowledge and gender, but found associations between knowledge and the year of study, and the source of information [15]. Regarding the association between knowledge and gender, the number of female respondents in this study might contribute to the difference with other studies, and contribute to the higher percentage of sufficient knowledge than males. In regard to the year of study, senior year students tend to have a higher percentage of sufficient knowledge, because it might be easier for them to comprehend this new disease.

Regarding the source of information, differences in the categories of this variable might contribute to the distinction to Iranian study [13]. Students who got information from the official sources had a more sufficient knowledge. This result might be due to the official sources, such as official websites of government and WHO have a more reliable and actual information [16]. Meanwhile, the unofficial sources such as social media might contain misinformation [17]. It implies that students must be encouraged to use the official sources to seek information about COVID-19, as it can be seen in this study that most students used unofficial sources and had a more insufficient knowledge about COVID-19 prevention. Location of FoM on Java island had a higher percentage of sufficient knowledge. Almost two-third of all FoM in Indonesia who are accredited with A reside in Java island [18]. The accreditation process improves the quality of medical education [19]. In addition, four out of six provinces on Java island were among ten provinces with the highest cases of COVID-19 in Indonesia during the time this study took place [20]. This might trigger medical students on Java island to learn more about COVID-19.

Regarding attitude, around half of the students (55.7%) had a positive attitude toward COVID-19 prevention. This finding was lower than that of in other studies in

India, Iraq, and Uganda, where more than 80, 90.8, and 74% had a positive attitude, respectively [12, 14, 15]. The differences in the aspects contained in the attitude statements might contribute to these findings, such as in the study in India and Uganda where there were aspects about confidence in the government for controlling COVID-19 pandemic [12, 15]. Study in Iraq also had aspects about beliefs and concerns in getting COVID-19 infections [14].

Seven out of 12 statements about attitude, which were related to the aspects of risk factors, transmission, clinical manifestations, diagnosis, and prevention were answered correctly by all the students. The students agreed on not visiting grandparents if they have respiratory symptoms during this pandemic, keeping social distance, isolating themselves when having COVID-19 symptoms, COVID-19 screening by rapid test antibody on healthy people, staying at home when COVID-19 cases still increasing, and using masks for elderly and for going outside. In spite of those aspects, 7 of 10 students answered incorrectly on the epidemiology and stigma aspects regarding the suitability of daily case reports and the contamination of COVID-19 in the whole family if one of their members is COVID-19 positive, respectively.

In this study, we found associations between attitude with gender, year of study, and source of information, which was not the case in the similar studies performed in India, Iraq, and Uganda [12, 14, 15]. Study in India did not find an association between attitude on COVID-19 prevention and gender [12]. Likewise, study in Iraq also did not find association between attitude and gender, but it showed an association between attitude and year of study [14]. Study in Uganda did not find association between attitude and year of study, but they found associations between attitude and source of information and gender: females had more negative attitude than males [15]. Concerning the association between attitude and gender, this study found that there were more females with a positive attitude than males, although both genders had a high percentage of positive attitudes. The number of female respondents could contribute to this result in this study and compared to other studies [12, 14]. This study also found a higher percentage of a positive attitude as the year of study getting more senior, which was in line with their knowledge. In addition, the number of students who used official sources with a positive attitude was higher than the unofficial sources-users, which was in line with their knowledge. Besides, this study was not found an association between attitude and location of FoM. This could be influenced by widely distributed COVID-19 news and information [21].

With respect to practice, half of the students had positive practice (56.3%). This result was similar to the finding of the study in Uganda (57%) but was lower than studies in Iran and Iraq, where 94.2 and 87% had positive practice, respectively [13-15]. Recruitment of clinical senior year students in Iran and Iraq could contribute to this finding [13, 14]. Almost three-quarter of the students implemented the positive practice in

giving health education to their surroundings, routinely disinfecting stuff and washing hands with WHO 6 steps, covering nose and mouth while sneezing or coughing, rarely touching face when hands were not washed, and eating healthy food. However, around half of students frequently interacting with someone outside and going outside from home.

In this study, there was association between practice and gender, and source of information. Study in India found an association between practice towards COVID-19 and gender among medical students [12]. Likewise, study in Iraq also found associations between practice and gender, and year of study [14]. On the other hand, study in Iran did not find associations between practice and gender, and source of information [13]. Study in Uganda also did not find association between practice and gender, and year of study, but they found associations between practice and source of information [15]. Regarding the association between practice and gender, this study found that females had a more positive practice. This might be due to a higher concern in females about COVID-19 [22]. Females were also found to have a higher fear of COVID-19 [23]. This could affect their health behavior compliance [24]. This finding was inconsistent to the studies in Iran and Uganda, as it might be caused by the different aspects in practice questions of Iranian study [13]. Also, over four-fifth of the medical students in Uganda were involved in health education about COVID-19 [15]. As well as for the knowledge and attitude, more students with a positive practice used official sources than unofficial sources, even though both sources had a higher percentage of positive practice. No association between practice and year of study was found in this study. This was in contrast to the study in Iraq, and might because of the difference in the study population [14]. This study also showed that there was no association between practice and the location of FoM. Massive COVID-19 news could contribute to these findings [21].

Theoretically, attitude has a cognitive component (knowledge). This attitude affects the individual's intention which influences their practice [25]. In addition, practice is affected by the cognitive factors [26]. Therefore, we evaluated the correlation between knowledge and attitude, attitude and practice, and knowledge and practice. We found that knowledge on COVID-19 prevention was weakly correlated with attitude. Likewise, attitude was weakly correlated with practice. Surprisingly, knowledge was not correlated with practice. The explanation might be the strength of the correlation between knowledge and attitude as well as between attitude and practice. This study found the correlation between knowledge and attitude was weak ($r = 0.24$), and also for attitude and practice ($r = 0.21$). This explained there were a lot of factors affecting attitude, as well as practice. Another explanation might be due to the lack of awareness in this study population on implementing COVID-19 prevention. In addition, during this study, the information about COVID-19 was still developing, along with the rapid spread of updated

information and no specific vaccine or treatment available, they might contribute to the skeptical attitude in this study population. Hence, it could be accepted that correlation was not found between knowledge and practice in this study.

This study is not free from the limitations. As this is an online survey, we could not ensure whether there were fraudulent acts when the respondents answered the questionnaire [27]. However, this type of study would be justifiable to be conducted because of the ongoing pandemic situation. Second, as this is a cross-sectional study design, which capture the data at one point in time, the determinants found in this study need to be further verified [28]. Third, the presence of temporal influences, where this study was conducted five months after the COVID-19 pandemic was announced. The results of this study might be different if it were carried out the study later.

Conclusions

Only around half of undergraduate medical students in Indonesia had sufficient level of knowledge, positive attitude, and positive practice toward COVID-19 prevention. This indicated that only half of the students had a notable concern this new pandemic. Knowledge on COVID-19 prevention was associated with gender, year of study, location of FoM, and source of information. Attitude toward the COVID-19 prevention was associated with gender, year of study, and source of information. Meanwhile the practice of COVID-19 prevention was associated with gender and source of information. There were weak correlations between knowledge and attitude and between attitude and practice.

This study implied that efforts are needed to improve knowledge, attitude, and practice of the medical students in Indonesia about COVID-19 prevention, before they can be deployed to provide proper counselling, information, and education to Indonesian society. Hence, they could have the capacity to play a role through health education about preventing COVID-19 transmission to Indonesian society. Students could be encouraged to use credible sources for actual and more accurate information about COVID-19.

Increasing students' knowledge might contribute to increasing attitude and practice in preventing COVID-19 transmission. These findings can be used as a parameter for making public policy to prepare the students in the prevention of COVID-19 pandemic or other outbreaks.

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Conflict of interest statement

The authors declare no conflict of interest.

Authors' contributions

LYG was responsible for preparation of the study, data collection, data analysis, and writing the manuscript. YS contributed in the study design and preparation of the questionnaire. LER contributed in the study design. HS and RR contributed in the conception and design of the study, data analysis, and finalizing the writing of the manuscript [1].

References

- [1] Lu H, Stratton CW, Tang YW. Outbreak of pneumonia of unknown etiology in Wuhan China: the mystery and the miracle. *J Med Virol* 2020;92:401-2. <https://doi.org/10.1002/jmv.25678>
- [2] Ge H, Wang X, Yuan X, Xiao G, Wang C, Deng T, Ge H, Wang X, Yuan X, Xiao G, Wang C, Deng T, Yuan Q, Xiao X. The Epidemiology and Clinical Information about COVID-19. *Eur J Clin Microbiol Infect Dis* 2020;39:1011-9. <https://doi.org/10.1007/s10096-020-03874-z>
- [3] Cucinotta D, Vanelli M. WHO Declares COVID-19 a pandemic. *Acta Biomed* 2020;91:157-60. <https://doi.org/10.23750/abm.v91i1.9397>
- [4] World Health Organization. WHO Coronavirus Disease (COVID-19) Dashboard. <https://covid19.who.int/table> (accessed on 02/07/2021).
- [5] Han Y, Yang H. The transmission and diagnosis of 2019 novel coronavirus infection disease (COVID-19): a Chinese perspective. *J Med Virol* 2020;92:639-44. <https://doi.org/10.1002/jmv.25749>
- [6] Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. *J Autoimmun* 2020;109:497-506. <https://doi.org/10.1016/j.jaut.2020.102433>
- [7] Ariawan I, Jusril H. COVID-19 in Indonesia: where are we? *Acta Med Indones* 2020;52:193-5.
- [8] Shimizu K. 2019-nCoV, fake news, and racism. *Lancet* 2020;395:685-6. [https://doi.org/10.1016/S0140-6736\(20\)30357-3](https://doi.org/10.1016/S0140-6736(20)30357-3)
- [9] The Jakarta Post. 'Our country is at war': Education Minister Nadhim Makarim calls on students to join fight against COVID-19. <https://www.thejakartapost.com/news/2020/03/26/our-country-is-at-war-education-minister-nadhim-makarim-calls-on-students-to-join-fight-against-covid-19.html> (accessed on 02/07/2021).
- [10] Lazarus G, Mangkuliguna G, Findyartini A. Medical students in Indonesia: an invaluable living gemstone during coronavirus disease 2019 pandemic. *Korean J Med Educ* 2020;32:237-41. <https://doi.org/10.3946/kjme.2020.165>
- [11] Eryando T, Sipahutar T, Rahardiantoro S. The risk distribution of COVID-19 in Indonesia: a spatial analysis. *Asia Pacific J Public Health* 2020;32:1-3. <https://doi.org/10.1177/1010539520962940>
- [12] Maheshwari S, Gupta P, Sinha R, Rawat P. Knowledge, attitude, and practice towards coronavirus disease 2019 (COVID-19) among medical students: a cross-sectional study. *J Acute Dis* 2020;9:100-4. <https://doi.org/10.4103/2221-6189.283886>
- [13] Hossein Taghrir M, 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;23:249-54. <https://doi.org/10.34172/aim.2020.06>
- [14] Khalil NS, Al-Yuzbaki DB, Tawfeeq RS. Covid-19 - knowledge,

- attitude and practice among medical undergraduate students in Baghdad city. *EurAsian J Biosci* 2020;14:4179-86.
- [15] Olum R, Kajjimu J, Kanyike AM, Chekwech G, Wekha G, Nassozi DR, Olum R, Kajjimu J, Kanyike AM, Chekwech G, Wekha G, Nassozi DR, Kemigisa J, Mulyamboga P, Muhoozi OK, Nsenga L, Lyavala M, Asiiimwe A, Bongomin F. Perspective of medical students on the COVID-19 pandemic: survey of nine medical schools in Uganda. *JMIR Public Heal Surveill* 2020;6:e19847. <https://doi.org/10.2196/19847>
- [16] World Health Organization. Mental health and psychosocial considerations during the COVID-19 outbreak. Geneva: WHO 2020.
- [17] Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): the epidemic and the challenges. *Int J Antimicrob Agents* 2020;55:105924. <https://doi.org/10.1016/j.ijantimicag.2020.105924>
- [18] Indonesian Accreditation Agency for Higher Education in Health. Directory of Accreditation Results - IAAHEH. https://lamptkes.org/en/Search-Result-of-Accreditation-Result-Database?_token=B2Dv0ZqYGWF6dnVMqZwfmyTAMHVMaolrZLEfitRF&_method=patch&jenjang=sarjana&nama_pt=&nama_ps=pendidikan+Dokter&thn=&cek=masih+berlaku&ok= (accessed on 02/07/2021).
- [19] Al Mohaimeed A, Midhet F, Barrimah I. Academic accreditation process: experience of a medical college in Saudi Arabia. *Int J Health Sci (Qassim)* 2012;6:23-9. <https://doi.org/10.12816/0005970>
- [20] World Health Organization (WHO) Indonesia. Coronavirus disease 2019 (COVID-19) situation report - 22. Jakarta: WHO 2020.
- [21] Rathore FA, Farooq F. Information overload and infodemic in the COVID-19 pandemic. *J Pakistan Med Assoc* 2020;3:S162-5. <https://doi.org/10.5455/JPMA.38>
- [22] Fancourt D, Steptoe A. COVID-19 Social study results release 8. London: University College 2020.
- [23] Broche-Pérez Y, Fernández-Fleites Z, Jiménez-Puig E, Fernández-Castillo E, Rodríguez-Martin BC. Gender and fear of COVID-19 in a Cuban population sample. *Int J Ment Health Addict* 2020;1-9. <https://doi.org/10.1007/s11469-020-00343-8>
- [24] Harper CA, Satchell LP, Fido D, Latzman RD. Functional fear predicts public health compliance in the COVID-19 pandemic. *Int J Ment Health Addict* 2020;1-14. <https://doi.org/10.1007/s11469-020-00281-5>
- [25] Jain V. 3D model of attitude. *Int J Adv Res Manag Soc Sci* 2014;3:1-12.
- [26] Glanz K, Rimer BK, Viswanath K. Health behavior theory, research, and practice. Vol. 38. United States: Jossey-Bass 2009.
- [27] Ball HL. Conducting online surveys. *J Hum Lact* 2019;35:413-7. <https://doi.org/10.1177/0890334419848734>
- [28] Wang X, Cheng Z. Cross-sectional studies: strengths, weaknesses, and recommendations. *Chest* 2020;158:S65-71. <https://doi.org/10.1016/j.chest.2020.03.012>

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