JURNAL PENDIDIKAN KEDOKTERAN INDONESIA

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ORIGINAL RESEARCH

CROSS-SECTIONAL STUDY: ONLINE LEARNING AND OTHER FACTORS IN COVID-19 CONTRIBUTING TO MEDICAL STUDENTS' STRESS IN BALI, INDONESIA

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ABSTRACT

Background: Conversion of face-to-face learning to online learning is applied since COVID-19 in the hope that this solution keeps students protected from mortality and morbidity caused by COVID-19.

Aims: This study aims to determine whether medical students' stress can be aggravated by several factors, namely online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies in order to obtain information if online learning can be applied in the future.

Methods: Research design used was cross-sectional with qualitative approach to describe medical students' opinion regarding stress elevation caused by six factors above. Data was collected using online questionnaires distributed to 238 medical students randomly chosen using simplified random sampling. Then, data is analysed with multiple linear regression.

Results: It is found that each factor (online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies) independently and collectively elevates medical students' stress. Collectively, six factors mentioned above has 85% effect on increasing medical students' stress.

Conclusion: Based on the results shown above, it can be concluded that the application of online learning has to be reconsidered due to stress it can bring.

Keywords: COVID-19; online learning; student's response; students' stress

PRACTICE POINTS

- In COVID-19, many people become comfortable in using online learning as a learning method for its effectivity without knowing the negative effects it can bring, especially to students' mental health.
- By examining both independent and overall effect of stress caused by online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies, it can be seen that the usage of online learning must be reconsidered as a learning method in the future.

INTRODUCTION

Stress refers to an emotional or physical tension that usually has a trigger. This trigger exists in the form of frustrating events or thoughts which is actually essential in order to respond to a challenge or demand, but when it lasts for a long time and continues in elevated rates, it is harmful to both psychological and physical health.[14] According to a national survey conducted by Sacred Heart University, Connecticut, it shows that 57% college students reported an elevated stress and 61% of them reports an overwhelming anxiety in the last 12 months. In addition, a survey that is finished at GC Women University, Sialkot using Depression Anxiety Stress Scale (DAAS) shows that frequency of depression, anxiety, and stress respectively was 75%, 88,4%, and 84,4%. These results show a tremendous elevation from normal levels which are 25%, 11,6%, and 15,6% for depression, anxiety, and stress respectively.[15]

Stress of college students in general are already quite concerning but stress actually has a higher impact on medical students. The main reason of this is medical education itself which is perceived as a stressful environment with rigid, authoritarian, and competitive systems that can potentially lead to burnout.[1] Some others factors found are fear of examination, high parental expectations, lack of leisure, financial problems, peer pressure, and aspirations for higher studies.[2] Levels of stress to vary in different countries, nevertheless showing a similar percentage such as 31,2% in British Universities, 41,9% in Malaysian medical schools, 61,4% in Thai medical schools, and 63,8% in Saudi Arabia Medical schools.[1]

COVID-19 is deemed as a very dangerous virus mainly because it is a novelty thus no one has ever gained an immunity to it. COVID-19 triggers an inflammatory response that can cause cytokine storm and lung damage in some people especially those with immunity problems. It also becomes deadlier with old age, male sex, and chronic conditions.[16]

Bali is one of the provinces in Indonesia showing elevated COVID-19 cases since the start of the outbreak with 1.232 active cases, 154.879 total cases, and 4.583 death cases reported per 20 July 2022, placing Bali in the top ten province in Indonesia with the highest COVID-19 cases.[17] Bali is high in its cases due to high population mobility between regions and between countries. Another plausible reason is Balinese population consists of many elderly people, thus causing a high potential of fatality rate.[3] These advancing cases are the reason for the closing of many sectors, including education. Nevertheless, even in this condition education must still continue, so traditional classroom learning inevitably must be converted to online learning.

Stress levels seem to get worse after COVID-19 pandemic, After the spread of COVID-19, online learning gets even more popular than before, making many people favour this way of learning instead of the traditional classroom (face-to-face) learning. Online learning also provides a more flexible schedule because it takes place over the internet, tend to be more affordable, and can be accessed anytime and anywhere.[18] On the other hand, online learning can be dangerous in increasing stress of medical students. For instance, an online survey conducted by medical universities in Western China who engage in online learning shows two of the potential stressors include online learning environment support and personal resilience and coping mechanism in online learning.[2]

In conclusion, online learning that is caused by COVID-19 is proven to be more effective than traditional classroom learning, but on the other hand it also has an impact on university students' psychosocial health.[2] According to some researches, in COVID-19 pandemic, there are a few factors that can become harder to maintain, therefore further increasing medical students' stress. For instance, online learning,[2]

financial barriers,[4] social isolation,[5,6] physical activities limitation,[5,6] change of diet,[5] anxiety-prone tendencies,[8] medication consummation,[5] and use of tobacco.[7] These factors, which are related to online learning application and COVID-19 itself still becomes a subject of debate.

Based on the explanation given beforehand, problems in this study can be divided into two main causes. Firstly, people tend to be interested in online learning because of its effectivity even though it is not yet proven to be more advantageous than traditional classroom learning when done in a long period of time. The other reason questions the validity if stress in university students is due to several factors, namely online learning, financial barriers, social isolation, physical activity limitation, change of diet, anxiety-prone tendencies, medication consummation, and use of tobacco. In order to carry out this research with more focus and depth, also to avoid problem widening, research problems should be limited. Therefore, two research problems are raised. Medication consummation and use of tobacco will be eliminated as aggravating factors due to the tendency of medical students who rarely consume drugs and use tobacco. Responses in this study will also be limited to medical students in Udayana University, Bali only.

Knowing problems related to COVID-19 are still considered as a novelty, there are little to no prior researches that evaluate deeply if COVID-19 that happens in Bali as one of most the vulnerable provinces in Indonesia can increase students' stress due to factors such as online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies. Because of this reason, authors aim to discuss this problem with more depth. Authors hope to provide more information if online learning can still be implemented in the future even when the pandemic is over.

Based on theories and explanations from other prior researches, authors determine a hypothesis that online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies can increase stress either independently and collectively.

METHODS

This study has six independent variables namely, online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies and a dependent variable which is medical students' stress. Data collection is done using online questionnaires and distributed to 238 Udayana University students from the first until seventh semester of the Bachelor of Medicine and Medical Profession Study Program, Faculty of Medicine, Udayana University, Bali. Samples are taken from 2018-2021 class with approximately 34 students representing each semester. Online questionnaire in this study is composed of 60 questions in total with 15 questions analysing online learning, 6 questions analysing financial barriers, 4 questions analysing social communication, 2 questions analysing physical activity limitation, 3 questions analysing change of diet, 5 questions analysing anxiety-prone tendencies, and 25 questions analysing stress.

This research used cross-sectional analysis design with multiple linear regression such as T-Test and ANOVA (F-Test) as its statistical analysis. Results are analysed using SPSS version 22. T-Test is used in finding individual influence of each factor namely, online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies in aggravating students' stress. Because this study uses a 5% confidence interval, reliability coefficient in this

study uses a significant value < 0.05. This research also used ANOVA (F-Test) to find the collective impact of online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies in increasing students' stress. Reliability coefficient of this test also uses a significant value < 0.05.

RESULTS AND DISCUSSION

Multiple linear regression identifies cause-effect relationship between independent and dependent variables. Before the hypothesis is analysed, set of tests known as classic assumption test, have to be completed.[19] Classic assumption test is divided into normality, multicollinearity, and heteroscedasticity tests.

Normality test in this study used the help of SPSS 22.0 For Windows and tested using Kolmogorov-Smirnov test. Based on SPSS output, significance value of 0.090 > 0.05 is obtained. It can be concluded that data is distributed normally.

Normality test was followed by multicollinearity test. Multicollinearity test in this study used the help of SPSS 22.0 For Windows. Based on the SPSS output, it is known that online learning variable has VIF value of 3.208 < 10.00 and tolerance value of 3.12 > 0.10, financial barrier variable has VIF value of 3.111 < 10.00 and tolerance value of 0.321 > 0.10, social isolation variable has VIF value of 3.038 < 10.00 and tolerance value of 0.329 > 0.10, physical activity limitation has VIF value of 1.732 < 10.00 and tolerance value of 0.729 > 0.10, change of diet variable has VIF value of 2.119 < 10.00 and tolerance value of 0.472 > 0.10, and anxiety-prone tendencies variable has VIF value of 1.948 < 10.00 and tolerance value of 0.513 > 0.10. Based on these results, it can be concluded that data is multicollinearity-free.

Results of Heteroskedasticity test in this study used the help of SPSS 22.0 for windows, and tested using Glaser test. Based on SPSS output, the significance value of each variable found are online learning of 0.651 > 0.05, financial barriers of 0.924 > 0.05, social isolation of 0.945 > 0.05, physical activity limitation of 0.123 > 0.05, change of diet of 0.133 > 0.05, and anxiety-prone tendencies of 0.866 > 0.05. Based on these results, it can be concluded that data did not have heteroscedasticity.

After classical assumption test have been carried out, data can be continued for multiple regression analysis.

Results of research hypothesis tests using multiple regression analysis are analysed by its independent and collective impact. Table 2 measured the significance value of each independent tests using T-Test. It is found that the result of each calculation is 0.000 < 0.05, so it can be concluded that there is a positive and significant influence of online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies on students' stress during the COVID-19 pandemic partially. Table 3 shows collective influence of online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies to students' stress during COVID-19 pandemic. Based on this result, it is known that the significance value is 0.000 < 0.05, so it can be concluded that there is a collective influence of online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies to stress of students' during COVID-19 pandemic.

Regression used to illustrate the influence of online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies on students' stress levels during the COVID-19 pandemic can be seen in table 4 with equation described as follows:

Y = 16.014 + 0.647 X1 + 0.742 X2+ 0.807X3 + 0.640 X4+ 0.760 X5 + 0.829 X6

Y = Stress level; X1 = Online learning; X2 = financial barriers; X3 = Social communication; X4 = Physical Activity; X5 = Diet; X6 = Anxiety-prone tendencies

Regression equation above shows that if free variables of online learning (X1) financial barriers (X2), social isolation (X3), physical activity limitation (X4), change of diet (X5) and anxiety-prone tendencies (X6) are worth 0 or constant, then the variables bound to stress level (Y) will be worth 16,014. Any change in the value in the units of a free variable will cause a change in the value of the bound variable by the beta coefficient of the free variable. For example, the increase in online learning by one-on-one, the stress level will increase by 0.647.

The magnitude of this collective influence contributed between online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies to students' stress during the COVID-19 pandemic period can be seen in the coefficient of determination table (Adjusted R Square) in table 5. It shows the value of the coefficient of determination (Adjusted R Square) of 0.850. This shows that 85% of students' stress is influenced by online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies, while the remaining 15 % were influenced by other factors that were not studied.

(INSERT ALL TABLES HERE)

Students' responses from Faculty of Medicine, Bachelor of Medicine and Medical Profession Study Program explained all factors research, namely online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies both individually and collectively aggravate stress in medical students. Based on the questionnaires, Findings shows that, there are many reasons why online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies can cause stress in medical students.

Online learning is only preferred by half of respondents compared to offline learning due to vision problems and no place dedicated specifically for learning. Based on some respondents' opinions, they are not ready to learn by online learning because of a few reasons. First, they are uncomfortable in discussing matters with strangers they may never meet in the real world, even if they are fairly comfortable in asking questions online to their professors and peers. Even though most of them are able to use computer well and are comfortable in using internet in order to search for information and download files, some of them are uncomfortable in computer maintenance, printer use and maintenance, and have no one to depend on if they have problems with them. Some also do not have supporting software such as antivirus and devices such as headphone and speaker. Based on these reasons, students feel that online learning in COVID-19 is a factor that can aggravate stress in medical students.

Results of these data also corresponds to the explanation of other studies discussed before. For example, research conducted at Eritrea Institute of Technology shows 71% students have moderate stress due to some stressors that includes inadequate learning facilities, difficulty to cope with long learning periods, high academic burdens, and excessive assignments.[20] In addition, according to World Medical Association, it is necessary for medical students to fulfil the goal of basic

medical education that includes acquiring knowledge, skills, and professional behaviours that will prepare them to unlimited career opportunities either in patient care, public care, clinical research, basic research, health management, and further medical education.[21] By applying online learning, face-to-face learning is minimalized, lectures are given without detailed explanation, instability of internet connection is more likely to happen, and additional expenses are required. On the other hand, there is a constant expectation to perform well even in this condition.[20]

After COVID-19 closed down many sectors and created economic burdens to almost everyone, from households, primary earners, to large enterprises, it is clear that a lot of university students have also been affected. Half of students agree that they feel worried by their financial condition and one-third of them agree that they are emotionally drained by just thinking about this problem. A few of them even agree that they are frustrated by their finances. These burdens cause some students to be unable in learning effectively. This problem also affects their relation with other people due to missed social activities in order to maintain finances. Based on these reasons, students feel that the increase of financial barriers in COVID-19 is a factor that can aggravate stress in medical students.

Results of these data also corresponds to the explanation of other studies discussed before. For instance, research done by UNICEF in 2021 shows that COVID-19 has several impacts in the financial department. For instance, there is a continual decrease of household earnings since the pandemic started in 2019. 74,3% households significantly earn less in October-November 2020 compared to January 2020, 77,8% households experience increased essential expenses, 57,3% households experience increased communication expenses, previously secure new wave households become vulnerable, households' primary earner works fewer hours with less wages, 47,3% primary earners switched job sector from formal to informal, 87,5% businesses are affected by COVID-19 outbreak, and large enterprises experience long term structural problems.[22]

COVID-19 caused social isolation and a decrease of relationships between relatives, university peers, and professors. Most students reported feeling moderate stress due to this isolation, while others reported experiencing mild and severe stress. By having no one to interact with, problems such as stress, sleeplessness, immunity function reduction, anxiety, depression, even suicide rates tend to increase. Based on these reasons, students feel that social isolation in COVID-19 is a factor that can aggravate stress in medical students.

Results of these data also corresponds to the explanation of other studies discussed before using Pakistan students as its model, it shows several disadvantages of social isolation caused by online learning, for instance, lack of interaction and communication, feeling impersonal and isolated, lack of social context, lack of students' collaboration, inability to learn effectively, feeling uncomfortable and not confident, and unable to replace face-to-face traditional learning.[9]

Respondents reported that there is a reduction of physical activity after the pandemic shown by an increase of respondents preferring low intensity exercises compared to moderate and high intensity ones. A portion of respondents also chooses not to exercise. On the contrary, there is an increase of students who release stress by exercising. Based on these reasons, students feel that physical activity reduction in COVID-19 is a factor that can aggravate stress in medical students.

Results of these data also corresponds to the explanation of other studies discussed before that compares physical activity in men and women before and after the pandemic, the results show that before the pandemic, physical activity is classified

as very active with 69% physically active participants compared to after the pandemic with only 39%.[10] With this drastic reduce of physical activity, mental health problems inversely increase in the form of lower life satisfaction and happiness, stress, anxiety, depression, and lower mental well-being.[11]

Half of respondents reported problem in controlling frequency, portion, and type of food consumed when dealing with stress caused by online learning. Binge eating can result in High in Energy Density (HED) consumption, overweight, and obesity. Based on these reasons, students feel that change of diet in COVID-19 is a factor that can aggravate stress in medical students.

Results of these data also corresponds to the explanation of other studies discussed before, such as, research about overweight people shows that mental health issues such as major depression, bipolar, and panic disorders are closely linked to obesity.[23], maladaptive coping methods in dealing with stress will create behavioural problems. For instance, self-blame, low self-acceptance and more uncontrolled eating.[12], and after COVID-19, there is a 4,4% increase of weight gain which can further worsen mental health problems.[24]

Medical students are not too concerned with COVID-19, seeing that only some reported having problems such as headaches, sleeping problems, digestive problems, nausea, and loss of appetite when exposed to information regarding COVID-19. Anxiety in medical students is mainly related to their personality as an A-type highly stressed personality. Psychologically, half of them reported that they are less active, less energized, less enthusiastic, often annoyed, more often in having a bad mood, often exhausted, often worried, often restless, having difficulty concentrating when learning or working. Some of respondents even reported depression, anger, and dislike in doing anything at all. Academically, medical students are considered to be diligent and focused in their studies shown by their habit of doing tasks on a regular basis, using free time to complete their studies, preparing and reflecting on exams, and having good time management. On the other hand, this condition can be worrisome because they invest more energy and time in learning rather than resting. In addition, they also prefer to learn rather than to socialize, thus making them easily stressed. Based on these reasons, students feel that people with anxiety-prone tendencies in COVID-19 is a factor that can aggravate stress in medical students.

Results of these data also corresponds to the explanation of other studies discussed before by that mentioned chronic stress makes it increasingly difficult for academic success due to poor brain development that causes students to be more impulsive, hyperactive, and distracted. This condition leads to a lot of absence and a higher probability of quitting education, not to mention physical and psychological problems that are sure to arise.[13]

Knowing these implications exist and may become dangerous in maintaining students' well-being, it is important for every party involved in education especially online learning to understand not only its benefits but also its limitations and dangers. Due to this reason, students and education providers are hoped to reconsider students' stress before changing their learning style from face-to-face learning to online learning, especially for medical students.

This study's advantage lies in its high internal validity by focusing one specific issue which is stress in medical students caused by six factors mentioned above. Based on results obtained, recommendations can be made to rethink the decision of using online learning, especially for medical students due to its negative impacts, especially in causing high stress for students themselves. On the other hand, factors researched in this study only covered 85% influence in students' stress, so there are

still 15% impact not yet been described. In addition, this research only took samples from Medical Faculty, thus making this research has a low external validity.

CONCLUSION

Each factor namely online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies have an influence in students' stress during COVID-19 pandemic. Collectively, these factors researched also have an influence in raising students' stress during COVID-19 with a collective percentage of 85%.

RECOMMENDATION

It is recommended that this research be further developed, because this study only covered 85% of factors influencing student stress levels. In the future, other researchers are hoped to examine other factors other than what has been described in this study that have the same influence. In addition, this research only took samples from the Medical Faculty. It is hoped that in future researches, responses from other faculties can also be collected

COMPETING INTEREST

The authors declare that there are no competing interests related to the study

AUTHORS' CONTRIBUTION

- *Claudia Felicia Limanda* – developing research proposal, collecting data, data analysis, and publication manuscript.
- *Susy Purnawati* – developing research proposal and publication manuscript.
- *Luh Made Indah Sri Handari Adiputra* – developing research proposal and publication manuscript
- *Ketut Tirtayasa* – developing research proposal and publication manuscript.

APPENDIX

Table 1

Descriptive Test

Variable		N	Percetage
Gender	Male	160	67,2%
	Female	78	32,8%
Age (year)	*17*	2	8 %
	18	36	15,1%
	19	66	27,7%
	20	69	29%
	21	42	17,6%
	22	21	8,8%
	24	2	0,8%

Table 2

T-Test

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std.Error	Beta			Tolerance	VIF
(Constant)	8.930	2.012		4.440	.000		
Online Learning	1.727	.070	*.850*	24.832	.000	1.000	1.000
(Constant)	24.204	1.592		15.200	.000		
Financial Barriers	3.046	.139	.818	21.846	.000	1.000	1.000
(Constant)	34.124	1.146		29.772	.000		
Social Communication	3.055	.140	.818	21.847	.000	1.000	1.000
(Constant)	37.934	2.135		17.767	.000		
Physical Activity Limitation	3.976	.406	.538	9.805	.000	1.000	1000
(Constant)	35.069	1.417		24.745	.000		
Change of Diet	3.535	.209	.741	16.939	.000	1.000	1.000
(Constant)	53.977	.441		122.332	.000		
Anxiety-prone Tendencies	5.086	.343	.695	14.830	.000	1.000	1.000

a. Dependent Variable: Students Stress

Table 3

ANOVA Test

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	9232.165	6	1538.694	225.427	.000[b]
Residual	1576.730	231	6.826		
Total	10808.895	237			

a. Dependent Variable: Stunts Stress (Y)
b. Predictors: Online Learning (X1), Financial Barriers (X2), Social Communication (X3), Physical Activity Limitation (X4), Change of Diet (X5), Anxiety-prone Tendencies (X6)

Table 4

Beta Coefficient

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	16.014	1.819		8.806	.000
Online Learning	.647	.091	.319	7.083	.000
Financial Barriers	.742	.165	.199	4.496	.000
Social Communication	.807	.164	.216	4.936	.000
Physical Activity Limitation	.640	.218	.087	2.943	.004
Change of Diet	.760	.175	.159	4.351	.000
Anxiety-prone Tendencies	.829	.257	.113	3.227	.001

Table 5

Coefficient of Determination (Adjusted R Square)

Model Summary

Model	R	R Square	Adjusted R Square	Std Error of the Estimate
1	,927[a]	,854	,850	2,61260

[a] Predictors: Online Learning (X1), Financial Barriers (X2), Social Communication (X3), Physical Activity Limitation (X4), Change of Diet (X5), Anxiety-prone Tendencies (X6)

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