Society of Medical Education & Research

2024, Volume 4, Page No: 189-197
ISSN: 3108-4818

International Journal of Social and Psychological Aspects of Healthcare

Undergraduate Students' Knowledge, Attitudes, and Behaviors Regarding COVID-19 during Emergency Remote Learning

Chiara Lombardi[1]*, Alessio Contini[1], Federica Russo[1]

[1]Department of Clinical Psychology, Faculty of Medicine, University of Florence, Florence, Italy.

***E-mail** ✉ chiara.lombardi@gmail.com

Abstract

The COVID-19 pandemic severely disrupted the education sector. To reduce disruptions to teaching and learning, the majority of Malaysian universities transitioned to online delivery during this exceptional phase of the pandemic. As increasing numbers of Malaysians achieved full vaccination against COVID-19, the education sector was anticipated to resume in-person instruction in the current year. Evaluating the knowledge, attitudes, and practices (KAP) regarding COVID-19 among undergraduates engaged in emergency remote learning is essential prior to returning to on-campus teaching and learning. Accordingly, a study was undertaken to address this objective. A sample of 299 Malaysian undergraduates was recruited using snowball sampling. The online survey consisted of three primary sections: informed consent, sociodemographic details, and COVID-19 KAP items. Average scores were 4.05 out of 6 for knowledge, 11.14 out of 12 for attitude, and 5.07 out of 7 for practice. Findings indicated that first-year students exhibited significantly higher KAP scores ($p < 0.05$) compared to fourth-year students. Furthermore, science majors demonstrated significantly higher attitude scores ($p < 0.05$) than non-science majors. No significant differences in KAP scores were observed across gender, ethnicity, or prior COVID-19 infection history. Partial correlation analyses showed positive associations between knowledge and attitude scores ($r = 0.193$, $p = 0.001$), knowledge and practice scores ($r = 0.343$, $p < 0.001$), and attitude and practice scores ($r = 0.149$, $p = 0.010$). These findings indicate that targeted COVID-19 educational interventions, such as workshops, seminars, or training sessions, for fourth-year students may help improve their KAP levels.

Keywords: COVID-19, Remote Learning, ociodemographic, KAP

Introduction

Coronavirus disease 2019 (COVID-19) is a highly contagious illness caused by the SARS-CoV-2 virus. The disease spread and evolved quickly following its initial emergence in late December 2019 in Wuhan, China. Its global proliferation can be attributed to factors such as an extended incubation period, elevated transmissibility, and the presence of asymptomatic infections [1]. Transmission primarily occurs via close contact and respiratory droplets [2].

Malaysia recorded its first confirmed COVID-19 case on 25 January 2020 [3]. Subsequently, multiple outbreaks emerged across different parts of the country. To control the virus's spread, the Malaysian government enforced phased lockdown measures over the preceding year [4]. This led to significant disruptions across various sectors. In education, students were required to remain at home, prompting a shift from traditional to online teaching and learning modalities [5].

Emergency remote learning (ERL) describes the abrupt transition from in-person to virtual instruction during a crisis [6]. Once the crisis eases, the system reverts to its prior format [7]. Unlike purposefully designed online distance education, ERL was adopted by most educational institutions amid the COVID-19 outbreak to maintain instructional continuity. With rising rates of full

Access this article online https://smerpub.com/

Received: 02 June 2025; **Accepted:** 19 October 2025

How to cite this article: Lombardi C, Contini A, Russo F. Undergraduate Students' Knowledge, Attitudes, and Behaviors Regarding COVID-19 during Emergency Remote Learning. Int J Soc Psychol Asp Healthc. 2024;4:189-97. https://doi.org/10.51847/7vTs4Dkjvt

vaccination among Malaysians against COVID-19, a return to face-to-face instruction was projected for the current year.

From 1 May 2022, Malaysia introduced eased COVID-19 standard operating procedures nationwide, including optional outdoor mask wearing, in-class instruction, elimination of physical distancing, and discontinuation of MySejahtera (a mobile application for COVID-19 contact tracing) check-ins [8], among other changes. Individuals can contract COVID-19 despite full vaccination [9]. Relative to other age groups, undergraduates tend to participate actively in extracurriculars like part-time employment, volunteer work, sports, and student organizations [10], increasing their exposure risk to COVID-19.

Knowledge, attitude, and practice (KAP) studies serve as effective instruments for assessing awareness, perceptions, and behaviors related to a specific issue [11]. In public health contexts, KAP data inform resource distribution and the design of interventions [11]. Evaluating COVID-19 KAP among undergraduates is vital ahead of resuming physical classes to mitigate transmission within university settings. Therefore, this research sought to examine COVID-19-related KAP in undergraduates during emergency remote learning.

Materials and Methods

Research design and participants

In October 2021, a cross-sectional survey was performed using a snowball sampling strategy. An anonymous, self-completed questionnaire was developed on Google Forms, and its link was shared through channels like Microsoft Teams, Facebook, Instagram, and WhatsApp. The required minimum sample size of 264 was derived from the Cochran equation, assuming a 22% prevalence rate [12], 5% margin of error, and 95% confidence level. After screening, 299 Malaysian students enrolled in bachelor's degree programs were included, while those in foundation, diploma, or postgraduate courses were excluded. To avoid multiple entries from the same individual, participants had to sign in with their email addresses. No identifying details were gathered to maintain confidentiality. The study received approval from the Universiti Tunku Abdul Rahman Scientific and Ethical Review Committee (protocol: U/SERC/181/2021).

Questionnaire development

The survey, delivered in English, included three core parts: consent form, demographic profile, and items evaluating COVID-19 knowledge, attitudes, and practices (KAP). The initial page explained the research purpose, context, inclusion requirements, guarantees of privacy and anonymity, and confirmed that involvement was entirely optional. Participants indicated consent by choosing "agree" to continue. Demographic data covered gender, ethnic background, academic year, discipline, and any previous COVID-19 diagnosis. The KAP components were modified from a tool previously used by Ferdous *et al*. [13]. Knowledge was measured with 6 dichotomous items (yes/no/don't know); accurate responses earned 1 point, while wrong or unsure answers scored 0, giving a possible range of 0–6. Attitudes were assessed via 6 statements on a 3-point Likert scale (agree/undecided/disagree), scored as 2/1/0 respectively, for a maximum of 12 points. Practices were evaluated with 7 items (yes/sometimes/no); appropriate behaviors received 1 point and inappropriate ones 0, producing scores from 0 to 7.

Data processing and analysis

Analyses were performed with Microsoft Excel 2016 (Microsoft Corp., Redmond, WA, USA) and IBM SPSS version 26 (IBM SPSS Statistics, Inc., Chicago, IL, USA). Raw responses were cleaned and encoded in Excel before transfer to SPSS. Distribution of continuous variables was evaluated; those with skewness between −2 and +2 were treated as normally distributed [14]. Categorical data were expressed as counts and proportions; continuous outcomes as means ± standard deviations (SD). Group comparisons of KAP scores across demographic categories employed independent t-tests or one-way ANOVA, with Tukey post-hoc tests when needed. Since certain demographic characteristics can act as confounders [15], partial correlation coefficients—adjusted for variables showing significance in initial bivariate tests—were calculated to explore interrelationships among knowledge, attitude, and practice scores. A p-value below 0.05 was considered statistically significant.

Results and Discussion

Demographic details of the study sample are displayed in **Table 1**. Among the 299 participants, 44.8% were male and 55.5% female. Most identified as Chinese (61.5%), were in their third year of study (38.8%), majored in

science-related fields (51.8%), and reported no previous COVID-19 infection (82.9%).

Table 1. Profile of the study participants

Variable	Frequency (%)
Gender	
Male	134 (44.8)
Female	165 (55.2)
Ethnic group	
Chinese	184 (61.5)
Malay	52 (17.4)
Indian	54 (18.1)
Others	9 (3.0)
Academic discipline	
Science-related	155 (51.8)
Non-science	144 (48.2)
Academic year	
First year	77 (25.8)
Second year	68 (22.7)
Third year	116 (38.8)
Fourth year	38 (12.7)
Prior COVID-19 infection	
Yes	51 (17.1)
No	248 (82.9)

Levels of knowledge, attitudes, and practices regarding COVID-19

The participants' responses to the knowledge, attitude, and practice items are outlined in **Table 2**. Over 60% of the study participants acknowledged that COVID-19 is a serious illness, is exclusive to humans, and can spread between humans and animals in both directions. In addition, 58.2% indicated a belief that the virus could be transmitted through animal-derived products, while 54.8% held the view that transmission was possible via thoroughly cooked items.

Table 2. Responses to COVID-19 knowledge, attitude, and practice items

Item	Response	n (%)
Knowledge items		
K1: Is COVID-19 considered a serious illness?	Yes	278 (92.9)
	Don't know	13 (4.3)
	No	8 (2.6)
K2: Does COVID-19 infect only people?	Yes	201 (67.2)
	Don't know	29 (9.7)
	No	69 (23.1)
K3: Can COVID-19 spread from people to animals?	Yes	190 (63.5)
	Don't know	63 (21.1)
	No	46 (15.4)
K4: Can COVID-19 spread from animals to people?	Yes	205 (68.6)
	Don't know	54 (18.1)
	No	40 (13.4)
K5: Can the virus be transmitted through animal-derived foods (e.g., milk, meat)?	Yes	174 (58.2)
	Don't know	64 (21.4)
	No	61 (20.4)
K6: Can COVID-19 be transmitted through thoroughly cooked food?	Yes	164 (54.8)
	Don't know	44 (14.8)

	No	91 (30.4)
Attitude items		
A1: Is it essential to notify health authorities about suspected cases?	Agree Undecided Disagree	281 (94.0) 13 (4.3) 5 (1.7)
A2: Is wearing a face mask in crowded areas important?	Agree Undecided Disagree	275 (92.0) 21 (7.0) 3 (1.0)
A3: Is it important to wash hands and face after being outdoors?	Agree Undecided Disagree	275 (92.0) 23 (7.7) 1 (0.3)
A4: Do you believe COVID-19 can be prevented?	Agree Undecided Disagree	247 (82.6) 43 (14.4) 9 (3.0)
A5: Do you believe COVID-19 can be managed at home?	Agree Undecided Disagree	222 (74.2) 61 (20.4) 16 (5.4)
A6: Do you think health education plays a key role in preventing COVID-19?	Agree Undecided Disagree	272 (91.0) 27 (9.0) 0 (0)
Practice items		
P1: Do you cover your mouth with a tissue or handkerchief when coughing or sneezing?	Yes Sometimes No	217 (72.6) 60 (20.1) 22 (7.4)
P2: Do you regularly wash your hands with soap and water?	Yes Sometimes No	236 (78.9) 42 (14.0) 21 (7.0)
P3: Do you refrain from touching your face and eyes?	Yes Sometimes No	208 (69.6) 66 (22.1) 25 (8.4)
P4: Do you practice physical distancing (or stay in home quarantine)?	Yes Sometimes No	236 (78.9) 46 (15.4) 17 (5.7)
P5: Do you consume nutritious food during the COVID-19 period?	Yes Sometimes No	198 (66.2) 71 (23.7) 30 (10.0)
P6: Do you follow a healthy lifestyle during the COVID-19 period?	Yes Sometimes No	192 (64.2) 81 (27.1) 26 (8.7)
P7: Do you follow all government regulations regarding COVID-19?	Yes Sometimes No	228 (76.3) 51 (17.1) 20 (6.7)

Participant demographics

In terms of attitudes, over 90% of participants indicated that suspected cases of COVID-19 ought to be notified to public health officials, that face masks should be used in crowded settings, that hands and face need to be cleaned after returning from outdoors, and that health education could help lower the number of COVID-19 infections. Additionally, 82.6% of participants considered COVID-19 a disease that can be prevented, while 74.2% felt it could be managed with home treatment.

With respect to practices, the majority of participants reported covering their mouth and nose with a tissue or handkerchief when coughing or sneezing (72.6%), regularly washing hands with soap and water (78.9%), refraining from touching their face or eyes (69.6%), observing physical distancing or staying at home during quarantine periods (78.9%), consuming nutritious foods

(66.2%), adopting a healthy daily routine (64.2%), and adhering to official government guidelines related to COVID-19 (76.3%).

Differences in knowledge, attitude, and practice scores across various groups

Table 3 presents variations in KAP scores based on sociodemographic factors. The mean scores were 4.05 ± 1.90 for knowledge, 11.14 ± 1.29 for practice, and 5.07 ± 2.27 for attitude. Participants majoring in science showed significantly higher attitude scores ($p < 0.05$) compared to those in non-science fields. First-year students had significantly higher overall KAP scores ($p < 0.05$) than fourth-year students. No notable differences in KAP scores were observed between second- and third-year students. In contrast, fourth-year students displayed significantly lower attitude and practice scores ($p < 0.05$) relative to second- and third-year students. Variables including gender, ethnicity, and personal history of COVID-19 showed no significant impact on KAP scores.

Table 3. Bivariate analysis of factors linked to knowledge, attitudes, and practices regarding COVID-19

Parameter	Knowledge score		Attitude score		Practice score	
	Mean (SD)	t/F (p-value)	Mean (SD)	t/F (p-value)	Mean (SD)	t/F (p-value)
Sex						
Male	4.17 ± 1.95	−0.970 (0.333)	11.15 ± 1.27	−0.065 (0.948)	4.97 ± 2.33	0.663 (0.508)
Female	3.96 ± 1.85		11.14 ± 1.32		5.15 ± 2.22	
Ethnicity†						
Chinese	3.93 ± 1.86[a]	1.619 (0.185)	11.23 ± 1.06[a]	1.130 (0.337)	5.17 ± 2.16[a]	0.450 (0.717)
Malay	4.54 ± 1.89[a]		11.13 ± 1.66[a]		4.94 ± 2.48[a]	
Indian	4.09 ± 1.95[a]		10.91 ± 1.56[a]		4.94 ± 2.41[a]	
Other	3.56 ± 2.24[a]		10.78 ± 1.64[a]		4.44 ± 2.60[a]	
Field of study						
Science	4.13 ± 1.89	0.652 (0.515)	11.36 ± 1.04	3.006 (0.003)	4.89 ± 2.38	−1.397 (0.163)
Non-science	3.98 ± 1.90		10.91 ± 1.50		5.26 ± 2.14	
Year of study†						
Year 1	4.71 ± 1.85[a]	4.726 (0.003)	11.74 ± 0.59[a]	11.889 (0.000)	5.64 ± 2.22[a]	3.552 (0.015)
Year 2	3.72 ± 2.16[b]		11.16 ± 1.32[b]		4.75 ± 2.37[a]	
Year 3	3.95 ± 1.70[b]		11.00 ± 1.37[b]		5.12 ± 2.22[a]	
Year 4	3.63 ± 1.79[b]		10.34 ± 1.55[c]		4.32 ± 2.15[b]	
COVID-19 history						
Yes	4.45 ± 1.77	−1.647 (0.101)	10.98 ± 1.36	0.986 (0.325)	5.20 ± 2.25	−0.446 (0.656)
No	3.97 ± 1.92		11.18 ± 1.28		5.04 ± 2.28	

† Values in the same column bearing different superscript letters differ significantly from one another at $p < 0.05$, according to Tukey's post-hoc test.

Associations among knowledge, attitude, and practice scores

Table 4 presents the zero-order and partial correlation coefficients for the KAP domains. Correlation strength was classified according to established guidelines: >0.90 as very strong, 0.70–0.89 as strong, 0.40–0.69 as moderate, and <0.39 as weak [16]. In the partial correlation analyses, sociodemographic factors identified as significant in the bivariate tests **(Table 3)** served as covariates.

After adjusting for field of study and year of study, the total knowledge score showed weak positive associations with both the attitude score ($r = 0.193$, $p = 0.001$) and the practice score ($r = 0.343$, $p < 0.001$). Similarly, the overall attitude score displayed a weak positive relationship with the overall practice score ($r = 0.149$, p

= 0.010) when controlling for the same covariates: field of study and year of study.

Table 4. Bivariate and adjusted correlations among knowledge, attitude, and practice scores

Variables	Zero-order correlation		Partial correlation ††	
	Coefficient (r)	p value	Coefficient (r)	p value
Knowledge–Attitude	0.208	<0.001	0.193	0.001
Knowledge–Practice	0.353	<0.001	0.343	<0.001
Attitude–Practice	0.159	0.006	0.149	0.010

†† Adjusted for field of study (coded as 0 = Science, 1 = Nonscience) and year of study (coded as 0 = Years 1–2, 1 = Years 3–4).

Universities across Malaysia initially shut down when the Movement Control Order was enforced in March 2020 to address the COVID-19 pandemic. Subsequently, multiple campus closures and mobility limitations were imposed to curb increasing infection rates. The understanding, perspectives, and behaviors of university students play a critical role in limiting and managing the transmission of the virus within academic settings.

The overall percentage scores for the knowledge, attitude, and practice sections were 67.5%, 92.8%, and 72.4%, respectively. The knowledge and practice scores in this research were below those reported by Peng *et al*. [12], who recorded 82% for knowledge and 89% for attitude among Chinese undergraduates, and by Saefi *et al*. [17], who noted 74% knowledge and 87% attitude among Indonesian undergraduates. In contrast, the attitude score in the current research exceeded those from the Chinese (85%) and Indonesian (91%) samples [12, 17]. Applying Bloom's cut-off point criteria (Good: 80–100%, Moderate: 60–79%, Poor: 0–59%) [18], participants here exhibited strong attitudes alongside moderate levels of knowledge and practice regarding COVID-19. Given that adherence to preventive actions against COVID-19 is heavily shaped by individual knowledge [19], it is essential for government bodies, health organizations, and university administrations to develop a uniform national educational initiative on COVID-19 targeted at students prior to fully resuming in-person classes.

Earlier research indicated that COVID-19-related KAP levels varied by gender and ethnic background [17, 20]. Yet, no such differences emerged in this investigation. This outcome may stem from Malaysia experiencing one of the peak daily case numbers in Southeast Asia during May 2021 [21]. The rapid escalation in infections likely motivated undergraduates, regardless of gender or ethnicity, to actively pursue disease-related details from various outlets. Among these, social media emerged as the primary source [22, 23]. For younger individuals, social media serve as vital platforms for generating, sharing, and accessing information. University students represent a key segment of this youth demographic [24]. The participants in this study were aged between 18 and 25 years **(Table 1).** Relative to older groups, individuals aged 16–24 typically devote around 3 hours daily to social media [25]. It should be highlighted, however, that content shared on these platforms is not always accurate, as user-generated posts can be opinion-based and include false narratives or unfounded claims [26]. Health organizations at national and global levels, including the Ministry of Health Malaysia, WHO, and CDC, have leveraged their verified social media profiles to distribute reliable COVID-19 updates. This approach could effectively encourage positive behavioral shifts to strengthen preventive habits among students. Nevertheless, studies show that only a limited portion of university students rely on these authoritative social media channels for COVID-19 information [27]. This factor could contribute to the moderate knowledge and practice scores observed among the participants.

Notably, this research revealed that year 4 students had markedly lower KAP scores ($p < 0.05$) compared to year 1 students. In contrast, a study on medical students identified an influence of academic year on KAP but with an opposite pattern, where year 4 scores surpassed those of year 1 [28]. This difference likely arises from variations in participants' academic disciplines. Medical students typically enter clinical rotations in year 4, building expertise on various illnesses through earlier theoretical phases. As a result, they demonstrate greater familiarity with COVID-19 prevention strategies [29]. Moreover, numerous medical students participated directly in patient care during the outbreak [30]. Thus, elevated KAP among senior medical students compared to juniors is expected. In the present investigation involving non-medical students, the reduced scores in year 4 may relate to the substantial demands of their capstone projects. These projects involve extended

efforts in gathering data, analyzing results, reviewing literature, and preparing theses [31]. Consequently, this could lead to the lowest COVID-19 KAP levels among year 4 respondents relative to years 1–3. These findings imply that targeted COVID-19 sessions, such as workshops or seminars, for final-year students would be beneficial, especially since prior work has shown KAP improvements following relevant training [32].

Aligning with Hatabu *et al*. [24], students in science-related fields displayed significantly higher attitude scores ($p < 0.05$) toward COVID-19 than those in non-science fields. No significant variations were observed in knowledge or practice across majors. This could be linked to the extended periods spent online accessing COVID-19 materials while learning remotely from home or dormitories [33], thereby indirectly boosting knowledge levels.

The study further identified positive associations among knowledge-attitude, knowledge-practice, and attitude-practice domains, in line with existing evidence [17, 29]. Numerous investigations underscore the value of KAP in communities for slowing infection transmission during outbreaks [24, 34]. This stems from how an individual's outlook on a disease ties to their understanding of it, which in turn affects their adoption of mitigation behaviors. That said, knowledge by itself does not fully explain attitudes or practices concerning COVID-19, as elements like emotions and perceived risks also shape actions and precautions [35]. This accounts for the relatively weak correlations ($r < 0.39$) between KAP components in this work.

This research may represent the initial evaluation of COVID-19 KAP among Malaysian university students during online emergency education. The derived insights can guide educational institutions and decision-makers in crafting targeted approaches to improve virtual learners' KAP on COVID-19 ahead of transitioning back to on-campus instruction. However, reliance on convenience sampling limits the generalizability of results to the broader student population.

Conclusion

T During the COVID-19 pandemic, university education shifted to online formats. Evaluating undergraduates' knowledge, attitudes, and practices toward COVID-19 is crucial before returning to traditional classroom settings. The present research found overall scores of 67.5% for knowledge, 92.8% for attitude, and 72.4% for practice related to COVID-19. These results reflect strong attitudes but only moderate knowledge and practice among the participants. Targeted efforts to elevate knowledge and practice concerning COVID-19 in this group are strongly recommended.

Acknowledgments: None

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

References

1. Sondakh JJS, Warastuti W, Susatia B, Wildan M, Sunindya BR, Budiyanto MAK, Fauzi A. Indonesia medical students' knowledge, attitudes, and practices toward COVID-19. Heliyon. 2022;8: e08686.
2. World Health Organization (WHO). (2020). Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations. https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations. Accessed 15 April 2022.
3. Tan ST, Tan CX, Tan SS. Food security during the COVID-19 home confinement: A cross-sectional study focusing on adults in Malaysia. Human Nutr Metab. 2022;27:200142.
4. Tan CX, Goh SD, Tan SS, Tan ST. Eating behavior among remote working adults during the COVID-19 pandemic. Nutr Food Sci. 2022. https://doi.org/10.1108/NFS-11-2021-0331.
5. Pung CYY, Tan ST, Tan SS, Tan CX. Eating behaviors among online learning undergraduates during the covid-19 pandemic. Int J Environ Res Public Health. 2021;18(23):12820.
6. Zamora-Antuñano MA, Rodríguez-Reséndiz J, Cruz-Pérez MA, Rodríguez Reséndíz H, Paredes-García WJ, Díaz JAG. Teachers' perception in selecting virtual learning platforms: a case of mexican higher education during the COVID-19 crisis. Sustainability. 2021;14(195):1–19.
7. Rodriguez-Segura L, Zamora-Antuñano MA, Rodriguez-Resendiz J, Paredes-García WJ,

Altamirano-Corro JA, Cruz-Pérez MÁ. Teaching challenges in COVID-19 scenery: teams platform-based student satisfaction approach. Sustainability. 2020;12:1–29.

8. Noorshahrizam SA. New Covid-19 SOP starting today: Things you need to know. Malaymail. 2022. https://www.malaymail.com/news/malaysia/2022/05/01/new-covid-19-sop-things-you-need-to-know/2056570.
9. World Health Organization (WHO). Coronavirus disease (COVID-19): Vaccines. 2022. https://www.who.int/news-room/questions-and-answers/item/coronavirus-disease-(covid-19)-vaccines. Accessed 6 May 2022.
10. Berihun G, Walle Z, Teshome D, Berhanu L, Abebe M, Ademas A, Adane M. Knowledge, attitude, and preventive practices towards COVID-19 among students of Ethiopian higher education institutions. J Multidiscip Healthc. 2021;14:2123–36.
11. Andrade C, Menon V, Ameen S, Kumar Praharaj S. Designing and conducting knowledge, attitude, and practice surveys in psychiatry: practical guidance. Indian J Psychol Med. 2020;42(5):478–81.
12. Peng Y, Pei C, Zheng Y, Wang J, Zhang K, Zheng Z, Zhu P. A cross-sectional survey of knowledge, attitude and practice associated with COVID-19 among undergraduate students in China. BMC Public Health. 2020;20(1):1–8.
13. Ferdous MZ, Islam MS, Sikder MT, Mosaddek ASM, Zegarra-Valdivia JA, Gozal D. Knowledge, attitude, and practice regarding COVID-19 outbreak in Bangladesh: an onlinebased cross-sectional study. PLoS ONE. 2020;15:1–17.
14. George D, Mallery P. IBM SPSS statistics 26 step by step: a simple guide and reference. 16th ed. Cambridge: Routledge; 2019.
15. Kawasaki Y, Tamaura Y, Akamatsu R, Sakai M, Fujiwara K. Factors associated with the practice of nursing staff sharing information about patients' nutritional status with their colleagues in hospitals. Eur J Clin Nutr. 2018;72(1):112–6.
16. Schober P, Boer C, Schwarte LA. Correlation coefficients: appropriate use and interpretation. Anesth Analg. 2018;126(5):1763–8.
17. Saefi M, Fauzi A, Kristiana E, Adi WC, Muchson M, Setiawan ME, Ramadhani M. Survey data of COVID-19-related knowledge, attitude, and practices among indonesian undergraduate students. Data Brief. 2020;31: 105855.
18. Feleke BT, Wale MZ, Yirsaw MT. Knowledge, attitude and preventive practice towards COVID-19 and associated factors among outpatient service visitors at Debre Markos compressive specialized hospital, north-west Ethiopia, 2020. PLoS ONE. 2021;16(7): e0251708.
19. Hossain MB, Alam MZ, Islam MS, Sultan S, Faysal MM, Rima S, Monia HT. Do knowledge and attitudes matter for preventive behavioral practices toward the COVID-19? A cross-sectional online survey among the adult population in Bangladesh. Heliyon. 2020;6(12): e05799.
20. Alobuia WM, Dalva-Baird NP, Forrester JD, Bendavid E, Bhattacharya J, Kebebew E. Racial disparities in knowledge, attitudes and practices related to COVID-19 in the USA. J Public Health. 2020;42(3):470–8.
21. Lum R. Covid-19: Malaysia hit by record cases despite prolonged lockdown. BMJ. 2021. https://doi.org/10.1136/bmj.n2155.
22. Salman M, Mustafa ZU, Asif N, Zaidi HA, Hussain K, Shehzadi N, Saleem Z. Knowledge, attitude and preventive practices related to COVID-19: a cross-sectional study in two Pakistani university populations. Drugs Ther Perspect. 2020;36(7):319–25.
23. Aynalem YA, Akalu TY, Gebregiorgis BG, Sharew NT, Assefa HK, Shiferaw WS. Assessment of undergraduate student knowledge, attitude, and practices towards COVID-19 in Debre Berhan University, Ethiopia. PLoS ONE. 2021;16:1–13.
24. Hatabu A, Mao X, Zhou Y, Kawashita N, Wen Z, Ueda M, Tian YS. Knowledge, attitudes, and practices toward COVID-19 among university students in Japan and associated factors: an online cross-sectional survey. PLoS ONE. 2021;15(12): e0244350.
25. Georgiev D. How much time do people spend on social media? 2022. https://review42.com/resources/how-much-time-do-people-spend-on-social-media/. Accessed 18 Apr 2022.
26. Tsao SF, Chen H, Tisseverasinghe T, Yang Y, Li L, Butt ZA. What social media told us in the time of COVID-19: a scoping review. Lancet Digit Health. 2021;3(3):e175–94.

27. Hasan H, Raigangar V, Osaili T, Neinavaei NE, Olaimat AN, Aolymat I. A cross-sectional study on university students' knowledge, attitudes, and practices toward COVID-19 in the United Arab Emirates. Am J Trop Med Hyg. 2021;104(1):75–84.
28. 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(2):4179–86.
29. Adli I, Widyahening IS, Lazarus G, Phowira J, Baihaqi LA, Ariffandi B, Findyartini A. Knowledge, attitude, and practice related to the COVID-19 pandemic among undergraduate medical students in Indonesia: A nationwide cross-sectional study. PLoS ONE. 2022;17:1–16.
30. Jha N, Singh N, Bajracharya O, Manandhar T, Manandhar T, Devkota P, Shankar PR. Knowledge about the COVID-19 pandemic among undergraduate medical and dental students in Lalitpur, Nepal. Med Pharm Rep. 2021. https://doi.org/10.15386/mpr-1928.
31. Harrison ME, Whalley WB. Undertaking a dissertation from start to finish: the process and product. J Geogr High Educ. 2008;32(3):401–18.
32. Zhang J, Yin Y, Dean J, Zhang X, Zhang Y, Wang J, Zhang Y. Knowledge, attitude, and practice survey of COVID-19 among healthcare students during the COVID-19 outbreak in China: an online cross-sectional survey. Front Public Health. 2021;9:1–9.
33. Gallè F, Sabella EA, Da Molin G, De Giglio O, Caggiano G, Di Onofrio V, Napoli C. Understanding knowledge and behaviors related to covid−19 epidemic in italian undergraduate students: the EPICO study. Int J Environ Res Public Health. 2020;17(10):1–11.
34. Okoro J, Ekeroku A, Nweze B, Odionye T, Nkire J, Onuoha M, Owoh J. Attitude and preventive practices towards COVID-19 disease and the impact of awareness training on knowledge of the disease among correctional officers. Emerald Open Res. 2022;2:51.
35. Ning L, Niu J, Bi X, Yang C, Liu Z, Wu Q, Gao L. The impacts of knowledge, risk perception, emotion and information on citizens' protective behaviors during the outbreak of COVID-19: a cross-sectional study in China. BMC Public Health. 2020;20(1):1–12.