

Depression, anxiety, and stress among health college students during covid-19 outbreak and online education

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ABSTRACT

Covid-19 pandemic has an impact to the changing educational system, raising the mental health issues, including college students' psychology. This study explores demographic and knowledge about Covid-19 associated with college student's depression, anxiety, and stress in online classes during outbreak. We undertook a cross-sectional study by using questionnaires to explore demographic characteristics and knowledge about Covid-19 among college students during the online classes. Mental health was assessed using DASS-42. The logistic regression used to investigate the association between demographic characteristics and knowledge about Covid-19 with mental health among college students. The prevalence of depression among 599 college students was 27.5%, meanwhile the prevalence of anxiety and stress were 44.6% and 21.29%, respectively. Based on the logistic regression, being in second year (OR = .43), having friends who got infected with Covid-19 (OR=.36), and feeling worried for delaying school (OR=.40) was significantly negatively correlated with depression, whereas having difficulties in adaptation of online class (OR=1.78) was significantly positively correlated with depression. The early identification of depression, anxiety, and stress among college students is pivotal and relevant related factors should be considered when developing preventive programs, particularly during online classes.

Key words:

anxiety; covid-19; depression; stress

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INTRODUCTION

The novel coronavirus (SARS-Cov-2) disease began in Wuhan, China at the end of December 2019. WHO announced that it had reached the pandemic level, impacting numerous countries worldwide. To date (August 12, 2022) there have been 585,950,085 confirmed cases of Covid-19, including 6,425,422 deaths based on covid19.who.int website.¹ According to covid19.go.id, 6,282,774 cases have been confirmed with the disease, with 53,127 active cases in Indonesia. The continuous increase in cases may affect people psychologically, apart from physical damage.

There have been some reports of psychological effects of the epidemic on the general public, patients, medical workers, children, younger and older.²⁻⁴ The continuous outbreak of the epidemic, strict isolation measures and delays in school schedules, colleges, and universities is expected to impact the psychology of college students. The mental health issues repeatedly reported as significant challenges among universities worldwide, impacting students' education due to the pandemic outbreak.⁵ The prevalence of anxiety among college students was significantly increased across three waves of the Covid-19. In addition, the life satisfaction of college students decreased significantly in the previous waves.⁶ A study in the US found that there was increasing stress and anxiety among university students. Some stressors related anxiety was decreased social interactions due to physical distancing, difficulty in concentrating, and increased concerns on academic performance.⁷ Other studies found that college students were reported to have more sedentary behavior, increased levels of depression, anxiety, and stress level due to the coronavirus-related news.⁸

⁹ Among college students, those who

undergo self-quarantine may feel boredom, loneliness, irritated, and other related negative emotions related with mental health problems.³ There is lack of comprehensive study on the psychological status among college students facing online courses during the epidemic, especially in Indonesia. Therefore, using a cross-sectional study, we aimed to explore whether any demographic factors and knowledge about Covid-19 associated with the college student's depression, anxiety, and stress level while participating in online class during Covid-19 outbreak.

METHODS

Design and sample

A cross-sectional study design was employed in this research. We used purposive random sampling among college students in University of Muhammadiyah Malang. We applied inclusion criteria: health college students at University of Muhammadiyah Malang in the 2019-2020 academic period, willingness to participate in research, and those who could write and speak Bahasa Indonesia communicatively. Sample size for this study was 406, with margin error 5% and confident interval 95%. Total participants in this study was 756 participants in the target population. During data cleaning process, 157 questionnaires were excluded due to the duplication of data. A total of 599 respondents were recruited and analyzed.

Data collection

The data were collected using an electronic questionnaire. Next, after the ethics committee admitted the authorization, the head of universities were contacted by official letters, which the researcher provided. Participants were requested to read the informed consent followed by completing questionnaires. Any commitment made by participants to

fulfil the questionnaire form would not impact their academic accomplishment, and respondent rights were protected.

Instruments

The researchers created a questionnaire related to demographic data. It was applied to identify the students' age, gender, department, school grade, and return to the original house during Covid-19. The self-reported knowledge about Covid-19 was consisted of 16 questions. Depression, Anxiety, and Stress were assessed using The Depression Anxiety Stress Scale-42 (The DASS-42) Bahasa Indonesia version.¹⁰ The total score ranged 0~42 for depression, anxiety, and stress. If the score is higher than mean score, it indicated the presence of depression, anxiety, and stress. In this study, the DASS-42 Bahasa Indonesia version had a good reliability with Cronbach's Alpha 0.943.¹¹

Data analyses

SPSS 22 was used for the data analyses. Descriptive statistical methods (i.e., percentage, mean, and standard deviation) were used to describe the demographic characteristics, knowledge of Covid-19, depression, anxiety, and stress

among the students. The logistic regression was used to investigate whether demographic factors and knowledge about Covid-19 were associated with the college students' depression, anxiety, and stress level while participating in online classes during the Covid-19 outbreak. Statistical significance was inferred at $p < 0.05$.

Ethics consideration

This research was authorized by the Health Research Ethical Committee of the University of Muhammadiyah Malang (ethical approval no. E.5.a/150/KEPK-UMM/V/2020). Electronic information was sent to students explaining that participation was entirely voluntary.

RESULTS

Study Participants Characteristics

Table 1 shows the characteristics of the 599 participants. Regarding depression, the mean score was 7.27, with 27.5% of participants having depression. The mean score of anxiety was 7.74, with 44.6% of participants had anxiety. For stress, the mean score was 11.33 and 26.2% of participants had stress.

Table 1. Participant characteristics (n=599)

Variable	Frequency (n)	Percentage (%)
Age		
17-21 yo	442	73.8
22-26 yo	157	26.2
Sex		
Male	101	16.9
Female	498	83.1
Grade		
First year	110	18.4
Second year	199	33.2
Third year	122	20.4
Fourth year	92	15.3
Profesi	76	12.7
Department		
Medical	106	17.7
Pharmacy	342	57.1

Variable	Frequency (n)	Percentage (%)
Nursing	93	15.5
Physiotherapy	58	9.7
Return to home		
No	101	16.9
Yes	498	83.1
Looking for the Covid-19 information		
No	25	4.2
Yes	574	95.8
Looking for information on the Covid-19 trend in Indonesia		
No	155	25.9
Yes	444	74.1
Looking for information on the Covid-19 trend in living residency		
No	144	24.0
Yes	455	76.0
Any Covid-19 cases in family		
No	566	94.5
Yes	33	5.5
Any Covid-19 cases among friends		
No	557	93.0
Yes	42	7.0
Any Covid-19 cases in significant others		
No	448	74.8
Yes	151	25.2
Any experience of quarantine		
No	264	44.1
Yes	335	55.9
Cancelled any events		
No	238	39.7
Yes	361	60.3
Large Scale Social Restriction implemented in living residency		
No	254	42.4
Yes	345	57.6
Scared to go outside		
No	147	24.5
Yes	452	75.5
Difficulty in adaptation to online classes		
No	249	41.6
Yes	350	58.4
Difficulty in internet network		
No	240	40.1
Yes	359	59.9
Class interrupted		
No	71	11.9
Yes	528	88.1
Difficulty in task, exam, and consultation		
No	185	30.9

Variable	Frequency (n)	Percentage (%)
Yes	414	69.1
Satisfied with the result of online class		
No	505	84.3
Yes	94	15.7
Worry for delaying school		
No	77	12.9
Yes	522	87.1
Depression Score (Mean: 7.27 and SD \pm 6.75)		
Depression		
No	434	72.5
Yes	165	27.5
Anxiety Score (Mean: 7.74 and SD \pm 5.49)		
Anxiety		
No	332	55.4
Yes	267	44.6
Stress Score (Mean: 11.33 and SD \pm 6.98)		
Stress		
No	442	73.8
Yes	157	26.2

Multivariate analysis of factors associated with depression

Table 2 shows results of the multivariate logistic regression analysis for depression. Factors that were significantly associated with lower likelihood of having depression were in the second year (OR = 0.43, 95% CI = 0.24-0.75, $p < 0.01$), having

friends who got infected with Covid-19 (OR = 0.36, 95% CI = 0.14-0.92, $p < 0.05$), and feeling worried for delaying school (OR = 0.40, 95% CI = 0.22-0.74, $p < 0.01$). Participants who had difficulties adapting to online classes (OR = 1.78, 95% CI = 1.13-2.82, $p < 0.05$) were more likely to have depression.

Table 2. Multivariate analysis of factors associated with depression

Variables	Total
	OR (95% CI)
Age	
17-21 YO	1.00
22-26 YO	1.43 (0.66~3.10)
Sex	
Male	1.00
Female	1.15 (0.64~2.06)
Grade	
First year	1.00
Second year	0.43 (0.24~0.75)**
Third year	0.67 (0.36~1.24)
Fourth year	0.67 (0.28~1.60)
Internship	0.38 (0.13~1.06)

Variables	Total
	OR (95% CI)
Department	
Medical	1.00
Pharmacy	0.88 (0.49~1.57)
Nursing	0.83 (0.39~1.75)
Physiotherapy	1.40 (0.64~3.07)
Return to home	
No	1.00
Yes	0.90 (0.51~1.58)
Looking for the Covid-19 information	
No	1.00
Yes	1.25 (0.45~3.48)
Looking for information on the Covid-19 trend in Indonesia	
No	1.00
Yes	1.02 (0.67~1.71)
Looking for information on the Covid-19 trend in living residency	
No	1.00
Yes	0.77 (0.46~1.28)
Any Covid-19 cases in family	
No	1.00
Yes	1.61 (0.66~3.90)
Any Covid-19 cases among friends	
No	1.00
Yes	0.36 (0.14~0.92)*
Any Covid-19 cases in significant others	
No	1.00
Yes	1.58 (0.97~2.58)
Any experience of quarantine	
No	1.00
Yes	1.16 (0.76~1.77)
Cancelled any events	
No	1.00
Yes	0.77 (0.50~1.19)
Large Scale Social Restriction implemented in living residency	
No	1.00
Yes	1.20 (0.78~1.87)
Scared to go outside	
No	1.00
Yes	1.09 (0.66~1.78)
Difficulty in adaptation with online classes	
No	1.00
Yes	1.78 (1.13~2.82)*
Difficulty in the internet network	
No	1.00
Yes	1.17 (0.77~1.78)
Class interrupted	

Variables	Total OR (95% CI)
No	1.00
Yes	2.06 (0.97~4.36)
Difficulty in task, exam, and consultation	
No	1.00
Yes	1.11 (0.67~1.85)
Satisfied with the result of online class	
No	1.00
Yes	0.91 (0.48~1.71)
Worry for delaying school	
No	1.00
Yes	0.40 (0.22~0.74)**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Multivariate analysis of factors associated with anxiety

Table 3 shows the results of the multivariate logistic regression analysis for anxiety. Factors significantly associated with a lower likelihood of having anxiety were seeking information on the trend of Covid-19 per day in one's living area (OR = 0.55, 95% CI = 0.34-0.90, $p < 0.05$) and having friends who got infected with Covid-19 (OR = 0.33, 95% CI = 0.14-0.76,

$p < 0.01$). Participants who had significant others who got infected with Covid-19 (OR = 2.01, 95% CI = 1.27-3.20, $p < 0.01$), experienced quarantine for 14 days (OR = 1.52, 95% CI = 1.04-2.26, $p < 0.05$), felt scared to go out (OR = 1.71, 95% CI = 1.08-2.71, $p < 0.05$), and had difficulties with adaptation of online class (OR = 1.81, 95% CI = 1.21-2.73, $p < 0.01$) were more likely to have anxiety.

Table 3. Multivariate analysis of factors associated with anxiety

Variables	Total OR (95% CI)
Age	
17-21 YO	1.00
22-26 YO	0.50 (0.24~1.02)
Sex	
Male	1.00
Female	1.38 (0.80~2.36)
Grade	
First year	1.00
Second year	0.51 (0.30~0.86)*
Third year	0.87 (0.49~1.56)
Fourth year	1.66 (0.72~3.80)
Internship	0.69 (0.26~1.82)
Department	
Medical	1.00
Pharmacy	0.95 (0.56~1.61)
Nursing	0.92 (0.47~1.80)
Physiotherapy	0.62 (0.29~1.34)

Variables	Total
	OR (95% CI)
Return to home	
No	1.00
Yes	1.28 (0.75~2.13)
Looking for the Covid-19 information	
No	1.00
Yes	0.84 (0.33~2.15)
Looking for information on the Covid-19 trend in Indonesia	
No	1.00
Yes	1.24 (0.77~1.99)
Looking for information on the Covid-19 trend in living residency	
No	1.00
Yes	0.55 (0.34~0.90)*
Any Covid-19 cases in family	
No	1.00
Yes	1.50 (0.62~3.63)
Any Covid-19 cases among friends	
No	1.00
Yes	0.33 (0.14~0.76)**
Any Covid-19 cases in significant others	
No	1.00
Yes	2.01 (1.27~3.20)**
Any experience of quarantine	
No	1.00
Yes	1.52 (1.04~2.26)*
Cancelled any events	
No	1.00
Yes	1.19 (0.79~1.77)
Large Scale Social Restriction implemented in living residency	
No	1.00
Yes	1.37 (0.92~2.05)
Scared to go outside	
No	1.00
Yes	1.71 (1.08~2.71)*
Difficulty in adaptation to online classes	
No	1.00
Yes	1.81 (1.21~2.73)**
Difficulty in the internet network	
No	1.00
Yes	0.97 (0.53~1.42)
Class interrupted	
No	1.00
Yes	0.96 (0.53~1.76)
Difficulty in task, exam, and consultation	
No	1.00

Variables	Total OR (95% CI)
Yes	1.15 (0.73~1.80)
Satisfied with the result of online class	
No	1.00
Yes	0.76 (0.43~1.35)
Worry for delaying school	
No	1.00
Yes	1.27 (0.71~2.30)

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Multivariate analysis of factors associated with stress

Table 4 shows the results of the multivariate logistic regression analysis for stress. Factors significantly associated with a lower likelihood of having stress were looking for information on the trend of Covid-19 per day in living areas (OR = 0.55, 95% CI = 0.32-0.93, $p < 0.05$).

Participants who had significant others who got infected with Covid-19 (OR = 2.09, 95% CI = 1.27-3.46, $p < 0.01$), felt their classes interrupted (OR = 2.37, 95% CI = 1.06-5.30, $p < 0.05$), and had difficulties with adaptation to online classes (OR = 1.69, 95% CI = 1.05-2.72, $p < 0.05$) were more likely to have stress.

Table 4. Multivariate analysis of factors associated with stress

Variables	Total OR (95% CI)
Age	
17-21 YO	1.00
22-26 YO	0.57 (0.25~1.29)
Sex	
Male	1.00
Female	1.49 (0.78~2.83)
Grade	
First year	1.00
Second year	0.46 (0.26~0.83)**
Third year	0.64 (0.34~1.21)
Fourth year	0.91 (0.37~2.20)
Internship	0.63 (0.22~1.84)
Department	
Medical	1.00
Pharmacy	1.70 (0.89~3.24)
Nursing	1.89 (0.86~4.14)
Physiotherapy	1.59 (0.66~3.82)
Return to home	
No	1.00
Yes	1.08 (0.60~1.97)
Looking for Covid-19 information	

Variables	Total
	OR (95% CI)
No	1.00
Yes	0.77 (0.27~2.22)
Looking for information on the Covid-19 trend in Indonesia	
No	1.00
Yes	1.08 (0.63~1.85)
Looking for information on the Covid-19 trend in living residency	
No	1.00
Yes	0.55 (0.32~0.93)*
Any Covid-19 cases in family	
No	1.00
Yes	1.23 (0.49~3.08)
Any Covid-19 cases among friends	
No	1.00
Yes	0.48 (0.20~1.17)
Any Covid-19 cases in significant others	
No	1.00
Yes	2.09 (1.27~3.46)**
Any experience of quarantine	
No	1.00
Yes	1.42 (0.91~2.21)
Cancelled any events	
No	1.00
Yes	1.27 (0.81~2.01)
Large Scale Social Restriction implemented in living residency	
No	1.00
Yes	1.13 (0.72~1.78)
Scared to go outside	
No	1.00
Yes	1.14 (0.68~1.90)
Difficulty in adaptation with online classes	
No	1.00
Yes	1.69 (1.05~2.72)*
Difficulty in internet network	
No	1.00
Yes	1.22 (0.79~1.87)
Class interrupted	
No	1.00
Yes	2.37 (1.06~5.30)*
Difficulty in task, exam, and consultation	
No	1.00
Yes	0.95 (0.56~1.60)
Satisfied with the result of online class	
No	1.00
Yes	1.41 (0.75~2.63)
Worry for delaying school	

Variables	Total
	OR (95% CI)
No	1.00
Yes	1.25 (0.63~2.49)

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

DISCUSSION

The current study investigated the association of demographic and Covid-19 knowledge with depression, anxiety, and stress level in college students who underwent online classes during the Covid-19 outbreak. Our study revealed some factors associated with depression, anxiety, and stress, such as demographic respondents, especially year grade and knowledge factors related to someone have infected Covid-19. Online class learning adaptation during pandemic was found to be a prominent factor that causes depression, anxiety, and stress in health college students.

Trends of Covid-19 cases around the world were available at <https://covid19.who.int>. In contrast, the Covid-19 cases pattern in Indonesia was available at <https://covid19.go.id>.¹² The study identified that most students searched for the pattern of Covid-19 cases per day in Indonesia and their living areas. The severity of Covid-19 cases in the areas where the students lived was linked to the increasing levels of students' depression and anxiety.¹³ Demographic data results detected that most of the students had experienced 14 days quarantine, and there was a significant restriction of social interaction in their living areas, so they cancelled some events. As a consequence, most students feared going outside the house.

During Covid-19, most universities have transitioned to online class learning to keep learning quality in academic activities. The results showed that respondents needed help adapting to online classes and internet networks in the learning process, indicating

that health college student are not ready for online classes. Compared to the traditional classroom, the online class was more challenging and had more advantages for learners since it provided convenience and flexibility.¹⁴ The performance of the online learning students during the pandemic was equal to pre-pandemic courses.¹⁵ The most notable learning point during the pandemic is the absence of social interaction and face-to-face contact, which reduces the motivation and effort of the students.¹⁶ Our data indicated that 69.1% of respondents needed help with assignments, exams, and consultations. Most students wanted more than online classes (84.3%). The satisfaction of online learning classes depends on the course design, teacher quality, prompt feedback, and students' assumption.¹⁷ Communication and flexibility in the online learning class were associated with a higher student satisfaction level.¹⁸ It is important to recognize students' satisfaction since this component impacts online learning quality.¹⁹

This study evaluated depression, anxiety, and stress level among health college's student who underwent online classes during the Covid-19 outbreak. The results showed that depression, anxiety, and stress were identified in a small proportion of the health college students. Students in the second-year levels were associated with low levels of depression and stress. Compared to first-year students, the advanced students were more likely to have higher levels of depression, anxiety, and stress. Second-year students who felt convenient with the normal campus activities and social environment before pandemic need the significant adaptation with the situation changes during pandemic.²⁰ The psychological distress

among college students was identified due to the students' worry about losing an academic year.²¹ In addition, the decrease in mental health among college students was correlated with the impact of academic challenges.²²

Factors related to the Covid-19 cases as a trigger of depression, anxiety, and stress were investigated in the health college students. Respondents who had significant others infected with Covid-19 were correlated with anxiety and stress. The previous study showed that most universities students were worried that someone within their network might become infected with Covid-19. They fear the illness will be more severe after getting infected.²³ In addition, the universities students who know someone infected by Covid-19 were predicted to experience increased psychological impact.²⁴ This condition was also supported by our result indicating that Covid-19 led the students to fear going outside and correlated with higher anxiety levels. Moreover, quarantine experiences were correlated with college students' anxiety levels. The previous study addressed students' depression, anxiety, and stress when they experienced home quarantine during the Covid-19 outbreak.²⁵ Undergoing quarantine during the pandemic, students living alone were more likely to have depression.²⁶ Moreover, social interaction restriction was a significant cause of stress for college students.²⁷

This study highlighted that college students who had difficulties with adaptation to online classes had a high prevalence to get the incidence of depression, anxiety, and stress. In addition, those who felt their classes interrupted were more likely to have stress. Adaptation to the transition to remote education is essential for students and teaching faculty members. In coping with the problem of online learning during pandemic, there should be

an excellent information technology support system.²⁸ In addition, teaching faculty members should provide counseling services to assist students in dealing with the risk of developing mental health.^{29, 30}

RECOMMENDATIONS

Depression, anxiety, and stress were recognized among health college students. Students who had significant others who got infected with Covid-19, experienced quarantine and felt scared to go out were more likely to have anxiety. Students who had significant others who got infected with Covid-19 and felt class interrupted were more likely to have stress. Related to online education, the most prominent factor findings linked with depression, anxiety, and stress from this study was difficulties in online class adaptation. Our results can represent depression, anxiety, and stress parameters-related factors in health college students, which can be used as a consideration to develop counseling intervention for the students. However, this study also had a limitation. The questionnaire about knowledge of Covid-19 needed to be more comprehensive to measure the knowledge of participants related to Covid-19.

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REFERENCES

1. World Health Organization. Coronavirus disease 2019 (COVID-19): situation report, 82. Geneva: World Health Organization; 2020. 2020-04-11.
2. Wang Z-H, Yang H-L, Yang Y-Q, Liu D, Li Z-H, Zhang X-R, et al. Prevalence

- of anxiety and depression symptom, and the demands for psychological knowledge and interventions in college students during COVID-19 epidemic: A large cross-sectional study. *Journal of Affective Disorders*. 2020;275:188-93.
3. Liu X, Liu J, Zhong X. Psychological State of College Students During COVID-19 Epidemic. *LANGLH*. 2020;22. doi: <https://dx.doi.org/10.2139/ssrn.3552814>
4. Huang L, Lei W, Xu F, Liu H, Yu L. Emotional responses and coping strategies in nurses and nursing students during Covid-19 outbreak: A comparative study. *PLOS ONE*. 2020; 15(8):e0237303.
5. 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). doi: 10.7759/cureus.7541.
6. Rogowska AM, Ochnik D, Kuśnierz C, Chilicka K, Jakubiak M, Paradowska M, et al. Changes in mental health during three waves of the COVID-19 pandemic: a repeated cross-sectional study among polish university students. *BMC Psychiatry*. 2021;21(1):627. doi: 10.1186/s12888-021-03615-2.
7. Son C, Hegde S, Smith A, Wang X, Sasangohar F. Effects of COVID-19 on College Students' Mental Health in the United States: Interview Survey Study. *J Med Internet Res*. 2020;22(9):e21279. doi: 10.2196/21279.
8. Cao W, Fang Z, Hou G, Han M, Xu X, Dong J, et al. The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res*. 2020;287:112934. doi: 10.1016/j.psychres.2020.112934
9. Liu J, Zhu Q, Fan W, Makamure J, Zheng C, Wang J. Online Mental Health Survey in a Medical College in China During the COVID-19 Outbreak. *Front Psychiatry*. 2020;11:459. doi: 10.3389/fpsy.2020.00459
10. Damanik ED. Pengujian reliabilitas, validitas, analisis item dan pembuatan norma Depression Anxiety Stress Scale (DASS). Universitas Indonesia: Indonesia; 2006.
11. Devi HM, Purborini N, Chang HJ. Mediating effect of resilience on association among stress, depression, and anxiety in Indonesian nursing students. *J Prof Nurs*. 2021;37(4):706-13. doi: 10.1016/j.profnurs.2021.04.004.
12. Syifa N, Purborini N. Trends of Influenza's Symptoms Drug Search Terms in Indonesian-Language using Google Trends in the Covid-19 Pandemic. *Borneo Journal of Pharmacy*. 2022;5(2):179-85.
13. Wu S, Zhang K, Parks-Stamm EJ, Hu Z, Ji Y, Cui X. Increases in Anxiety and Depression During COVID-19: A Large Longitudinal Study From China. *Front Psychol*. 2021;12:706601. doi: 10.3389/fpsyg.2021.706601.
14. Muthuprasad T, Aiswarya S, Aditya KS, Jha GK. Students' perception and preference for online education in India during COVID -19 pandemic. *Soc Sci Humanit Open*. 2021;3(1):100101. doi: 10.1016/j.ssaho.2020.100101.
15. Zheng M, Bender D, Lyon C. Online learning during COVID-19 produced equivalent or better student course performance as compared with pre-pandemic: empirical evidence from a school-wide comparative study. *BMC Med Educ*. 2021;21(1):495. doi: 10.1186/s12909-021-02909-z.
16. Almendingen K, Morseth MS, Gjølstad E, Brevik A, Tørris C. Student's experiences with online teaching following COVID-19 lockdown: A mixed methods explorative study. *PLOS ONE*. 2021;16(8):e0250378. doi: 10.1371/journal.pone.0250378.
17. Gopal R, Singh V, Aggarwal A. Impact of online classes on the satisfaction and performance of students during the pandemic period of COVID 19.

- Education and Information Technologies. 2021;26(6):6923-47.
18. Elshami W, Taha MH, Abuzaid M, Saravanan C, Al Kawas S, Abdalla ME. Satisfaction with online learning in the new normal: perspective of students and faculty at medical and health sciences colleges. *Med Educ Online*. 2021;26(1):1920090. doi: 10.1080/10872981.2021.1920090.
 19. Keržič D, Alex JK, Pamela Balbontín Alvarado R, Bezerra DdS, Cheraghi M, Dobrowolska B, et al. Academic student satisfaction and perceived performance in the e-learning environment during the COVID-19 pandemic: Evidence across ten countries. *PLOS ONE*. 2021;16(10):e0258807. doi: 10.1371/journal.pone.0258807
 20. Roche AI, Holdefer PJ, Thomas EBK. College student mental health: Understanding changes in psychological symptoms in the context of the COVID-19 pandemic in the United States. *Curr Psychol*. 2022;1-10. doi: 10.1007/s12144-022-03193-w.
 21. Hasan N, Bao Y. Impact of "e-Learning crack-up" perception on psychological distress among college students during COVID-19 pandemic: A mediating role of "fear of academic year loss". *Child Youth Serv Rev*. 2020;118:105355. doi: 10.1016/j.childyouth.2020.105355
 22. Haikal M, Doucette H, Meisel MK, Birch K, Barnett NP. Changes in College Student Anxiety and Depression From Pre- to During-COVID-19: Perceived Stress, Academic Challenges, Loneliness, and Positive Perceptions. *Emerg Adulthood*. 2022;10(2):534-45. doi: 10.1177/21676968211058516.
 23. Spatafora F, Matos Fialho PM, Busse H, Helmer SM, Zeeb H, Stock C, et al. Fear of Infection and Depressive Symptoms among German University Students during the COVID-19 Pandemic: Results of COVID-19 International Student Well-Being Study. *Int J Environ Res Public Health*. 2022;19(3). doi: 10.3390/ijerph19031659.
 24. Browning MHEM, Larson LR, Sharaievska I, Rigolon A, McAnirlin O, Mullenbach L, et al. Psychological impacts from COVID-19 among university students: Risk factors across seven states in the United States. *PLOS ONE*. 2021;16(1):e0245327. doi: 10.1371/journal.pone.0245327
 25. Hamaideh SH, Al-Modallal H, Tanash M, Hamdan-Mansour A. Depression, anxiety and stress among undergraduate students during COVID-19 outbreak and "home-quarantine". *Nurs Open*. 2022;9(2):1423-31. doi: 10.1002/nop2.918.
 26. Bolatov AK, Seisembekov TZ, Askarova AZ, Baikanova RK, Smailova DS, Fabbro E. Online-Learning due to COVID-19 Improved Mental Health Among Medical Students. *Med Sci Educ*. 2021;31(1):183-92. doi: 10.1007/s40670-020-01165-y.
 27. McLafferty M, Brown N, McHugh R, Ward C, Stevenson A, McBride L, et al. Depression, anxiety and suicidal behaviour among college students: Comparisons pre-COVID-19 and during the pandemic. *Psychiatry Res Commun*. 2021;1(2):100012. doi: 10.1016/j.psycom.2021.100012.
 28. Kita Y, Yasuda S, Gherghel C. Online education and the mental health of faculty during the COVID-19 pandemic in Japan. *Sci Rep*. 2022;12(1):8990. doi: 10.1038/s41598-022-12841-x.
 29. Ishimaru D, Adachi H, Nagahara H, Shirai S, Takemura H, Takemura N, et al. Characteristics of Adaptation in Undergraduate University Students Suddenly Exposed to Fully Online

- Education During the COVID-19 Pandemic. *Front Psychiatry*. 2021; 12:731137. doi: 10.3389/fpsyt.2021.731137.
30. Lin C, Tong Y, Bai Y, Zhao Z, Quan W, Liu Z, et al. Prevalence and correlates of depression and anxiety among Chinese international students in US colleges during the COVID-19 pandemic: A cross-sectional study. *PLOS ONE*. 2022;17(4):e0267081. doi: 10.1371/journal.pone.0267081.