ORIGINAL ARTICLE

Impact of COVID-19 pandemic on the depression, anxiety and stress level among undergraduate students in a university, Perak, Malaysia

Jasdeep Singh A/L Ranjit Singh[1]*, Kenneth Ashwin A/L Jeyajulian[2], Mageswaran A/L Murugan[3], Felix Chew Chun Hung[4], Tricia Darshni A/P Thomas Matthew[5], Ng Sim Yie[6], Buvaneswaran A/L Muralitaran[7], Mohammad Fikri Bin Safian[8], Elden Oswald A/L Joseph William[9], Chu Ying Tong[10], Tan Chin Chuan[11], Rosheni A/P Gunendran[12], Nurhanifah Binti Mohammad Izani[13]

Corresponding author:

[1]Jasdeep Singh A/L Ranjit Singh, MBBS final year student, Email: jasdeepsingh.ranjitsingh@qiu.edu.my [ORCID]

[2]Kenneth Ashwin A/L Jeyajulian [ORCID]
[3]Mageswaran A/L Murugan [ORCID]
[4]Felix Chew Chun Hung [ORCID]
[5]Tricia Darshni A/P Thomas Matthew [ORCID]
[6]Ng Sim Yie [ORCID]
[7]Buvaneswaran A/L Muralitaran [ORCID]
[8]Mohammad Fikri Bin Safian [ORCID]
[9]Elden Oswald A/L Joseph William [ORCID]
[10]Chu Ying Tong [ORCID]
[11]Tan Chin Chuan [ORCID]
[12]Rosheni A/P Gunendran [ORCID]
[13]Nurhanifah Binti Mohammad Izani [ORCID]

[1-13]Final year MBBS student

All authors are affiliated to
Faculty of Medicine, Quest International University (QIU), No. 227, Plaza Teh Teng Seng (Level 2), Jalan Raja Permaisuri Bainun, 30250 Ipoh, Perak Darul Ridzuan, Malaysia

ABSTRACT
Introduction:
The Coronavirus disease 2019 (COVID-19) pandemic poses a psychological threat to people worldwide, including undergraduates in Malaysia. However, limited research has been done focused primarily on the psychological impact of this pandemic on undergraduate students, which has timeliness and needs to be addressed appropriately. Therefore, the study aims to assess the depression, anxiety, and stress (DAS) levels among undergraduate students in Quest International University (QIU) due to the COVID-19 pandemic.

Methods:
An online cross-sectional survey was conducted among undergraduates in QIU. The online questionnaires were distributed via Google forms and were based on the Depression Anxiety Stress Scale-21(DASS-21) to collect data on the psychological impacts of the COVID-19 pandemic on undergraduate students.

Results:
A total of 57.3 % of the respondents reported experiencing depression, 66.4% had anxiety and, 50.4 % experienced mild to extremely severe stress. Pearson's Chi-square test showed no significant association between gender, nationality, and faculty of study and the development due to COVID-19. Kruskal Wali's test showed no median difference between the year of study of the respondents and the outcomes of DAS amongst respondents.

Conclusion:
COVID-19 has resulted in a significant rise in the number of undergraduates suffering from DAS. Our study has demonstrated that gender, nationality, faculty of study, and year of study are not significant factors in developing DAS among undergraduates.

Keywords
Coronavirus, DASS-21, gender, SARS-CoV-2, undergraduate students

Introduction

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has become a global public health emergency. The virus can cause mild infections like the common cold in people to severe respiratory infections or distress. [1] In the Nidovirales order, coronaviruses are under the Coronaviridae family. Coronavirus exhibits the surface protein antigens mimicking spikes in the shape of a crown lining the viral outer surface. Initially, these viruses were believed to cause infections in animals only but changed following the onset of cases of a severe acute respiratory syndrome (SARS) outbreak caused by the SARS Coronavirus epidemic in the year 2003. [2] and within a decade, another virus from the same family was endemic to nations in the Middle East. [3] WHO has declared COVID-19 as a pandemic as of March 11, 2020. [4] Globally, as of 5:58 pm CET, December 15, 2021, there have been 270,791,973 confirmed cases of COVID-19, including 5,318,216 deaths, reported to WHO. [5]

This pandemic has heavily influenced college students academically, physically, mentally, and financially in multiple ways. This global COVID-19 disaster has disrupted the education of a large number of undergraduates worldwide. [6] Higher education institutions throughout Malaysia moved to the online teaching and learning platform to disrupt the COVID-19 spread throughout the globe involving students and university staff members. [7] The lives of college students have changed drastically in a short period, as they were advised to leave campus, along with the need to adapt to e-learning at home.

The shift to online learning platforms, especially in courses that are not initially planned for online platforms, has probably doubled students' stress. Specific courses designed to provide more interaction and hands-on procedures, including practical sessions, laboratory sessions, and artistic courses, have a substantial drawback in assessing these students. [8] The main issue that has arisen due to this switch is that many students have trouble accessing computers and the internet at home. [9] Other challenges include worries regarding their health and their family members and financial concerns, primarily among those who sustain themselves by working in sectors greatly affected by the prolonged shutdown, such as the service or retail sectors. [10]

Mental health among the citizens of countries with major COVID-19 outbreaks implemented movement control orders showed elevated levels of stress, anxiety, and depression, especially among vulnerable populations like undergraduate students. [11] Besides academic difficulties and economic stressors, having a friend, family, or relative infected with COVID-19 is also related to rising anxiety levels. [12] The experience is challenging and may lead to significant economic stress due to loss of jobs and lack of social interactions, like social withdrawal, cyberbullying, substance abuse, and mental health problems, such as depression and attempts of suicide. [13] Depression has major morbidity and mortality risks leading to increased suicide risk, susceptibility

to disease, and other adverse effects. A study from Bangladesh showed that 82.4% of the total participants were experienced mild to severe depressive symptoms. Sudden and prolonged unemployment, financial insecurity, a general lack of family support, and a prolonged period of isolation were pointed out. [14] A New Jersey study showed 25.4% of the participants experienced mild to severe depressive symptoms due to isolation, loss of housing, and the unexpected displacement resulting from the sudden university closure, unemployment, and financial difficulties, the removal of social networks, and fears of an unstable academic future. Regarding anxiety, 44.6% of respondents experienced mild to highly severe general anxiety. [10]

During the COVID-19 pandemic, students are suffering huge stress which impacted their psychosocial wellbeing. We undertook the study to explore the prevalence of DAS among undergraduate students in QIU due to this COVID-19 pandemic and compare the DAS level differences between medical and non-medical as well as pre-clinical and clinical medical students.

Methods

Study period, study design, and participants

An online cross-sectional survey was done via the Google email platform. Questionnaires were administered targeting undergraduates in QIU to assess the difference in the depression, anxiety, and stress levels due to the COVID-19 pandemic. The study was conducted from February 1, 2021, to March 17, 2021, at QIU.

Inclusion and exclusion criteria

Undergraduate students in QIU comprise medical and other faculties students regardless of age, gender, and nationality. We excluded Foundation students and postgraduate students in QIU from this study.

Sample Size Calculation

Purposive sampling was used in this study as this method is easier for us to find participants during this COVID-19 pandemic. The calculation of the sample size was done using the single proportion formula. The sample size was 383 assuming 46.9% of the participants have depression [15], and 10% was added to the sample size assuming the non-response rate making the sample 421 in total.

Collection of data

Data on the psychological impacts of the COVID-19 pandemic was collected using Depression, Anxiety, and Stress Scale - 21 Items (DASS-21) questionnaires. [16] The total number of items is 21 with three subscales and 4 points Likert scale.

The DASS-21 questionnaire has a scoring scale [0 - did not apply to me at all, 1 - applied to me to some degree, or some of the time, 2 - applied to me to a considerable degree or a good part of time, 3 - applied to me very much or most

of the time] used in this study. [Supplimentory table (Table – 4)]

Independent variables

Sociodemographic variables were considered independent variables evaluated under five domains, namely gender, age, nationality, faculty of study, and year of study.

Dependent variables

Psychological impacts of different levels of depression, anxiety, and stress were the dependent variables.

Criteria for scoring

DASS-21 questionnaire was used; 0= did not apply to me at all, 1= Applied to me to some degree, or some of the time, 2= Applied to me to a considerable degree or a good part of the time, 3= Applied to me very much or most of the time.

Data management and statistical analysis

The data obtained via the questionnaires distributed were analysed using Statistical Package for the Social Sciences (SPSS) windows version 22. $p < 0.05$ was considered statistically significant.

Ethical committee approval

Before the commencement of the study, ethical approval was obtained from the QIU Joint Research Ethical Committee (JREC). The participants were given a detailed explanation of the study and were only allowed to participate if consent was gained. Each participant was encouraged to fill in the study questionnaire voluntarily and independently to the best of their knowledge. Participants were free to withdraw from the study if they intended to. Confidentiality of the data collected was ensured by all means, and the data attained was only be used for research purposes.

Results

Table 1: Socio-demographic characteristics of participants (n=232)

Socio-demographic variables	n	(%)	Median	(IQR)
Age			23	(2)
Gender				
Male	66	(28.4)		
Female	166	(71.6)		
Ethnicity				
Malay	13	(5.6)		
Chinese	84	(36.2)		
Indian	112	(48.3)		
Others	23	(9.9)		
Nationality				
Malaysian	200	(86.2)		
Non-Malaysian	32	(13.8)		
Faculty of Study				
Faculty of Business and Management (FBM)	29	(12.5)		
Faculty of Medicine (FOM)	127	(54.7)		
Faculty of Science and Technology (FST)	27	(11.6)		
Faculty of Social Science (FSS)	45	(19.4)		
Faculty of Pharmacy (FOP)	4	(1.7)		
Current Academic Year				
Year 1	57	(24.6)		
Year 2	25	(10.8)		
Year 3	56	(24.1)		
Year 4	50	(21.6)		
Year 5	44	(19.0)		

In this survey, the response from a total number of 232 respondents was collected. The faculty of Pharmacy had the lowest number of respondents (1.7%), whereas the Faculty of Medicine had the greatest number of respondents (54.7%) Indians were more (48.3%) followed by Chinese (36.2%) and Malays (5.6%). Females were more (71.6%) compared with males. The majority of the students are from Year 1 and year 3, followed by year 4, year 5. (Table 1).

Table 2 expedite the impact of COVID-19 on depression and anxiety. Regarding depression, the highest number of respondents (34.9%) had positive feelings whereas only 15.1% had almost always found it challenging to work up the initiative to do things. Enthusiasm was lacking always for 11.6%, whereas the majority (42.2%) had no complaints about it. Meaningless life was a major feeling for 12.9% students, whereas 52.6% didn't complain about it.

Concerned with anxiety, almost one-third of the students reported often dryness in the mouth, 20.3% sometimes experienced trembling in hand, 19.4% almost always worried about situations was experienced. Close to panic for sometimes was a feeling for 27.6%, increase in heart rate for sometimes experienced by 25.4%, scary feeling for sometimes was felt by 22.8% of students.

Considering stress, hard to wind down sometimes felt by 36.2%, sometimes overreacting was experienced by 33.6%. Almost one-fifth of the students often experienced over-reacting to situations, using a lot of nervous energy, agitation, and difficulty relaxing, whereas one-third of the students sometimes had the same feelings.

Table 3 shows an association between sociodemographic factors and depression. Males (62.2%) were reported to experience mild to extremely severe depression compared to female respondents (55.5%). Malaysian respondents (19.0%) were more severely depressed than non-Malaysians. Medical and allied health science students had relatively more levels of depression in all three categories, mild, moderate, and severe, compared with non-medical students.

Female respondents (27.7%) experienced extremely severe anxiety, although it was not significantly associated. Malaysian undergraduates (22.5%) suffered more from

moderate anxiety compared to non-Malaysian undergraduates (12.5%).

Table 2: Impact of COVID-19 on depression and anxiety(n=232)

	Never		Sometimes		Often		Almost Always	
	n	(%)	n	(%)	n	(%)	n	(%)
Depression								
I couldn't seem to experience any positive feeling at all	81	(34.9)	79	(34.1)	52	(22.4)	20	(8.6)
I found it difficult to work up the initiative to do things	68	(29.3)	62	(26.7)	67	(28.9)	35	(15.1)
I felt that I had nothing to look forward to	99	(42.7)	49	(21.1)	56	(24.1)	28	(12.1)
I felt down-hearted and blue	86	(37.1)	79	(34.1)	43	(18.5)	24	(10.3)
I was unable to become enthusiastic about anything	98	(42.2)	57	(24.6)	50	(21.6)	27	(11.6)
I felt I wasn't worth much as a person	105	(45.3)	52	(22.4)	48	(20.7)	27	(11.6)
I felt that life was meaningless	122	(52.6)	49	(21.1)	31	(13.4)	30	(12.9)
Anxiety								
I was aware of dryness of my mouth	70	(30.2)	52	(22.4)	69	(29.7)	41	(17.7)
I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	132	(56.9)	44	(19.0)	34	(14.7)	22	(9.5)
I experienced trembling (e.g. in the hands)	133	(57.3)	47	(20.3)	33	(14.2)	19	(8.2)
I was worried about situations in which I might panic and make a fool of myself	70	(30.2)	64	(27.6)	53	(22.8)	45	(19.4)
I felt I was close to panic	97	(41.8)	64	(27.6)	41	(17.7)	30	(12.9)
I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	109	(47.0)	59	(25.4)	37	(15.9)	27	(11.6)
I felt scared without any good reason	113	(48.7)	53	(22.8)	42	(18.1)	24	(10.3)
Stress								
I found it hard to wind down	53	(22.8)	84	(36.2)	65	(28.0)	30	(12.9)
I tended to over-react to situations	78	(33.6)	78	(33.6)	51	(22.0)	25	(10.8)
I felt that I was using a lot of nervous energy	71	(30.6)	82	(35.3)	51	(22.0)	28	(12.1)
I found myself getting agitated	80	(34.5)	77	(33.2)	53	(22.8)	22	(9.5)
I found it difficult to relax	83	(35.8)	77	(33.2)	50	(21.6)	22	(9.5)
I was intolerant of anything that kept me from getting on with what I was doing	82	(35.3)	69	(29.7)	62	(26.7)	19	(8.2)
I felt that I was rather touchy	103	(44.4)	65	(28.0)	46	(19.8)	18	(7.8)

Table 3: Association between sociodemographic factors and depression, anxiety and stress (n=232)

Sociodemographic factors and depression

Depression	Normal		Mild		Moderate		Severe		Extremely severe		χ^2	(df)	p value
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)			
Gender													
Male	25	(37.9)	5	(7.6)	13	(19.7)	11	(16.7)	12	(18.2)	2.925	(4)	0.57×
Female	74	(44.6)	17	(10.2)	21	(12.7)	30	(18.1)	24	(14.5)			
Nationality													
Malaysian	81	(40.5)	20	(10.0)	29	(14.5)	38	(19.0)	32	(16.0)	3.700	(4)	0.448×
Non-Malaysian	18	(56.3)	2	(6.3)	5	(15.6)	3	(9.4)	4	(12.5)			
Faculty													
Medical and allied health	58	(43.3)	10	(7.6)	21	(16.0)	26	(19.8)	16	(12.2)	4.576	(4)	0.334×
Non- Medical	41	(43.3)	12	(11.9)	13	(12.9)	15	(14.9)	20	(19.8)			
Year of Study	3	(3.0)	3	(3.0)	3	(2.0)	4	(2.0)	3	(3.0)	8.371	(4)	0.079×a
Anxiety													
Gender													
Male	22	(33.3)	3	(4.5)	15	(22.7)	9	(13.6)	17	(25.8)	1.406	(4)	0.843×
Female	56	(33.7)	13	(7.8)	34	(20.5)	17	(10.2)	46	(27.7)			
Nationality													
Malaysian	60	(30.0)	15	(7.5)	45	(22.5)	23	(11.5)	57	(28.5)	8.802	(4)	0.066×
Non-Malaysian	18	(56.3)	1	(3.1)	4	(12.5)	3	(9.4)	6	(18.8)			
Faculty													
Medical and allied health	40	(33.6)	11	(8.4)	30	(22.9)	14	(10.7)	32	(24.4)	2.331	(4)	0.675×
Non- Medical	34	(33.7)	5	(5.0)	19	(18.8)	12	(11.9)	31	(30.7)			
Year of Study	3	(4.0)	4	(2.0)	3	(2.0)	3.5	(3.0)	3	(2.0)	8.524	(4)	0.074×a
Stress													
Gender													
Male	32	(48.5)	8	(12.1)	13	(19.7)	11	(16.7)	2	(3.0)	0.575	(4)	0.966×
Female	83	(50.0)	19	(11.4)	37	(22.3)	22	(13.3)	5	(3.0)			
Nationality													
Malaysian	97	(48.5)	23	(11.5)	42	(21.0)	32	(16.0)	6	(3.0)	3.779	(4)	0.437×
Non-Malaysian	18	(56.3)	4	(12.5)	8	(25.0)	1	(3.1)	1	(3.1)			
Faculty													

Medical and allied health	66	(50.4)	18	(13.7)	29	(22.1)	17	(13.0)	1	(0.8)	6.626	(4)	0.157ˣ
Non- Medical	49	(48.5)	9	(20.8)	21	(15.8)	16	(5.9)	6	(5.9)			
Year of Study	3	(3.0)	3	(4.0)	3	(2.0)	3	(3.0)	3	(2.0)	2.942	(4)	0.571ˣª

ˣp>0.05
ª Kruskal Walis test was performed

A greater number of respondents from the medical and allied health faculties (8.4%) reported experiencing moderate anxiety compared to respondents from the non-medical faculties 5%.

A total of 16.7 % male and 13.3% female respondents reported that they experienced severe stress levels. Severe levels of stress were more commonly reported among Malaysian undergraduates (16.0%) when compared to non-Malaysians (3.1%). Fewer respondents from non-medical faculties (5.9%), developed mild to extremely severe stress due to the COVID-19 pandemic than respondents from Medical and allied health faculties (13.0%).

Discussion

The influence of gender on the development of depression

The COVID-19 pandemic came out as one of the most devastating public health disasters the world has faced in recent years. Based on responses collected and analysed on the effect of gender on the risk of undergraduates developing depression, male respondents documented a higher level of mild to extremely severe depression than females. However, we have found that both genders experienced equal levels of depression due to the COVID-19 pandemic. These findings are supported by Rodríguez-Hidalgo et al. The authors did not find a disparity between genders in experiencing depression among a group of university students in Ecuador. [17] However, contrary to the present finding, research in Ethiopia showed that female respondents suffered more from mild to extremely severe depression than males. [18] Another cross-sectional study in Saudi Arabia showed that female students were more likely to experience depressive symptoms. [19] Women are more vulnerable to mental illness, cultural influences, economic inequality, or hormonal fluctuations. [18] Clinical factors such as technical skills have also been very stressful for female students. [20] We did not find any gender influence may be due to undergraduates in general experiencing fear of unemployment or inability to progress academically due to the COVID-19 pandemic. We observed nationality played a role in a respondent's risk of developing depression, anxiety, or increased stress levels because our research's proportion of non-Malaysian respondents to Malaysian respondents is small.

Faculty of study and the risk of depression

Although insignificant, we observed Medical and allied health science students had relatively more levels of depression when compared to others. In contrast to our findings, medical students showed better mental fortitude in facing COVID-19 with a low depression level, as stated in a cross-sectional study at Jian University in China. Their results varied from our findings may be due to the stressful training in everyday life, which makes the students more used to stressful conditions and therefore less vulnerable to the effects of COVID-19 and repercussions. [21] Another study among medical and non-medical university students in Egypt documented that more medical undergraduates experienced depressive symptoms than non-medical undergraduates due to the COVID-19 pandemic. Contributing factors for the depression were self-isolation, suspension of most daily activities, and the general lockdown inclusive of university closures. Other factors include cancelled practical exams and worries among students, especially medical students, about their academic progress and grades, which have a significant psychological impact. [22]

The influence of gender on the development of stress and anxiety

We have observed no significant difference in the gender for anxiety, which is supported by a similar study that reported the level of DAS among undergraduate students is homogenous. Authors showed the psychological impact of the lockdown, and the fear of COVID-19 infection affected both genders equally [23]. However, contradictory findings were reported by Sundarasen et al., where more females experienced moderate to extremely severe anxiety. The authors explained that females are more emotionally developed than males, and these emotions are more easily disrupted by stressful situations such as the COVID-19 lockdown. [24] Abdulghani et al. also reported gender plays a significant role in a respondent's susceptibility to developing mild to highly severe stress that presents with medical and psychological symptoms. Females are more severely affected as the impact of stress on their psyche is more significant than that of male students. [25] Another study also demonstrated that mild to highly severe DAS were more common among females, pointing out biological sex differences between the genders. [26]

Our results may be different from these studies because the frequent lockdown measures and dread situation of the pandemic creates a phobia of getting infected with COVID-19 is so pervasive, that anxiety is equally perceived independent of gender.

Faculty of study and the risk of developing anxiety

Although we did not observe any statistically significant difference between the faculty of study on the risk of developing anxiety, we observed higher mean values amongst medical students regarding stress. Rehman et al. reported that students and lecturers from the medical faculty were at higher risk of developing anxiety compared to the

finance faculty [23], similar to our findings which may be due to the increased demand placed on students and lecturers from medical departments to adapt to a new online teaching and learning system as well as the uncertainty for their future. Another study by Saddik et al. revealed that more medical and dental undergraduates developed mild to extremely severe anxiety than non-medical undergraduates. They pointed out close contact between undergraduates from medical and allied health faculties to patients in hospitals who could be potential carriers of the COVID-19 virus, which may be a potential reason for QIU students [27].

However, Peng et al. reported that medical students are better at coping with stress than non-medical students during the COVID-19 pandemic, which may be due to a better ability to cope with stress when compared to other undergraduates [21]. Xie et al. also documented that medical students experienced fewer mental health problems, especially the development of severe stress when compared to non-medical students [28]. However, our results varied because medical and non-medical students in QIU had their classes without any postponement, and the classes were conducted via the online teaching and learning platform.

Conclusion
We conclude that DAS among undergraduates COVID-19 pandemic is evident. Medical and allied health science students were found to be vulnerable to anxiety and depression. necessary steps such as mental health counselling, moral support can be helpful for them.

Limitation and future scope
We acknowledge that our research has several limitations. Our study is an online cross-sectional study, so DAS's causal relationship among participants cannot be established. A longitudinal analysis would help in this regard. In addition, our sample size was small; future studies are recommended by involving students from other universities in the Perak state. The research results are insufficient to determine the severity of depression, anxiety, or stress among respondents as their symptoms have not been medically diagnosed or documented. The questionnaires are only sufficient to determine the respondent's experience of DAS. Another significant limitation is that the tools designed specifically for the COVID-19 pandemic, such as the coronavirus anxiety scale (CAS), were not utilized, and our research only involved the use of DASS-21.

Abbreviations
Coronavirus disease 2019 (COVID-19), Depression, Anxiety and Stress Scale - 21 Items (DASS-21), depression, anxiety, and stress (DAS), Joint Research Ethical Committee (JREC), Quest International University (QIU),

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), severe acute respiratory syndrome (SARS)

Relevance of the study
The present research is significant because COVID-19 has dramatically influenced people in different fields worldwide. In college and university students, adequate management of their emotions during these crises has become an immediate issue. Furthermore, the current ongoing coronavirus outbreak, strict home quarantine, and delay in starting schools, colleges, and universities across the country are expected to govern undergraduate university students' psychological health. These results may help in planning preventive strategies like stress management. The outcome result of this study will assist as baseline data for the development of mental health programs for individuals during the outbreak.

Acknowledgement

Authors' contribution
a. Study planning: JS, KA, MM, FCCH, TD, NSY
b. Data collection: BM, MFBS, EO, CYT, TCC, RG
c. Data analysis/ interpretation: JS, KA, MM, FCCH, CYT, TCC, RG
d. Manuscript writing: JS, KA, MM, FCCH, TD, NSY, BM, MFBS, EO
e. Manuscript revision: JS, KA, MM, FCCH, TD, NSY, BM, MFBS, EO, CYT, TCC, RG
f. Final approval: JS, KA, MM, FCCH, TD, NSY, BM, MFBS, EO, CYT, TCC, RG
g. Agreement to be accountable for all aspects of the work: JS, KA, MM, FCCH, TD, NSY, BM, MFBS, EO, CYT, TCC, RG

Funding

Availability of data and materials
All data underlying the results is available as part of the article, and no additional source data is required.

Competing interests
None declared.

Publisher's Note
QIU remains neutral with regard to jurisdictional claims in published maps and institutional affiliations. The

References

1. Lai C-C, Shih T-P, Ko W-C, Tang H-J, Hsueh P-R. 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(3):105924. http://dx.doi.org/10.1016/j.ijantimicag.2020.105924

2. Weiss SR, Navas-Martin S. Coronavirus pathogenesis and the emerging pathogen severe acute respiratory syndrome coronavirus. Microbiol Mol Biol Rev. 2005 Dec;69(4):635-64.

3. Wang N, Shi X, Jiang L, Zhang S, Wang D, Tong P, et al. Structure of MERS-CoV spike receptor-binding domain complexed with human receptor DPP4. Cell Res. 2013;23(8):986–93. http://dx.doi.org/10.1038/cr.2013.92

4. World Health Organization, Coronavirus Disease (COVID-19) - Events as They Happen. Internet [online 2021] [cited December 12, 2021]. Available from: www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen

5. WHO Coronavirus (COVID-19) Dashboard. Internet [online 2020] [cited December 12, 2021]. Available from: https://covid19.who.int/

6. Chaabane S, Doraiswamy S, Chaabna K, Mamtani R, Cheema S. The impact of COVID-19 school closure on child and adolescent health: A rapid systematic review. Children (Basel). 2021;8(5):415. http://dx.doi.org/10.3390/children8050415

7. Gewin V. Five tips for moving teaching online as COVID-19 takes hold. Nature. 2020 [cited 2021 Dec 12];580(7802):295–6. Available from: https://www.nature.com/articles/d41586-020-00896-7

8. Sahu P. Closure of universities due to Coronavirus disease 2019 (COVID-19): Impact on education and mental health of students and academic staff. Cureus. 2020;12(4):e7541. http://dx.doi.org/10.7759/cureus.7541

9. Engerman JA, Otto RF. The shift to digital: designing for learning from a culturally relevant interactive media perspective. Educ Technol Res Dev. 2021;69(1):1–5. http://dx.doi.org/10.1007/s11423-020-09889-9

10. Kibbey MM, Fedorenko EJ, Farris SG. Anxiety, depression, and health anxiety in undergraduate students living in initial US outbreak "hotspot" during COVID-19 pandemic. Cogn Behav Ther. 2021;50(5):409–21. http://dx.doi.org/10.1080/16506073.2020.1853805

11. Wang X, Hegde S, Son C, Keller B, Smith A, Sasangohar F. Investigating mental health of US college students during the COVID-19 pandemic: Cross-sectional survey study. J Med Internet Res. 2020 [cited 2021 Dec. 12];22(9):e22817. https://preprints.jmir.org/preprint/22817

12. Basheti IA, Mhaidat QN, Mhaidat HN. Prevalence of anxiety and depression during COVID-19 pandemic among healthcare students in Jordan and its effect on their learning process: A national survey. PLoS One. 2021;16(4):e0249716. http://dx.doi.org/10.1371/journal.pone.0249716

13. Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet [Internet]. 2020 [cited 2021 Dec 12];395(10227):912–20. https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30460-8/fulltext

14. Islam MA, Barna SD, Raihan H, Khan MNA, Hossain MT. Depression and anxiety among university students during the COVID-19 pandemic in Bangladesh: A web-based cross-sectional survey. PLoS One. 2020;15(8):e0238162. http://dx.doi.org/10.1371/journal.pone.0238162

15. Khan AH, Sultana MS, Hossain S, Hasan MT, Ahmed HU, Sikder MT. The impact of COVID-19 pandemic on mental health & wellbeing among home-quarantined Bangladeshi students: A cross-sectional pilot study. J Affect Disord. 2020;277:121–8. http://dx.doi.org/10.1016/j.jad.2020.07.135

16. Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. Behav Res Ther. 1995;33(3):335–43. http://dx.doi.org/10.1016/0005-7967(94)00075-u

17. Rodríguez-Hidalgo AJ, Pantaleón Y, Dios I, Falla D. Fear of COVID-19, stress, and anxiety in university undergraduate students: A predictive model for depression. Front Psychol. 2020;11:591797. http://dx.doi.org/10.3389/fpsyg.2020.591797

18. Aylie NS, Mekonen MA, Mekuria RM. The psychological impacts of COVID-19 pandemic among university students in Bench-Sheko Zone, South-west Ethiopia: A community-based cross-sectional study. Psychol Res Behav Manag. 2020;13:813–21. http://dx.doi.org/10.2147/PRBM.S275593

19. Hakami Z, Khanagar SB, Vishwanathaiah S, Hakami A, Bokhari AM, Jabali AH, et al.

Psychological impact of the coronavirus disease 2019 (COVID-19) pandemic on dental students: A nationwide study. J Dent Educ. 2021;85(4):494–503.
http://dx.doi.org/10.1002/jdd.12470

20. Westerman GH, Grandy TG, Ocanto RA, Erskine CG. Perceived sources of stress in the dental school environment. J Dent Educ [Internet]. 1993 [cited 2021 Dec 12];57(3):225–31.
https://pubmed.ncbi.nlm.nih.gov/8454777/

21. Xiong P, Ming W-K, Zhang C, Bai J, Luo C, Cao W, et al. Factors influencing mental health among Chinese medical and non-medical students in the early stage of the COVID-19 pandemic. Front Public Health. 2021;9:603331.
http://dx.doi.org/10.3389/fpubh.2021.603331

22. Ghazawy ER, Ewis AA, Mahfouz EM, Khalil DM, Arafa A, Mohammed Z, et al. Psychological impacts of COVID-19 pandemic on the university students in Egypt. Health Promot Int. 2021;36(4):1116–25.
http://dx.doi.org/10.1093/heapro/daaa147

23. Rehman U, Shahnawaz MG, Khan NH, Kharshiing KD, Khursheed M, Gupta K, et al. Depression, anxiety and stress among Indians in times of Covid-19 lockdown. Community Ment Health J. 2021;57(1):42–8.
http://dx.doi.org/10.1007/s10597-020-00664-x

24. Sundarasen S, Chinna K, Kamaludin K, Nurunnabi M, Baloch GM, Khoshaim HB, et al. Psychological impact of COVID-19 and lockdown among university students in Malaysia: Implications and policy recommendations. Int J Environ Res Public Health. 2020;17(17):6206.
http://dx.doi.org/10.3390/ijerph17176206

25. Abdulghani HM, Sattar K, Ahmad T, Akram A. Association of COVID-19 pandemic with undergraduate medical students' perceived stress and coping. Psychol Res Behav Manag. 2020;13:871–81.
http://dx.doi.org/10.2147/PRBM.S276938

26. Kalok A, Sharip S, Abdul Hafizz AM, Zainuddin ZM, Shafiee MN. The psychological impact of movement restriction during the COVID-19 outbreak on clinical undergraduates: A cross-sectional study. Int J Environ Res Public Health. 2020;17(22):8522.
https://doi.org/10.3390/ijerph17228522

27. Saddik B, Hussein A, Sharif-Askari FS, Kheder W, Temsah M-H, Koutaich RA, et al. Increased levels of anxiety among medical and non-medical university students during the COVID-19 pandemic in the United Arab Emirates. Risk Manag Healthc Policy. 2020;13:2395–406.
https://doi.org/10.2147/RMHP.S273333

28. Xie L, Luo H, Li M, Ge W, Xing B, Miao Q. The immediate psychological effects of Coronavirus Disease 2019 on medical and non-medical students in China. Int J Public Health. 2020;65(8):1445–53.
http://dx.doi.org/10.1007/s00038-020-01475-3

Supplementary table: (Table - 4) Reference ranges of DASS-21

	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely severe	28+	20+	34+