

ORIGINAL ARTICLE

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Submitted Date: 08-05-2023

Accepted Date: 16-02-2024

Please cite this article as: Saw J, Omar SA, Ismail Z, Nik Mat A, Chen XW. A cross-sectional study evaluating the association between peri-traumatic distress and post-traumatic stress disorder among future healthcare professionals during COVID-19 pandemic. *Education in Medicine Journal*. 2024 (early view).

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ARTICLE

ARTICLE INFO

Submitted: 08-05-2023
Accepted: 16-02-2024

A Cross-Sectional Study Evaluating the Association Between Peri-Traumatic Distress and Post-Traumatic Stress Disorder Among Future Healthcare Professionals During COVID-19 Pandemic

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ABSTRACT

This study aims to examine the prevalence of peritraumatic distress that is linked to the COVID-19 pandemic and its association with post-traumatic stress disorder (PTSD) among undergraduate medical and dental students during the COVID-19 pandemic in Malaysia. A cross-sectional study recruiting 401 undergraduate medical and dental students was conducted at a public university in Malaysia. Accordingly, an online questionnaire was distributed to the participants in September and October 2020, four months after the national COVID-19-related lockdown was relaxed. The primary variable in the analysis was COVID-19 peritraumatic distress, which was measured by the COVID-19 Peritraumatic Distress Index (CPDI), and the outcome variable was the PTSD screened by the Impact of Event Scale-Revised. Models with eight control variables were developed using linear regression analysis. A total of 401 students participated in the survey, with the mean (standard deviation) age recorded at 21.9 (1.55) years. The prevalence of CPDI was 31.9% (95% CI 27.4, 36.5). Simple linear regression showed that when unadjusted, the CPDI, year of study, income level, presence of financial difficulty, and gadget accessibility had a significant association with PTSD at p-value <0.25. It was revealed that the CPDI was consistently associated with PTSD, with the estimated adjusted coefficient regression of 0.37 (95% CI 0.32, 0.42), p<0.001, when other variables (year of study, income level, presence of financial difficulty, and gadget accessibility) were controlled. Significantly, identification of vulnerable students is vital to prevent further impact of psychological distress. Therefore, universities need to have revised and current academic guidelines or policies to minimize the distress that students could face in the event of a future pandemic.

Keywords: COVID-19, psychological distress, post-traumatic stress disorder, medical education, curriculum

CORRESPONDING

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INTRODUCTION

The coronavirus (COVID-19) has spread vastly and rapidly following the first outbreak in China in 2019. The spread of COVID-19 has caused strict movement restrictions as a control measure worldwide. This pandemic has impacted worldwide lockdowns, including Malaysia (1, 2). People are required to stay home and work from home (3) while students attend classes online, as all educational institutions are closed (4). The impact and risks of prolonged isolation and quarantine have undeniably brought adverse consequences to mental health and psychosocial well-being (5-7). This was especially shown in previous studies whereby individual mental health was attributed to disease outbreaks, higher psychological stress, and mental distress among the university students in Guangzhou during the influenza H1N1 (8), and medical students in Saudi Arabia during the Middle East Respiratory Syndrome Corona Virus (MERS-CoV) outbreak (9).

As much as the pandemic has affected all social strata or societal hierarchies and groups of people, students, especially university students, were greatly affected. University students faced abrupt changes in their lives, i.e., COVID-19-related fears, physical and social isolation, learning structure, and social environment (10). To add to the challenges, especially for medical and dental students, conventional bedside clinical teaching and other clinical activities in natural settings were restricted, and Open and Distance Learning (ODL) was adopted (11). The sudden changes in the learning mode undeniably have caused stress and panic (12).

Despite the ongoing psychological distress, few studies have assessed the predictive role of the peritraumatic distress condition of university students during the confined period, which subsequently imposes a future risk for other psychological disorders, namely post-traumatic stress disorder (PTSD). According to Bunnell et al. (2018), peritraumatic distress is defined as a combination of physical, cognitive, and emotional reactions that occur during a traumatic event (e.g., fear of dying, tachycardia, fear of losing control, COVID-19 pandemic) and immediately thereafter (13). With this, evidence showed that peritraumatic distress is one of the most potent predictors of PTSD symptoms (14, 15).

With regard to peritraumatic distress symptoms, the COVID-19 Peritraumatic Distress Index (CPDI) was widely used to assess the impact of the COVID-19 outbreak. Psychological distress was seen to be at its peak during the first phase of the pandemic. The top three countries out of thirteen that were studied that reported the highest prevalence of peritraumatic distress were Vietnam (94.5%), Egypt (64.1%), and Bangladesh (56.3%), while Nepal was the lowest (14.0%) (16). Accordingly, peritraumatic distress varied across the countries, where a prevalence of 61.1% was found among the Iranian, 53.8% among the Bangladeshi, and 34.4% among the Chinese participants who experienced mild or moderate and severe peritraumatic distress (17, 18).

University students have been one of the most vulnerable populations with respect to the negative effects of the pandemic. Therefore, early detection is vital in order to prevent the long-term impact of PTSD symptoms, especially among students considering other learning challenges that are faced by them. To corroborate this further, the prevalence of PTSD and distress symptoms was found to be high among university students in China (19).

However, there is limited information looking into the psychological distress of medical and dental undergraduate students. The impacts would have been different due to the exposure to healthcare services, curriculum structure as well as their deeper understanding about the COVID-19 virus compared to their other counterparts. Hence, this study aimed to examine (i) the prevalence of peritraumatic distress that is linked to the COVID-19 pandemic, and (ii) the association between COVID-19 peritraumatic psychological distress and PTSD among medical and dental students during the COVID-19 pandemic in Malaysia. Based on this study, it is believed a thorough understanding of the associated factors of PTSD will enable more evidence-based provision of future mental health support to the at-risk groups, especially when unforeseen future challenges occur. This will also aid in reviewing the existing educational curriculum by filling up the gaps and for the future preparedness of the stakeholders, universities, academicians, and students. Furthermore, this will also aid in reviewing and filling up the gaps in the educational curriculum as well as the future preparedness of the stakeholders (universities, academicians, and students) against sudden educational disruptions caused by unexpected public health emergencies.

MATERIALS AND METHODS

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Universiti Teknologi MARA, UiTM (REC/07/2020 (MR/167)). The authors received no specific funding for this work.

Study Design and Participants

A cross-sectional online survey was conducted at Universiti Teknologi MARA, a public university that recruits the largest number of students compared to other educational institutions in Malaysia. The study population comprises undergraduate students from the medical and dental faculties. The sample size was estimated based on both objectives, and the first objective yielded the largest number- where a single-proportion formula was used to determine the sample size. Taking the estimated prevalence of 26.6% of health professional students having psychological distress (20), the study requires a minimum sample size of 301 for estimating the expected proportion with 5% absolute precision and 95% confidence (21). A purposive sampling method was applied. The subject recruitment was terminated once the minimum number of 402 (with a 25% non-response rate) was reached.

Data Collection

The data collection was conducted over six weeks from early September to mid-October 2020, which was the fourth month after the uplift of seven weeks (18th March – 3rd May 2020) of national lockdown, which was also known as the Movement Control Order (MCO) 1.0 in Malaysia. Following this, the Ministry of Higher Education has urged for all academic activities to be conducted in a blend of asynchronous (without real-time interaction) and synchronous (real-time interaction) online learning until the end of 2020 (22). Asynchronous learning activities comprised recorded lectures, clinical skill procedures, and tutorial assignments uploaded to the student portal for students to access based on internet and gadget availability, while synchronous learning activities included case-based discussions, problem-based solving sessions in small groups, mentor-mentee counseling or meeting session which required lower network capacity, thus, ensuring broader accessibility of the learning activities to the students.

All full-time undergraduate medical and dental students from years 1 to 5 were invited to answer the questionnaire. The number of undergraduate students invited for this survey was 1125 medical students and 425 dental students. However, those who were under active treatment or were follow-ups for mental illness or who had not consented to participate in the research were excluded. The self-reported questionnaire link (in Google Form) was distributed to the batch leaders of each year through WhatsApp. The information details about the research and pre-requisite criteria that were stated on the first page of the form and an online consent must be filled out before proceeding to answer the questionnaire. During the data collection period, the batch leaders were reminded on

every alternate day to distribute the link to their respective batch until a total minimum sample size was reached.

The Google account that was used for data collection was the organizational account, and email addresses were not collected, hence, the breach of the subject's confidentiality was minimized. The setting of the Google form was limited to one response per user to prevent duplicated entries (16). All questions were in Malay (the Malaysian national language) and were set as mandatory questions to prevent missing responses. The data was anonymized.

Upon the completion of the questionnaire, the students would receive an auto-generated message of the overall result of the questionnaire as well as written feedback. A referral for further clinical assessment and evaluation was made for the students who were at risk of PTSD based on the questionnaire responses.

Measures

The questionnaire consisted of sociodemographic variables and measures to assess the peritraumatic psychological distress and stress reactions after a stressful event. Information on eight control or confounding variables was obtained: gender (male/female); course of study (medicine/dentistry); year of study (preclinical/clinical years); lower-household income level defined as the bottom 40% of Malaysians with a monthly household income below RM 4850 or B40 (yes/no) (22); presence of infected family members or close friends; presence of financial difficulty, internet accessibility (yes/no); and gadget accessibility (yes/no).

The primary variable is peritraumatic psychological distress (at the acute stress stage), measured by the COVID-19 Peritraumatic Distress Index (CPDI). It uses a Likert Scale to assess the frequency (never-0, occasionally-1, sometimes-2, often-3, and always-4) of anxiety, depression, specific phobias, cognitive change, avoidance, compulsive behavior, physical symptoms, and loss of social function. This validated CPDI consisted of 24 questions (16, 18) has a Cronbach's alpha reported at 0.95 and was used to determine the level of peritraumatic psychological distress during the initial phase of the COVID-19 pandemic (first two weeks of MCO 1.0) in Malaysia, i.e., 18th – 31st March 2020 (2). The total scores ranged from 0 to 100, which was further recorded into psychological distress (yes/no) or interpreted as normal or no distress (scores 0-28) and with psychological distress (29-100), where scores for mild psychological distress ranged from 29-52 and 53-100 had severe psychological distress (24).

The outcome variable of interest is psychological stress reactions after a stressful life event, i.e., MCO 1.0 attributed to the COVID-19 pandemic, which was assessed by the Impact of Event Scale-Revised (IES-R). A validated Malay version of IES-R consisting of three constructs (intrusive thoughts, avoidance behavior, and hyperarousal) with ten items was used as a screening tool for post-traumatic stress disorder (PTSD) (25). It has a good internal consistency reliability (RMSEA=0.079,

GFI=0.913, CFI=0.948, TLI=0.927, $\chi^2/df=1.697$), and the internal consistency reliability was reported to range from 0.605 and 0.845. The total scores ranged from 0 to 40. The higher the score, the more likely the presence of PTSD.

Statistical Analysis

Data management and analysis were conducted using the Statistical Package for the Social Sciences (SPSS) version 28.0. Descriptive analysis was performed to describe the characteristics of the study participants, where frequency (percentage, %) was presented for categorical data and mean standard deviation (SD) was presented for continuous variables. Subsequently, the inferential statistical analysis was carried out. Univariable (simple) and multivariable (multiple) linear regression analyses were conducted to estimate the crude and adjusted association of the primary variable (CPDI) and the outcome variable (PTSD). Variables were selected into the multiple linear regression model based on the level of statistical significance of p-value less than 0.25 and clinical importance (26). Purposeful manual variable selection was done using the enter method. The strength of the association between each factor and the CPDI was expressed as crude and adjusted regression coefficient (b), 95 percent confidence interval (95% CI), and corresponding p-values. The statistical test's level of significance was set at 0.05. Assumptions of the regression model were checked using the scatter plots of residuals against predicted values to assess the overall linearity, independence, normality, and homoscedasticity) for the residuals. Multicollinearity assessment was conducted by checking the tolerance and variance inflation factors. Influential diagnostic measures (dfBeta and Cook's distance) were used to identify influential observations.

RESULTS

Based on the invitations reaching 1,550 undergraduate students (1125 medical and 425 dental students), a minimum of 301 subjects were needed, and at the end of the study, a total of 401 (25.9% of 1550) students consented to take part in the present study and had completed every question in the form. The mean (SD) age was recorded at 21.9 (1.55) years. More females (317/401, 79.1%) participated in this survey than males (Table 1). Among them, around two-thirds (262/401) were medical students. Most of them (98.3%) were Malay, and all of them were single and Malaysians. Most participants (80.3%) undertook foundation programs that were offered by public universities (*Asasi*) before entering the university, and approximately one-third had a household income of less than RM 4,850 per month.

Table 1: Sociodemographic details of respondents (n=401)

Variables	Frequency (Percentage), n (%)
Gender	
Male	84 (20.9)
Female	317 (79.1)
Course enrolled	
Medical	262 (65.3)
Dentistry	139 (34.7)
Race	
Malays	394 (98.3)
Non-Malays	7 (1.7)
Education background	
Foundation	322 (80.3)
Matriculation	50 (12.5)
Diploma	27 (6.7)
Others	2 (0.5)
Household income per month	
B40 (<RM4850)	153 (38.2)
Non-B40 (>RM4850)	248 (61.8)

Descriptive analysis of CPDI found that the mean (SD) of total scores was recorded at 24.6 (12.01), one-third of the participants (31.9%; 95% CI 27.4, 36.5) had peritraumatic psychological distress during the acute stress stage, with 120 (29.9%) having mild distress and 8 (2.0%) having severe distress. Analysis from the IES-R revealed a mean (SD) of 7.3 (7.23) total scores, with a range of 0-34 that was obtained among the participants.

Simple linear regression analysis showed that out of eight variables, five variables were significantly associated with the risk of PTSD. These five variables (CPDI, year of study (preclinical/clinical), income level (b40/non-b40), presence of financial difficulty, and gadget accessibility) were then included in the multiple linear regression. Those having peritraumatic psychological distress (higher CPDI score) at baseline were more likely to have PTSD when other confounding variables were

adjusted (Table 1). The final model regression model is a good fit for the data, and CPDI scores explain a significant variance in PTSD ($R^2 = 0.45$, $F_{(3, 397)} = 111.327$, $p < 0.001$).

Model assumptions were fulfilled. There was no multicollinearity, and there were no interactions among independent variables. Diagnostic measures showed no influential observations had been identified. Results from multiple linear regression analysis have shown that there is a significant linear positive relationship between CPDI and PTSD scores. Those who have one CPDI score higher had 0.37 units higher in PTSD score (adjusted $b = 0.37$, 95% CI 0.32, 0.42, $P < 0.001$), after adjusting for the year of study effect.

Table 2: Linear regression analysis showing the estimated crude and adjusted regression coefficient (b), 95% confidence interval (CI), and corresponding p-values (n=401)

Variables	Simple linear regression		Multiple linear regression	
	b* (95% CI)	p-value	b† (95% CI)	p-value‡
CPDI	0.39 (0.34, 0.43)	<0.001	0.37 (0.32, 0.42)	<0.001
Gender (Female)	-0.28 (-0.31, .075)	0.754		
Course of study (Dentistry)	-0.38 (-1.87, 1.11)	0.616		
Year of study (Clinical)	-4.49 (-5.86, -3.12)	<0.001	-2.82 (-3.92, -1.73)	<0.001
Income level (non-B40)	1.24 (-0.21, 2.70)	0.094	-0.04 (-1.20, 1.11)	0.944
Infected members (Yes)	1.41 (-1.94, 4.75)	0.408		
Financial difficulty (Yes)	2.55 (0.90, 4.19)	0.003	0.57 (-0.75, 1.89)	0.395
Internet accessibility (Yes)	-0.27 (-3.26, 2.73)	0.862		
Gadget accessibility (Yes)	1.79 (0.02, 3.56)	0.047	-0.66 (-2.05, 0.73)	0.351

* Crude regression coefficient

† Adjusted regression coefficient

‡ Level of significance set at $p = 0.05$.

Constant of multiple linear regression final model = -0.048

Enter multiple linear regression method applied.

Model assumptions fulfilled.

No multicollinearity was detected.

There were no interactions among independent variables.

Coefficient of determination, $R^2 = 0.45$

Adjusted $R^2 = 0.443$

Final model equation: $PTSDScore = -0.048 + (0.37 * CPDIscore) - (2.82 * clinicalyears)$

DISCUSSION

The present study revealed one-third of the undergraduate medical and dental students had COVID-19 peritraumatic psychological distress. Besides that, this study has also demonstrated that peritraumatic psychological distress consistently has a significant association with PTSD, with and without the adjustment of other variables. The result of this study suggests that the impact of distress during the acute stage of the COVID-19 pandemic could predict the likelihood of undergraduate students developing subsequent PTSD, which helps in identifying populations that require further interventions and frequent monitoring when the pandemic subsides.

The prevalence of PTSD in this study was found to be 31.9%, and this indicates about one-third of the medical and dental students experienced psychological distress during the acute stage of the COVID-19 pandemic. This is similar to Malaysia's general population (35.9%) (16) and is slightly higher than another study with a similar population (Malaysia medical undergraduates) whereby about 26.7% of their participants have exhibited distress symptoms during the lockdown (24). The higher PTSD prevalence in the current study could be explained by the MCO implementation in Malaysia (24), which caused a significant impact on the students' physical, emotional, and mental health (27). A study conducted in France demonstrated similar findings wherein 35.5% of the participants reported significant distress symptoms during the early stage of the pandemic (28). Other studies reported a higher prevalence of distress symptoms, with 43.3 % depression and 45.4 % anxiety (29). This disagreement could be attributed to a different measure that was used to assess the distress symptoms.

Conversely, another study assessing students in six universities in China reported that only 2.7% and 9% of participants demonstrated symptoms of PTSD and distress, respectively (19). However, the low prevalence rate in the latter study could be explained by other factors, such as the survey period. Their study was conducted in February 2020, which can be considered an early period of the COVID-19 pandemic. As it is still at the beginning of the pandemic, the participants might not feel the effects to be severe. A systematic review of the impact of COVID-19 on mental health revealed a heterogeneous result on this matter (27). From this study, it is understood that the young age group and students were found to be most affected by the pandemic (29, 30). Consequently, this event was so traumatic for them that it had caused poor mental health.

Similar to the other prior public health emergencies (31), this global COVID-19 pandemic has brought unbearable psychological distress to people all over the world. The present study revealed that students who scored high on the CPDI scale were at higher risk of having PTSD than those with lower scores. The result from this study was consistent with the previous study, where it was noted that

CPI scores served as the strongest predictor of PTSD (32). Furthermore, it was also found that the peritraumatic distress scale was a good measure in assessing mental health conditions during the COVID-19 pandemic (33). As a continuation from the findings, clinical attention should be placed on the individuals with acute and persistent peritraumatic reactivity due to the COVID-19 pandemic as it was also found to be a strong predictor in the increase of poor mental health circumstances, which occurred 90 – 120 days later (28).

Confounding variables that were included in modeling the association between CPDI and PTSD were in concordance with previous reports, where students who were suffering from financial difficulty were at risk of having PTSD (34, 35). It is understood that during the lockdown period, loss of income was commonly reported across the globe, including in Malaysia. This might affect the students' ability to study effectively as they might have to help their families financially, have difficulty subscribing for better internet access, which eventually are additional burdens on them (24). Preclinical year students had a higher risk of experiencing peritraumatic distress symptoms than their clinical year seniors, as they had to adapt to new changes in online curricular delivery while familiarizing themselves with the medical program (24). When these confounders were controlled in the multivariable analysis, the association between peritraumatic distress and PTSD remained. A previous study has shown that constant worries, fears, and unresolved trauma could impact their future profession as a healthcare professional (36). Untreated PTSD can have a negative effect on their work efficiency (37). Therefore, early detection of PTSD symptoms is strongly recommended for future healthcare professionals to perform optimally.

Ostensibly, this is the first study that investigated the association between COVID-19 peritraumatic psychological distress and PTSD among medical and dental students during the COVID-19 pandemic in Malaysia. A primary limitation of this sample recruitment and online data collection is the nature of voluntary participation and the non-probability (random) sampling method (38), however, efforts were made to ensure that the target population has been reached. The demographic characteristics of the samples were similar to that of the target (predominantly females, Malays, and from foundation programs), hence, it is believed that the bias has been minimized and the present results could be generalized. Nevertheless, the single institution that is involved as a study site holds the 'Bumiputera only' policy for student recruitment in Malaysia. Being the largest institution of higher education in Malaysia as measured by the physical infrastructure, staffing resources, and student enrollment from the different states of Malaysia, results of this study could be generalized to the Bumiputera population but did not represent the entire population of the tertiary medical and dentistry education in Malaysia as a whole.

Another limitation of cross-sectional study involves the issue of temporal relationship and causality effect (39). Future investigations are necessary to validate the kinds of conclusions that can be drawn from this study. To address this research limitation, when a distressing event or major

disaster occurs, researchers are encouraged to conduct a prospective cohort study by undertaking a peritraumatic distress assessment at the baseline during the acute stage and follow the subjects to determine the PTSD outcome. The questionnaire served as a screening tool for peritraumatic distress, as such, immediate referrals or subsequent diagnostic evaluations are essential.

Bearing other confounding factors and variances, assessing COVID-19 peritraumatic distress may have predictive practicality in identifying higher-risk students. Thus, with these findings, early screening and intervention programs that are aimed at reducing and understanding mental health can be made. Rikard-Bell and Woolley (2018) successfully incorporated psychological medicine knowledge into the medical school curriculum by coordinating formal instruction with assessment and evaluating the subject's applicability; this proved to be advantageous for the students and better equipped them to engage with patients in the future (40) as well as strengthened the need to include the psychological and well-being components as integral parts of the Malaysian medical curriculum. Moreover, mitigating the risk factors and emphasizing resiliency among the students will be beneficial for their future preparedness as time elapses after the pandemic (28). Critical stress-management or coping skills shall be prioritized and are regarded as equally important as the core academic skills throughout the professional development of medical and dental students as future clinicians.

CONCLUSION

This study verifies the significant association between COVID-19 peritraumatic psychological distress and PTSD among undergraduate medical and dental students in Malaysia. From this study it is proposed that future curriculum reviews should consider screening these populations (i.e., the future clinical professionals dealing with life-threatening matters of the community) when a major disaster or life event occurs in the future.

ACKNOWLEDGEMENTS

Sincere gratitude expressed to the deaneries of the Faculty of Medicine and Dentistry, Universiti Teknologi MARA, for approving the conduct of this research among undergraduate students. We also thank the Group 6, Year 4 medical student (Academic Year 2019/2020) for assisting with data collection.

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Universiti Teknologi MARA, UiTM (REC/07/2020 (MR/167)).

REFERENCES

1. Cotula L. Towards a political economy of the COVID-19 crisis: Reflections on an agenda for research and action. *World Development*. 2021;138:105235. <https://doi.org/10.1016/j.worlddev.2020.105235>
2. Musa KI, Arifin WN, Mohd MH, Jamiluddin MS, Ahmad NA, Chen XW, et al. Measuring time-varying effective reproduction numbers for COVID-19 and their relationship with movement control order in Malaysia. *International journal of environmental research and public health*. 2021;18(6):3273. <https://doi.org/10.3390/ijerph18063273>
3. Kaur H, Singh T, Arya YK, Mittal S. Physical fitness and exercise during the COVID-19 pandemic: a qualitative enquiry. *Frontiers in psychology*. 2020;11:2943. <https://doi.org/10.3389/fpsyg.2020.590172>
4. Tang KHD. Movement control as an effective measure against Covid-19 spread in Malaysia: an overview. *Journal of Public Health*. 2022;30(3):583-6. <https://doi.org/10.1007/s10389-020-01316-w>
5. Cénat JM, Blais-Rochette C, Kokou-Kpolou CK, Noorishad P-G, Mukunzi JN, McIntee S-E, et al. Prevalence of symptoms of depression, anxiety, insomnia, posttraumatic stress disorder, and psychological distress among populations affected by the COVID-19 pandemic: A systematic review and meta-analysis. *Psychiatry research*. 2021;295:113599. <https://doi.org/10.1016/j.psychres.2020.113599>
6. Janssen M, Chang BP, Hristov H, Pravst I, Profeta A, Millard J. Changes in food consumption during the COVID-19 pandemic: analysis of consumer survey data from the first lockdown period in Denmark, Germany, and Slovenia. *Frontiers in nutrition*. 2021;60. <https://doi.org/10.3389/fnut.2021.635859>
7. Rogers JP, Chesney E, Oliver D, Pollak TA, McGuire P, Fusar-Poli P, et al. Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the COVID-19 pandemic. *The Lancet Psychiatry*. 2020;7(7):611-27. [https://doi.org/10.1016/S2215-0366\(20\)30203-0](https://doi.org/10.1016/S2215-0366(20)30203-0)
8. Gu J, Zhong Y, Hao Y, Zhou D, Tsui H, Hao C, et al. Preventive behaviors and mental distress in response to H1N1 among university students in Guangzhou, China. *Asia Pacific Journal of Public Health*. 2015;27(2):NP1867-NP79. <https://doi.org/10.1177/1010539512443699>
9. Al-Rabiaah A, Temsah M-H, Al-Eyadhy AA, Hasan GM, Al-Zamil F, Al-Subaie S, et al. Middle East Respiratory Syndrome-Corona Virus (MERS-CoV) associated stress among medical students at a university teaching hospital in Saudi Arabia. *Journal of infection and public health*. 2020;13(5):687-91. <https://doi.org/10.1016/j.jiph.2020.01.005>
10. Elmer T, Mepham K, Stadtfeld C. Students under lockdown: Comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland. *Plos one*. 2020;15(7):e0236337. <https://doi.org/10.1371/journal.pone.0236337>
11. Kadir F, Yeap BT, Hayati F, Ahmedy F, Bahar FHM, Jeffrey MS. Medical education during the COVID-19: a Malaysian experience. *International Journal of Medical Education*. 2022;13:84. <https://doi.org/10.5116/ijme.6231.a20e>
12. Mheidly N, Fares MY, Fares J. Coping with stress and burnout associated with telecommunication and online learning. *Frontiers in Public Health*. 2020;672. <https://doi.org/10.3389/fpubh.2020.574969>
13. Brunet A, Weiss DS, Metzler TJ, Best SR, Neylan TC, Rogers C, et al. The Peritraumatic Distress Inventory: a proposed measure of PTSD criterion A2. *American Journal of Psychiatry*. 2001;158(9):1480-5. <https://doi.org/10.1176/appi.ajp.158.9.1480>
14. Thomas É, Saumier D, Brunet A. Peritraumatic distress and the course of posttraumatic stress disorder symptoms: A meta-analysis. *The Canadian Journal of Psychiatry*. 2012;57(2):122-9.

15. Vance MC, Kovachy B, Dong M, Bui E. Peritraumatic distress: A review and synthesis of 15 years of research. *Journal of Clinical Psychology*. 2018;74(9):1457-84. <https://doi.org/10.1002/jclp.22612>
16. Marzo RR, Ismail Z, Nu Htay MN, Bahari R, Ismail R, Villanueva Eq 3rd, et al. Psychological distress during pandemic COVID-19 among adult general population: Result across 13 countries. *Clin Epidemiology Global Health*. 2021 Apr-Jun;10:100708. Doi:10.1016/j.cegh.2021.100708. Epub 2021 Feb 18.
17. Jahanshahi AA, Dinani MM, Madavani AN, Li J, Zhang SX. The distress of Iranian adults during the Covid-19 pandemic—More distressed than the Chinese and with different predictors. *Brain, behavior, and immunity*. 2020;87:124. <https://doi.org/10.1016/j.bbi.2020.04.081>
18. Qiu J, Shen B, Zhao M, Wang Z, Xie B, Xu Y. A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *General psychiatry*. 2020;33(2). <https://doi.org/10.1136/gpsych-2020-100213>
19. Tang W, Hu T, Hu B, Jin C, Wang G, Xie C, et al. Prevalence and correlates of PTSD and depressive symptoms one month after the outbreak of the COVID-19 epidemic in a sample of home-quarantined Chinese university students. *Journal of affective disorders*. 2020;274:1-7. <https://doi.org/10.1016/j.jad.2020.05.009>
20. Li Y, Wang Y, Jiang J, Valdimarsdóttir UA, Fall K, Fang F, et al. Psychological distress among health professional students during the COVID-19 outbreak. *Psychological medicine*. 2021;51(11):1952-4. <https://doi.org/10.1017/S0033291720001555>
21. Arifin WN. Sample size calculator (web) [Internet]. 2023 [cited 5 April 2023]. Available from: <http://wnarifin.github.io>.
22. malaymail.com [Internet]. Malaysia: Malay Mail; c2020 [cited 2023 April 5]. Available from: <https://www.malaymail.com/news/malaysia/2020/05/27/higher-education-ministry-all-university-lectures-to-be-online-only-until-e/1869975>.
23. Dailyexpress [Internet]. Malaysia; Bernama [cited 2023, Aug 21]. Available from: <https://www.dailyexpress.com.my/news/204614/malaysia-s-new-poor-in-dilemma/>
24. Mohamed S, Ismail Z, Norley Shuib NFA. Peri-Traumatic Distress and Its Relationship to Resilience and Coping Among Medical Students in Malaysia During COVID-19 Lockdown. *Frontiers in Psychiatry*. 2021;12. <https://doi.org/10.3389/fpyst.2021.789554>
25. Norhayati M, Aniza A. Psychometric properties of the Malay version of Impact of Event Scale-Revised (IES-R). *International journal of collaborative Research on Internal medicine & Public Health*. 2014;6(2):0-.
26. Bendel, R. B., & Afifi, A. A. (1977). Comparison of stopping rules in forward 'stepwise' regression. *Journal of the American Statistical Association*, 72, 46-53.
27. Xiong J, Lipsitz O, Nasri F, Lui LM, Gill H, Phan L, et al. Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *Journal of affective disorders*. 2020;277:55-64. <https://doi.org/10.1016/j.jad.2020.08.001>
28. Megalakaki O, Kokou-Kpolou CK, Vaudé J, Park S, Iorfa SK, Cénat JM, et al. Does peritraumatic distress predict PTSD, depression and anxiety symptoms during and after COVID-19 lockdown in France? A prospective longitudinal study. *Journal of psychiatric research*. 2021;137:81-8. <https://doi.org/10.1016/j.jpsychires.2021.02.035>
29. Liu CH, Zhang E, Wong GTF, Hyun S. Factors associated with depression, anxiety, and PTSD symptomatology during the COVID-19 pandemic: Clinical implications for US young adult mental health. *Psychiatry research*. 2020;290:113172. <https://doi.org/10.1016/j.psychres.2020.113172>
30. Conrad RC, Koire A, Pinder-Amaker S, Liu CH. College student mental health risks during the COVID-19 pandemic: Implications of campus relocation. *Journal of Psychiatric Research*. 2021;136:117-26. <https://doi.org/10.1016/j.jpsychires.2021.01.054>

31. Xiao, C. Novel approach of consultation on 2019 novel coronavirus (COVID-19)-related psychological and mental problems. Structured letter therapy. *Psychiatry investigation*. 2020; 17:175-176.
32. Antičević V, Bubić A, Britvić D. Peritraumatic Distress and Posttraumatic Stress Symptoms During the COVID-19 Pandemic: The Contributions of Psychosocial Factors and Pandemic-Related Stressors. *Journal of Traumatic Stress*. 2021;34(4):691-700. <https://doi.org/10.1002/jts.22701>
33. Lee CM, Juarez M, Rae G, Jones L, Rodriguez RM, Davis JA, et al. Anxiety, PTSD, and stressors in medical students during the initial peak of the COVID-19 pandemic. *PloS one*. 2021;16(7):e0255013. <https://doi.org/10.1371/journal.pone.0255013>
34. Li X, Fu P, Fan C, Zhu M, Li M. COVID-19 stress and mental health of students in locked-down colleges. *International journal of environmental research and public health*. 2021;18(2):771. <https://doi.org/10.3390/ijerph18020771>
35. Wathélet M, Fovet T, Jousset A, Duhem S, Habran E, Horn M, et al. Prevalence of and factors associated with post-traumatic stress disorder among French university students 1 month after the COVID-19 lockdown. *Translational psychiatry*. 2021;11(1):1-7.
36. Chen Q, Liang M, Li Y, Guo J, Fei D, Wang L, et al. Mental health care for medical staff in China during the COVID-19 outbreak. *The Lancet Psychiatry*. 2020;7(4):e15-e6. [https://doi.org/10.1016/S2215-0366\(20\)30078-X](https://doi.org/10.1016/S2215-0366(20)30078-X)
37. Qi G, Yuan P, Qi M, Hu X, Shi S, Shi X. Influencing factors of high PTSD among medical staff during COVID-19: evidences from both meta-analysis and subgroup analysis. *Safety and Health at Work*. 2022. <https://doi.org/10.1016/j.shaw.2022.06.003>
38. Andrade C. The limitations of online surveys. *Indian journal of psychological medicine*. 2020;42(6):575-6. <https://doi.org/10.1177/0253717620957496>
39. Solem RC. Limitation of a cross-sectional study. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2015;148(2):205. <https://doi.org/10.1016/j.ajodo.2015.05.006>
40. Rikard-Bell C, Woolley T. Aligning an undergraduate psychological medicine subject with the mental health needs of the local region. *BMC Medical Education*. 2018;18(1):1-7. <https://doi.org/10.1186/s12909-018-1192-4>