ORIGINAL RESEARCH

FACTORS AFFECTING MEDICAL STUDENTS' STRESS DURING COVID-19 PANDEMIC: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Since the emergence of COVID-19 in 2019, Indonesia's COVID-19 Task Force has implemented distance or online learning in educational sectors, especially in Java and Bali. In its implementation, a certain number of medical students developed a tendency to prefer online learning compared to face-to-face learning without completely understanding its risks. Other factors such as financial barriers, social isolation, limitation of physical activity, change of diet, and anxiety-prone tendencies in COVID-19 pandemic, not much further research has been carried out. This study aims to determine whether medical students' stress can be aggravated by several factors, namely online learning, financial barriers, social isolation, limitation of physical activity, change of diet, and anxiety-prone tendencies in order to obtain information whether online learning can be applied, even when the pandemic is over.

Methods: Research design used a quantitative approach. Data collection was performed through online questionnaires distributed to 238 medical students selected using simplified random sampling. Data was analysed descriptively and inferentially. Inferential analysis used T-Test and ANOVA Test.

Results: Online learning, financial barriers, social isolation, limitation of physical activity, change of diet, and anxiety-prone tendencies independently and cumulatively elevate medical students' stress. Cumulatively, independent factors mentioned above have 85% effect in aggravating of medical students' stress.

Conclusion: Online learning application has to be reconsidered due to additional stress implicated to medical students. In addition, financial barriers, social isolation, limitation of physical activity, change of diet, and anxiety-prone tendencies are important factors in aggravating medical students' stress.

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

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PRACTICE POINTS

- In COVID-19, online learning is widely used by medical students as an alternative learning method due to its effectiveness without knowing its risks, especially in the context of mental health.
- By examining the independent and cumulative effects of stress caused by online learning, financial barriers, social isolation, physical activity limitation, change of diet, and anxiety-prone tendencies, the use of online learning as a learning method must be reconsidered.

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INTRODUCTION

Stress is a triggered emotional or physical tension that exists to respond to life challenges and demands. When it continues in long-term and/ or elevated rates, it can be harmful to psychological and physical health.[1] College students, especially medical students not only have to deal with general chronic stress, but also academic stress. Academic stress happens as a result of stressful environment with rigid, authoritarian, and competitive systems,[2] afraid of exams, high expectations from parents, lack of leisure, peer pressure, financial problems, and aspirations for higher studies.[3] Stress in medical students varies in different countries, however showing similar percentages in British, Malaysian, and Saudi Arabian medical schools.[2]

COVID-19, a novel virus, is considered hazardous since its appearance in 2019. This virus spreads by respiration and can trigger an inflammatory response in the form of cytokine storm and lung damage, especially in people with risk factors such as old age, male sex, chronic conditions, and immunity problems.[4] According to the Indonesian Covid-19 task force, since the emergence of COVID-19, Bali has always been in the top ten provinces with the most active cases, total cases, and deaths.[5] Plausible reasons for these advancing numbers are an elevated number of Balinese elderly population and a higher than average mobility between regions and countries in Bali.[6] Based on regulations issued by Minister of Education and Culture, implementation of learning in educational units can be done either through limited face-to-face learning and/or distance learning, especially in Java and Bali due to its number of cases.[7]

Since this implementation, there are two different opinions of medical students with a certain number preferring online learning while the other preferring face-to-face learning. In one-way, online learning provides a more flexible schedule and tends to be more affordable.[8] However, online learning has a negative impact in activating potential stressors and affecting psychosocial health in medical students. In COVID-19 pandemic, there are several factors that can escalate students' stress. For instance, online learning implementation,[3] financial barriers,[9] social isolation, limitation of physical activities,[10,11] change of diet,[10] and anxiety-prone tendencies.[12]

Knowing COVID-19 and problems related to it is still considered a novelty, this study aimed to further evaluation if there is an independent and cumulative relation between online learning, financial barriers, social isolation, limitation of physical activities, change of diet, and anxiety-prone tendencies in increasing stress of medical students. Based on results of this study, it can be decided whether online learning can still be implemented even after the pandemic is over, especially for medical students.

METHODS

Study Design

This study used a quantitative design with a survey approach to examine the impact of online learning, financial barriers, social isolation, limitation of physical activities, change of diet, and anxiety-prone tendencies in COVID-19 to medical students' stress. Survey is defined as individual sample collection of information based on their responses to questions given.[13] Survey in this study requires participants to choose a number-labelled response on each question based on their particular perception of a condition. Data collection is implemented through questionnaires containing 60 questions each which are based partially from other existing questionnaires and recomposed based on their relevance (Table 1).

Table 1. Source of Questionnaire

Factors	Source of Questionnaire
Online learning	E-learning Characteristics and Readiness Questionnaire[14]
Financial barriers	Affective Reaction and Relational/ Interpersonal Behavior[15]
Social isolation	Covid-19 Student Stress Questionnaire[16]
Change of diet	Emotional Eater Questionnaire[17]
Anxiety regarding Covid-19	Coronavirus Anxiety Scale[18]
Psychological Distress	The Brief Job Test Questionnaire[19]
Academic Distress	Researchers-Made Questionnaire on Factors Affecting Mathematics Performance of Laboratory High School Students at Laguna State Polytechnic University A.Y. 2009-2010[20]

Validity and reliability tests are conducted in thirty participants to ensure questionnaire's accuracy and consistency. Decision making for validity showed r value more than r table for all questions which ranges from 0.361-0.920 while reliability showed Cronbach's Alpha more than 0.60 which ranges from 0.678-0.851 for all aspects making research instrument valid and reliable. This study determined medical students as total population, medical students from Bachelor of Medicine and Medical Profession Study Program, Faculty of Medicine, Udayana University, Bali class 2018-2021 as study population. Samples consisted of 238 medical students of Bachelor of Medicine and Medical Profession Study Program, Faculty of Medicine, Udayana University, Bali with 34 students from each semester (1st until 7th). Samples are recruited based on simplified random sampling.

In order to protect human rights and welfare of research subjects also ensuring that research can be done according to applicable guidelines, ethical clearance of this study was approved by Research Ethics Committee, Faculty of Medicine, Udayana University, Bali No. 723/UN14.2.2.VII.14/LT/2022. An informed consent procedure has also been carried out by participants prior to questionnaire completion.

Data Analysis

Data is analysed using descriptive and inferential analysis. Demographic of participants was reported by number and percentage based on gender and age. Questions were analysed and given specific codes based on category. Analysis design used in this study is cross-sectional analysis with T-Test and ANOVA-Test as its statistical analysis that were analysed using SPSS version 22. Both T-Test and ANOVA Test in this study used a 95% confidence interval. T-Test analysed independent correlation of Online Learning, Financial Barriers, Social Communication, Physical Activity Limitation, Change of Diet, and Anxiety-prone Tendencies to stress. ANOVA Test analysed cumulative correlation of Online Learning, Financial Barriers, Social Communication, Physical Activity Limitation, Change of Diet, and Anxiety-prone Tendencies to stress.
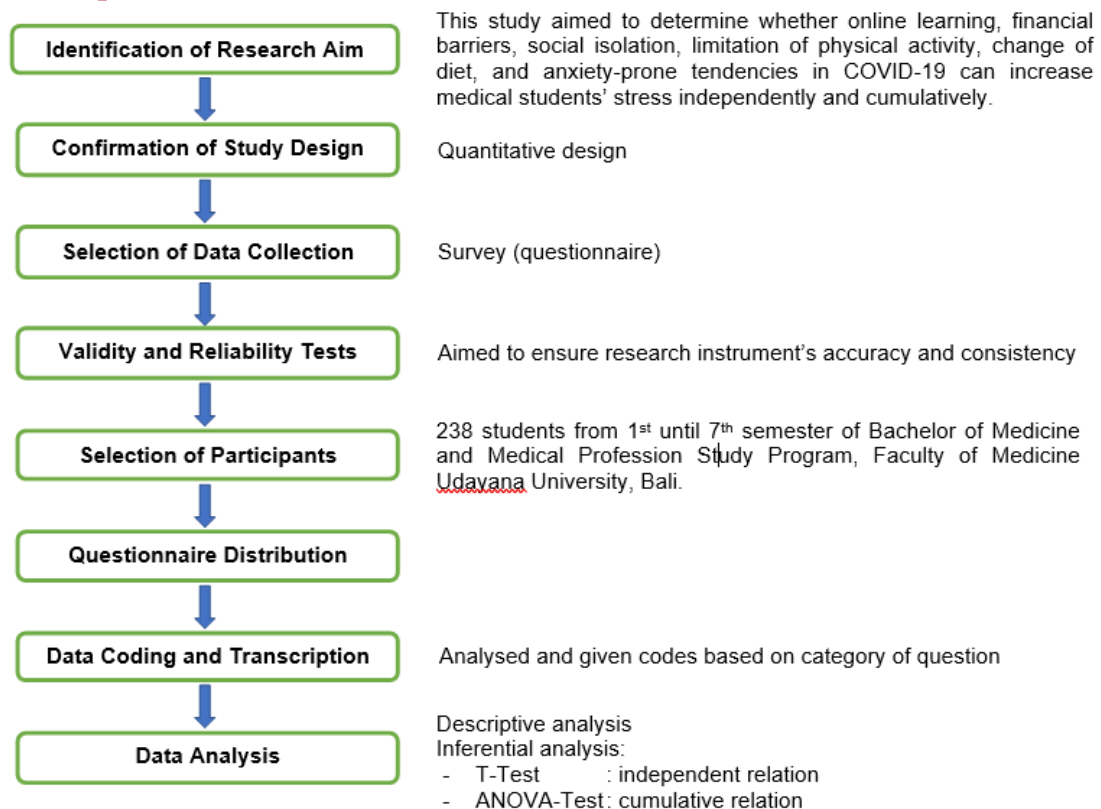
Research Steps

Figure 1. The Process of Study

RESULTS AND DISCUSSION

Table 2 below shows the demographics characteristics of the participants.

Table 2. Demographics of Participants

Characteristics	N	Percentage
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%

The results of T-Test (Table 3) showed a significant difference between online learning and stress (p = <0.001), financial barriers and stress (p = <0.001), social isolation and stress (p = <0.001), limitation of physical activity and stress (p = <0.001), change of diet and stress (p = <0.001), and anxiety-prone tendencies (p = <0.001) that showed an independent relation between online learning, financial barriers, social isolation, limitation of physical activities, change of diet, and anxiety-prone tendencies in increasing stress of medical students. Prior, data has also passed classical assumptions tests which consist of normality, multicollinearity, and heteroscedasticity tests.[21]

Table 3. Online Learning, Financial Barriers, Social Communication, Physical Activity Limitation, Change of Diet, and Anxiety-prone Tendencies Independent Influence to Stress

Variable	Unstandardized Coefficients B	t-test value	p-value
(Constant)	8.930	4.440	<0.001
Online Learning	1.727	24.832	<0.001
(Constant)	24.204	15.200	<0.001
Financial Barriers	3.046	21.846	<0.001

Variable	Unstandardized Coefficients B	t-test value	p-value
(Constant)	34.124	29.772	<0.001
Social Communication	3.055	21.847	<0.001
(Constant)	37.934	17.767	<0.001
Physical Activity Limitation	3.976	9.805	<0.001
(Constant)	35.069	24.745	<0.001
Change of Diet	3.535	16.939	<0.001
(Constant)	53.977	122.332	<0.001
Anxiety-prone Tendencies	5.086	14.830	<0.001

The results of ANOVA-Test (Table 4) showed a significant difference between online learning, financial barriers, social isolation, limitation of physical activity, change of diet, and anxiety-prone tendencies and stress (p = <0.001) that showed a cumulative relation between online learning, financial barriers, social isolation, limitation of physical activities, change of diet, and anxiety-prone tendencies in increasing stress of medical students.

Table 4. Online Learning, Financial Barriers, Social Communication, Physical Activity Limitation, Change of Diet, and Anxiety-prone Tendencies Cumulative Influence to Stress

Model	df	ANOVA	p-value
Regression	6	225.427	<0.001a
Residual	231		
Total	237		

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

Magnitude (Table 5) stated that the cumulative influence of online learning, financial barriers, social isolation, limitation of physical activities, change of diet, and anxiety-prone tendencies influenced 85% of medical students' stress, while the remaining 15% were influenced by other factors that are not included in this study.

Table 5. Magnitude of Cumulative Influence of Online Learning, Financial Barriers, Social Communication, Physical Activity Limitation, Change of Diet, and Anxiety-prone Tendencies to Stress

Model	R	R Square	Adjusted R Square
1	0.927[a]	0.854	0.850

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

Answers obtained in the questionnaire will further explain with more depth the potential of online learning, financial barriers, social isolation, limitation of physical activity, change of diet, and anxiety-prone tendencies in increasing medical students' stress.

Online learning impact on medical students' stress

Online learning is only preferred by 46.4% respondents due to vision problems (45.2%) and no specified place dedicated for learning (43.9%). Some respondents believed they are not ready to learn by online learning mainly because they are uncomfortable in discussing matters with strangers that they never meet in person (49%) even if they are fairly comfortable in asking questions online to their professors and peers (71.5%). Even though most of them are able to use computer well (88.3%) and are comfortable in internet use for downloading files and searching for information (79.5%), a certain proportion is uncomfortable in computer maintenance (34.3%), printer use and maintenance (20.9%), and have no one to depend to if there are problems with these devices. (37.7%). Some respondents reported not having supporting software such as antivirus (34.7%) and devices such as headphones and speaker (17.2%).

Compared to other prior studies, similar outcomes are obtained by Eritrea Institute of Technology. A total of 71% students reported a moderate stress due to inadequate learning facilities, long learning periods, high academic burdens, and excessive assignments. By further minimizing face-to-face learning and replacing it with online learning, lectures are given without a detailed explanation,

there is a higher chance of internet connection instability, additional expenses are required, meanwhile, expectation to perform well still stands.[22] According to World Medical Association, medical students are responsible in fulfilling the goal of basic medical education (knowledge, skills, and professional behaviours) for preparation of unlimited career opportunities in either patient or public care, clinical or basic research, health management, and further medical education,[23] making burden to perform well considerably higher than for college students in general.

Financial barriers impact on medical students' stress

Due to the closing of many sectors which creates additional economic burdens, a considerable proportion of households, primary earners, and large enterprises worldwide are implicated. Data collected by UNICEF shares the same facts that in 2021, COVID-19 impacts the financial department globally since its emergence in 2019. For instance, a continual decrease of household earnings has happened. 74.3% households continue to earn less, 77.8% and 57.3% households respectively experience an increase in essential and communication expenses, previously secured households become vulnerable, primary earners work fewer hours with less wages, 47.3% primary earners switched jobs from formal to informal, 87.5% businesses are affected by COVID-19 outbreak, and large enterprises start to experience long term structural problems.[24] According to this statement, it can be concluded that most students are also implicated by the same problem. 51% questionnaire respondents agree of feeling worried by financial problems, 31.4% feel emotionally drained only by thinking about this problem while 16.7% are frustrated by their finances. Approximately 17.6% students are unable to learn effectively and 13.4% decrease their social relationships in order to maintain finances.

Social isolation impact on medical students' stress

Social isolation is proven to contain some risks such as the lack of interaction and communication

that cause the inability to learn effectively, feeling impersonal and isolated, lacking social context and collaboration, and increasing uncomfortable and unconfident feelings.[25]

Respondents reported a mild-severe relationship decreases between relatives (69%), university peers (79.1%), and professors (78.7%) since the emergence by COVID-19. 44.4% respondents experience moderate stress due to social isolation, while others experience mild (36.9%) and severe stress (15.9%). When compared with a similar study done in Pakistan students, results mutually show by having no one to interact with, stress, sleeplessness, immunity function depletion, anxiety, depression, and suicide rates tend to increase.[25]

Physical activity reduction impact on medical students' stress

Most respondents reported preferring low intensity exercises compared to moderate and high intensity exercises. In addition, a total of 30.5% respondents also chose not to exercise after the pandemic. Results are supported by comparing it to other studies done prior that physically active participants are almost two times before (69%) the pandemic than afterwards (39%).[26] By drastically reducing physical activity, mental health problems tend to increase in the form of lower life satisfaction and happiness, stress, anxiety, depression, and lower mental well-being.[27]

Change of diet impact on medical students' stress

Other studies reported that after COVID-19, there is an average of 4.4% weight gain.[28] Data corresponds to research results which shows an increase of frequency (69.5%), portion (58.6%), and food type (58.2%) in respondents when dealing with stress caused by COVID-19. Binge eating, in turn, can potentially result in High in Energy Density (HED) consumption, overweight, and obesity. When people become overweight, several mental health issues can potentially arise in the form of major depression, bipolar, and panic disorders.[29] Behavioural problems tend to increase as well in the form of maladaptive coping methods such as self-blame, low self-acceptance, and uncontrolled eating.[30]

Anxiety-prone tendencies impact on medical students' stress

Medical students are not very concerned with COVID-19. Only a certain number of respondents reported having headaches (11.7%), sleeping problems (12.1%), digestive problems (10.5%), nausea (8.8%), and appetite loss (12.1%) when exposed to COVID-19 related information.

According to respondents, psychologically, they reported to be less active (59.4%), less energized (56.5%), less enthusiastic (48.5%), often angry (64.4%), often annoyed (45.2%), often having a bad mood (50.2%), often exhausted (23%), often worried (40.6%), often restless (49%), and having difficulty concentrating when learning or working (54.8%). Some of them even reported depression, anger, and dislike in doing anything at all (69.5%).

Academically, respondents are considered to be diligent and focused in their studies. In addition, they also have good time management. This result is shown by the tendency of students to do tasks on regular basis (90.7%), use free time to complete their studies (74%), and prepare and reflect on exams (95%). However, this condition is worrisome because they invest more energy and time into studying compared to resting (82.1%) and they usually prefer to learn rather than to socialize (75.7%), thus making them easily stressed compared to students in general.

Based on sources that discuss chronic stress, it is agreed that stress suppresses brain development that causes students to be more impulsive, hyperactive, and distracted. This condition can lead to more absence and a higher probability of quitting education altogether. Other physical and psychological problems are sure to follow.[31]

Results of this study explains that while online learning has some advantages in its flexibility and easy access, it can become a source of stress, making its implementation after the COVID-19 pandemic still debatable. This study aimed to give another view of online learning disadvantages to medical students and other parties involved in its implementation. Other implications such as financial barriers, social isolation, reduction of physical activity, change of

diet, and anxiety-prone tendencies also need to be considered by medical students, especially Balinese medical students due to higher stress impact as a result of more elevated cases compared to other provinces in Indonesia.[6] However, limitations of this study are its use of survey that just analyses students' opinion and perception about stress which might not be too accurate[13] and its low external validity making it not accurate enough to determine students' stress in other populations.[32]

CONCLUSION

Online learning, financial barriers, social isolation, reduction of physical activity, change of diet, and anxiety-prone tendencies in COVID-19 pandemic are risk factors that can increase stress in medical students independently and cumulatively. Considering this, its implementation after the pandemic is over is still debatable, especially for medical students.

RECOMMENDATION

Authors advise educational institutions to rethink the decision to online learning continuation after COVID-19 pandemic is over. Medical students should also pay attention to other risk factors in COVID-19 such as financial barriers, social isolation, reduction of physical activity, change of diet, and anxiety-prone tendencies in order to minimalize them. Future researches need to access stress more comprehensively not only based on students' perception and widen the scope of study.

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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

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