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The Prevalence and Association of Stress with Sleep Quality during the COVID-19 Pandemic among Medical Students at Airlangga University

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ABSTRACT The COVID-19 pandemic requires students to adapt to circumstances and cause various kinds of psychological problems during a pandemic outbreak. Some may experience stress, insomnia or hypersomnia. There are many factors causing poor sleep quality in students, including psychological problems such as stress which can worsen the quality of student's sleep during the COVID-19 pandemic. This study aims to prove that there is a relationship between stress and the sleep quality of medical students at Airlangga University during the COVID-19 pandemic. This study is an observational analytic study using the cross-sectional design to assess the relationship between stress and sleep quality of respondents using the Pittsburgh Sleep Quality Index (PSQI) and Depression, Anxiety, Stress Scale - 42 (DASS-42) questionnaires. The research subjects were active pre-clinical students in the medical study program, Faculty of Medicine, Airlangga University, totaling 280 students who were divided into 3 batches, namely Class of 2019, Class of 2020, and Class of 2021. From the results of the study, it was found that 84.7% of students experienced poor sleep quality and a normal stress level of 55.5%. Sleep quality and stress levels are related to each other. This is proven by the Spearman rank analysis, which shows sleep quality is related to the stress level with a p-value = 0.000 and rho = 0.230. Based on these results, it was concluded that sleep quality and stress level have a positive correlation. The researcher expects that the institution will be able to use the study's findings as information about student stress levels and sleep quality in order to prevent stress and poor sleep or to implement health-related stress management programs for students.

INDEX TERMS Correlation, COVID-19, Sleep Quality, Stress Level

I. INTRODUCTION

The COVID-19 pandemic causes a variety of psychological reactions in a pandemic outbreak. Some may experience stress, insomnia or hypersomnia, changes in diet, or substance abuse. One of the most frequent examples of this situation is mass panic.

Sleep is generally based on physiological characteristics in mammals including reduced body movement and electromyographic activity, reduced responsiveness to external stimuli, closed eyes, reduced respiratory rate, and changes in brain wave architecture [1]. Good sleep health with the right quality and quantity is recognized as an indicator of vitality, mental, emotional and physical health that leads to a good quality of life. Meanwhile, persistent lack of sleep can cause changes in physical health, leading to more serious conditions and even death [2].

The quality of a medical student's sleep affects not only how well they function academically but also how their behavior, mental health, and physical health will change over time. Compared to students from other fields, undergraduate medical students are more likely to report having poor sleep quality [3]. Pre-clinical medical students frequently experience poor sleep quality. According to Rezaei's research, 60% of students with a global PSQI score of 5 or more are considered "bad sleepers," while 40% of students with score of ≤ 5 are considered "good sleepers" [4].

The impact of COVID-19 on sleep quality varies from person to person and depends on the quality of sleep before the outbreak. Interestingly, some people who suffered from (medical) insomnia before the outbreak saw a significant improvement in sleep quality, while 20% of people who slept well before the pandemic worsened during the pandemic [5].

Several studies have shown a significant increase in poor sleep quality in medical students, with the number of poor sleep quality before the pandemic reaching 41.46%, and during pandemic increasing to 65.85% [6].

Various efforts have been made to deal with this pandemic, such as carrying out isolation, social distancing restrictions, and closing educational institutions, workplaces, and entertainment venues requiring people to stay in their homes to help break the chain of transmission [7]. The stress that people may experience during a pandemic can manifest as fear and anxiety about their health, changes in sleeping and eating patterns, difficulty sleeping and concentrating, worsening of chronic health problems, and increased intake of alcohol, smoking, or other substances [8].

The term stress is often used in scientific circles and in everyday language. For example, "stress" is sometimes used to refer to an actual life event or situation that happens to a person, such as losing a job or losing a spouse (hereinafter referred to as "stressor" or "stress exposure"). Stress is also used to refer to the cognitive, emotional, and biological reactions evoked by the situation ("stress response") [9]. Stress is the body's reaction to a change that requires a physical, psychological, and/or emotional response, regulation, and/or adaptation [10]. A stressor is an internal and external stimulus, that activates the Hypothalamic Pituitary Adrenal (HPA) axis and the sympathetic nervous system resulting in physiological changes. Long-term stress exposure can cause depression, post-traumatic stress disorder, and anxiety disorders [11]. The quantity and quality of sleep are just one of the numerous variables that influence stress levels. Due to the intense lectures and assignment obligations, medical students typically get less sleep which makes them feel sleepy throughout the day and causes them to have poorer sleep quality [12]. Adolescents who lack sleep are more likely to experience depression, consider taking their own lives, and substance abuse problems [13]. Several studies show a significant relationship between stress level and sleep quality, a high prevalence of poor sleep quality (76%) and stress (53%) were reported in studies conducted in Saudi Arabia in 2017 with a statistically significant correlation ($p < 0.001$).

According to logistic regression, students who are not stressed out are less likely to have poor sleep quality [14]. Additionally, according to Safhi's research, there is a strong correlation between stress and poor sleep quality ($P < 0.001$). 65% of all students reported experiencing stress. 76.4% of students had a total PSQI score below five, which indicates poor sleep quality. and it showed that an increase in stress levels is a significant predictor of having poor sleep quality [15]. The COVID-19 pandemic has also had an effect on stress levels among medical students. The results of research by Awadalla conducted in Saudi Arabia stated that overall, the stress felt by medical students during the

pandemic was (20.6%) significantly higher ($p = 0.001$) than before the pandemic (11.6%) [16].

Therefore, researchers are interested to prove that there is a relationship between stress and the sleep quality of medical students at Airlangga University during the COVID-19 pandemic.

II. METHOD

This type of research is an analytic observational study with a cross-sectional approach conducted at the Faculty of Medicine, Airlangga University. The population in this study were students of the Faculty of Medicine, Airlangga University, class of 2019, 2020, and 2021, who met the criteria, namely active students, students who were willing to be research subjects, pre-clinical students, and students aged 18-23 years. The population in this study amounted to 863. The sample calculation used the slovin formula with a Margin of Error of 0.05, so a minimum sample size of 280 was obtained. The sampling in this study used the Stratified Random Sampling technique based on the year of entry, and it was found that the number per stratum was 92 class of 2019, 92 class of 2020, and 97 class of 2021. are then drawn using a random sampling technique up to the number determined by the strata.

This study used an instrument in the form of a questionnaire. Research subjects were asked to fill out an identity form and a questionnaire in the form of the PSQI (Pittsburgh Sleep Quality Index) to assess sleep quality, The PSQI questions are grouped into 7 components to be assessed, namely sleep duration, sleep disturbance, sleep latency, daytime disfunction, sleep efficiency, overall sleep quality, and use of sleeping pills. The seven PSQI component scores have an overall reliability coefficient (Cronbach's alpha) of 0.83, indicating a high degree of internal consistency. A global PSQI score of > 5 resulted in a diagnostic sensitivity of 89.6% and a specificity of 86.5% ($kappa = 0.75$, $p < 0.001$) in differentiating good and poor sleep quality [17]. The DASS-42 questionnaire (Depression Anxiety Stress Scale) to measure the stress level of the respondents. The DASS-42 consists of 42 symptoms divided into three subscales of 14 items: a depression scale, an anxiety scale, and a stress scale. Participants rated the degree to which they had experienced each symptom during the previous week on a scale of 0-3. The results of the validity test on 3 of the 14 items of the DASS 42 questionnaire using the Pearson product moment. After the data was collected, it showed that the Pearson correlation value was positive, which was more than 0.532 for all stress, anxiety and depression items. Test the reliability of measuring instruments using Cronbach's alpha. Reliability test results obtained on 3 of the 14 items of the DASS 42 questionnaire showed stress = 0.951, anxiety = 0.943, and depression = 0.952 [18].

II. RESULT

Based on TABLE 1 on the characteristics of the research subjects, it was found that the subjects of this study totaled 281 active students at the Faculty of Medicine, Airlangga University, consisting of 92 (32.70%) students of the class of 2019, the 92 (32.70%) students of the class of 2020, and 97 (34.50%) students of the class of 2021. The characteristics of most respondents were female, totaling 180 students (64.10%) and the number of male respondents was 101 (35.90%). For ages dominated by ages 20-24 as many as 163 respondents (58%).

TABLE 1

CHARACTERISTICS OF RESPONDENTS

Variable	Characteristic	N	(%)
Gender	Male	101	35,9%
	Female	180	64,1%
Age	15-19	118	42%
	20-24	163	58%
Class Year	2019	92	32,7%
	2020	92	32,7%
	2021	97	34,5%
Total		281	100%

TABLE 2 shows respondent stress characteristics by gender show that most respondents experienced normal levels of stress. There were 61 (60.4%) male respondents with normal stress levels, as well as 95 (52.8%) female respondents with normal stress levels, and the data show that there is no significant difference in stress between males and females with p-value: 0.113 (p-value>0.05)

TABLE 2

CHARACTERISTICS OF RESPONDENT'S STRESS LEVEL BASED ON GENDER

Stress level	Gender	
	Female	Male
Normal	95 (52.8%)	61 (60.4%)
Mild	31 (17.2%)	20 (19.8%)
Moderate	36 (20%)	14(13.9%)
Severe	13 (7.2%)	4(4%)
Very Severe	5(2.8%)	2(1.9%)
P-Value	0.113	

Based on TABLE 3, There were 63 (53.4%) respondents between the ages of 15 and 19 who reported having experienced stress, which was classified into four levels: mild, moderate, severe, and extremely severe.

TABLE 3

Characteristics of respondent's stress level based on age range

Stress level	Age range	
	15-19	20-24
Normal	55 (46.6%)	101 (62%)
Mild	23 (19.5%)	28 (17.2%)
Moderate	29 (24.6%)	21 (12.9%)
Severe	7 (5.9%)	10 (6.1%)

Very Severe	4 (3.4%)	3 (1.8%)
P-Value	0.009	

However, there were more responders with typical levels of stress among those aged 20 to 24, 101 (62%) in total. A significant difference in stress levels was found between the ages of 15-19 and 20-24 with a p-value: 0.009 where less than the p-value of ≤ 0.05 .

TABLE 4 The characteristics of stress levels based on the class year shows that the class of 2020 and 2019 are less likely to experience stress. In particular, the 2019 class had 60 (65.2%) students while the 2020 class had 53 (57.6%).. Meanwhile, the class of 2021 has a greater level of stress (55.7%). There was a significant difference in stress level based on class year with a p-value: 0.012 where less than the p-value of ≤ 0.05 .

TABLE 4

CHARACTERISTICS OF RESPONDENT'S STRESS LEVEL BASED ON CLASS YEAR

Stress Level	Class Year		
	2019	2020	2021
Normal	60 (65.2%)	53 (57.6%)	43 (44.3%)
Mild	14 (15.2%)	17 (18.5%)	20 (20.6%)
Moderate	13 (14.1%)	13 (14.1%)	24 (24.7%)
Severe	4 (4.3%)	7 (7.6%)	6 (6.2%)
Very Severe	1 (1.1%)	2 (2.2)	4 (4.1%)
P-Value	0.012		

TABLE 5 shows the characteristics of the sleep quality of respondents based on gender. The majority of both sexes experienced poor sleep quality, 80 (79.2%) of the male respondents reported having poor sleep quality. Additionally, 58 (87.8%) of the responders who were female reported having poor sleep quality. The data show that there is no significant difference in stress between males and females with p-value: 0.056 (p-value>0.05).

TABLE 5

CHARACTERISTICS OF RESPONDENT'S SLEEP QUALITY BASED ON GENDER

Sleep Quality	Gender	
	Female	Male
Good	22 (12.2%)	21 (20.8%)
Poor	158 (87.8%)	80 (79.2%)
P-Value	0.056	

From TABLE 6 shows the characteristics of the respondent's sleep quality by age. In the age range 15-19 dominated by poor sleep quality with 103 (87.3%) respondents

experiencing poor sleep quality. The 20-24 age range was also dominated by respondents who experienced poor sleep quality with a total of 135 (82.8%) respondents. The majority of the two age ranges experienced poor sleep quality and there was no significant difference between the two age ranges p-value: 0.306 (p-value>0.05).

TABLE 6
CHARACTERISTICS OF RESPONDENT'S SLEEP QUALITY
BASED ON AGE RANGE

Sleep Quality	Age range	
	15-19	20-24
Good	15 (12.7%)	135 (17.2%)
Poor	103 (87.3%)	135 (82.8%)
P-Value	0.306	

In TABLE 7 shows the characteristics of the respondents by class year. The majority of the three classes experience poor sleep quality, class of 2019 with a total of 73 (79.3%) respondents, class of 2020 with a total of 73 (79.3%) respondents, however, the most class that experience poor sleep quality is the class of 2021 as many as 92 (94.8%). The data show that there is a significant difference in sleep quality based on class year with a p-value: 0.012 where less than the p-value of ≤ 0.05 .

TABLE 7
CHARACTERISTICS OF RESPONDENT'S SLEEP QUALITY
BASED ON CLASS YEAR

Sleep Quality	Class year		
	2019	2020	2021
Good	19 (20.7%)	19 (20.7%)	5 (5.2%)
Poor	73 (79.3%)	73 (79.3%)	92 (94.8%)
P-Value	0.012		

TABLE 8 shows the results of the Spearman rank correlation test with a p-value of 0.000 and Spearman's rho of 0.230, this shows a significant relationship between sleep quality and stress levels in medical students at Faculty of Medicine, Airlangga University.

TABLE 7
RELATIONSHIP OF SLEEP QUALITY AND STRESS LEVEL

Stress Level	Sleep Quality	
	Good	Poor
Normal	35 (81.4%)	121 (50.8%)
Stress (mild-Very severe)	8 (18.6%)	117 (49.2%)
P-Value	0.000	

IV. DISCUSSION

The results of the study in table 2, it shows that there is no significant difference in stress levels between male and female, the majority of the samples in this study have normal stress levels. These results are consistent with research by Hutahaean (2022) which was conducted at the medical

faculty in Medan where the majority of students experienced normal stress levels. In addition, in assessing the stress level of students, it cannot be grouped solely based on gender, because there are many other factors that cause stress in students [19].

In TABLE 3 shows that the age range 15-19 is more likely to experience stress than the age range 20-24. A significant difference in stress levels was found between the ages of 15-19 and 20-24. This higher stress level in the adolescent age group than in the more mature age group is caused because more mature individuals are often able to regulate their emotional responses better, and also more mature individuals tend to be less affected by bad responses caused by natural disasters such as COVID-19. [20].

In TABLE 4, it shows that based on the class year, it shows that each class experienced a normal level of stress, the class that experienced the most stress is the class of 2021 as the incoming class with a shorter study period than the other 2 classes. This may be due to the experience of the 2 classes above the class of 2021 having better self-adjustment than the class below them in dealing with life in medical college. The current study shows that stress among medical students is a dynamic process because stress continues to change with the year of study and the ever-changing expectations of students [21].

In general, medical students have an adaptive response and strong defense mechanisms because they are used to receiving many difficult assignments and other responsibilities [22]. Even though quite a lot of students experience stress, in their daily life, the majority of students have good academic performance or their productivity is quite good. The results of Tantra's research (2019) state that there is no significant relationship between stress levels and student learning outcomes which may be caused by the coping strategies employed by students. No matter how big the level of stress experienced by students, if you do a good coping strategy it will give you good learning outcomes [23].

TABLE 5 shows the characteristics of sleep quality of respondents based on gender. Where both sexes showed poor sleep quality and had no significant difference. According to Tristianingsih (2021), in her research, stated that there was no relationship between gender and sleep quality, but descriptively more female students experienced poor sleep quality [24].

The characteristics of sleep quality of the respondents based on age in table 6 show that almost the same number of poor sleep quality was experienced by the two age groups. The majority of the two age ranges experienced poor sleep quality and there was no significant difference between the two age ranges p-value: 0.306 (p-value>0.05). Although several studies say that the longer the life span, the worse the quality of sleep will be, but age has varied and specific effects on various aspects of sleep quality and does not worsen uniformly throughout a person's [25].

The results in table 7 show the characteristics of sleep quality of the respondents based on the class year. The three classes experienced poor sleep quality, but the largest group experiencing poor sleep quality was the class of 2021 with a total of 92 (94.8%) students. This may be caused by the transition or adaptation period experienced by first-year students from school to university with a busy class schedule causing irregular sleep schedules that affect the quality of student's sleep. Several studies state that majority of first-year students experienced poor sleep quality and daytime dysfunction than students in other years [26].

The results of this study stated that the sleep quality of most students was poor, but in fact students could still carry out their activities productively and did not interfere with their academic performance and learning outcomes. This is supported by the statement by Qalbi (2018) in his research that there is no significant relationship between sleep quality and medical student learning outcomes [27]. This can happen because many factors affect student academic performance, for example, such as student characteristics, lifestyle, study habits, learning motivation and socioeconomic conditions [28].

Analysis of the correlation test between stress and sleep quality using the Spearman rank test method which shows sleep quality is related to the stress level with a p-value = 0.000 and rho = 0.230. Based on these results, it was concluded that sleep quality and stress level have a positive correlation. Based on research by Clariska (2020), it is stated that there was a relationship between sleep quality and stress with a relationship strength level of 0.227 [29]. and research by Kartika (2021) also stated that there was a relationship between sleep quality and student stress levels with a relationship strength level of 0.356 [30]. but research by Kartini (2018), stated that there was no relationship between sleep quality and student stress levels with a p-value of 0.958 however, it is stated that stress is the strongest predictor of poor sleep quality [31].

In theory, stress affects the quality of sleep, due to the activation of the HPA hypothalamic pituitary adrenocortical by the circadian pacemaker in response to stress, and this causes increased arousal and exacerbates sleep difficulties [32]. In response to stress, the hypothalamus releases the hormone CRH, which is the key to activating the HPA axis. The release of CRH is followed by an increase in the secretion of adrenocorticotrophic hormone (ACTH) from the anterior pituitary and cortisol from the adrenal cortex [33]. The CRH hormone itself causes increase wakefulness, while ACTH itself affects a decrease in sleep time and sleep efficiency, and increases sleep latency. Meanwhile, high cortisol levels are said to make someone more difficult to fall asleep [34]. In this study, data was collected by a questionnaire, which was filled out by research subjects according to their memory, which can led to bias when filling out the questionnaire. The time and environmental

conditions could have also affected the results of completing the questionnaire, and other confounding variables were not investigated that might have affected the results.

V. CONCLUSION

The study purpose to prove that there is relationship between sleep quality and stress level of medical students at Faculty of Medicine, Airlangga University. The result of this study show that majority of subjects experienced poor sleep quality (84.7%). While the rest (15.3%) experienced good sleep quality. Most of the subjects experienced a normal stress level of 55.5%. the remaining 18.1% experienced mild stress, 17.8% moderate stress, 6% severe, and 2.5% very severe. There is a significant relationship between sleep quality and stress levels in students of the Faculty of Medicine, Airlangga University, with a positive correlation (p-value 0.000). The researcher expects that the institution will be able to use the study's findings as information about student stress levels and sleep quality in order to prevent stress and poor sleep or to implement health-related stress management programs for students.

Additional study is required with additional confounding factors that may affect the study's findings, as well as with more objective measurement tools like polysomnography to produce more objective results.

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