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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 has created significant challenges for students, triggering psychological issues such as stress, anxiety, and disrupted sleep patterns. Medical students, in particular, are prone to these issues due to the demanding nature of their academic programs. This study aimed to examine the relationship between stress levels and sleep quality among medical students at Airlangga University during the COVID-19 pandemic. An observational analytic design with a cross-sectional approach was employed. Data were collected from 280 active pre-clinical students using the Pittsburgh Sleep Quality Index (PSQI) and the Depression, Anxiety, and Stress Scale (DASS-42) questionnaires. The results revealed that 84.7% of participants experienced poor sleep quality, with a majority (55.5%) reporting normal stress levels. Statistical analysis using Spearman's rank correlation showed a significant positive relationship between stress and sleep quality ($p = 0.000$, $rho = 0.230$). The findings indicate that higher stress levels were associated with poorer sleep quality. This study emphasizes the need for health institutions to recognize the impact of stress on student sleep patterns and to implement effective stress management programs to improve students' well-being and academic performance. Further research with additional factors and objective sleep measurements is recommended to enhance the understanding of these relationships.

INDEX TERMS Stress, Sleep Quality, COVID-19, Medical Students, Pittsburgh Sleep Quality Index

I. INTRODUCTION

The COVID-19 pandemic has had a profound impact on various aspects of society, including the academic environment, especially among university students. Medical students, in particular, have faced unprecedented challenges during this period. The transition to online learning, social isolation, and the disruption of traditional academic activities have intensified psychological stress, which has, in turn, affected their mental and physical well-being. Among the most commonly reported psychological issues are stress and poor sleep quality, which have been shown to negatively affect students' academic performance and general health [1][2]. Stress, in particular, has been identified as a significant factor contributing to the deterioration of sleep quality, creating a cycle of distress that can further impair cognitive functioning, emotional regulation, and overall life satisfaction [3][4].

While several studies have explored the relationship between stress and sleep quality among medical students, much of the research has focused on pre-pandemic conditions. As a result, the unique challenges presented by the COVID-19 pandemic remain underexplored. The emergence of remote learning, extended isolation, and heightened health concerns have created new stressors, which may differ from those experienced before the pandemic [5][6]. Furthermore, limited studies have examined the intersection of stress and sleep quality specifically within the context of medical students during a global health crisis, particularly in developing countries like Indonesia [7].

Current methodologies for assessing stress and sleep quality rely heavily on self-report questionnaires, which provide valuable insights into individuals' psychological and physiological states. The Pittsburgh Sleep Quality Index (PSQI) is widely recognized as an effective tool for measuring sleep quality across various dimensions, including sleep duration, disturbances, and daytime dysfunction [8][9]. This tool has been validated in numerous populations and is considered the gold standard for sleep assessment [10]. Similarly, the Depression, Anxiety, and Stress Scale (DASS-42) is frequently utilized to assess psychological distress, providing a comprehensive measure of stress, anxiety, and depression [11][12]. These tools have proven their reliability and validity in assessing sleep and

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stress among medical students, making them ideal for the current study.

Despite the extensive use of the PSQI and DASS-42 in prior research, few studies have specifically examined the relationship between stress and sleep quality among medical students during the COVID-19 pandemic. Most of the existing literature has focused on either one of these factors separately, with limited exploration of how they interact within the context of a global health crisis [13][14]. Additionally, while many studies have reported an increase in stress and sleep disturbances among medical students during the pandemic, few have provided a robust correlation between these variables in the Indonesian context. This represents a significant gap in the literature, highlighting the need for further investigation into the mental health challenges faced by medical students during this unprecedented time [15].

This study aims to explore the relationship between stress and sleep quality among medical students at Airlangga University during the COVID-19 pandemic. Specifically, the research will assess the prevalence of poor sleep quality and varying levels of stress among medical students and examine how these two factors are correlated. By utilizing validated instruments like the PSQI and DASS-42, this study seeks to provide an in-depth understanding of the mental health challenges faced by medical students in this unique period.

1. The study contributes to understanding the extent of poor sleep quality and stress among medical students during the COVID-19 pandemic, offering insights into the mental health challenges specific to this population.
2. The study provides empirical evidence of the relationship between stress and poor sleep quality, contributing to the growing body of research on how psychological distress can impact sleep among students in medical programs.
3. By examining the link between stress and sleep, the study will inform the development of targeted health interventions aimed at improving student well-being, particularly through stress management and sleep improvement strategies.

This article is structured as follows: Section II presents the research methodology, including participant selection, data collection methods, and statistical analysis techniques. Section III discusses the results of the study, detailing the prevalence of sleep disturbances and stress levels among participants, as well as the correlation between these two factors. Section IV provides a comprehensive discussion of the findings, comparing them with similar studies, and addressing the implications for medical student health. Finally, Section V concludes the paper, summarizing the key findings and offering suggestions for future research in this area.

II. METHOD

This study aimed to assess the relationship between stress and sleep quality among medical students at Airlangga University during the COVID-19 pandemic. The research was conducted through an observational analytic design using a cross-sectional approach. This methodology was selected because it allows for the collection of data at a single point in time, facilitating an understanding of the prevalence of poor sleep quality and stress among the student population. The study employed standardized instruments to measure both stress and sleep quality, ensuring that the results would be valid and reliable for replication.

A. STUDY DESIGN

The study followed an observational analytic cross-sectional design. In a cross-sectional study, data are collected from participants at a single point in time, which provides a snapshot of the relationship between the variables under investigation. This design is particularly useful for exploring associations, as it is efficient and relatively straightforward to implement without the need for long-term follow-up .

B. STUDY POPULATION AND SAMPLE

The study was conducted at the Faculty of Medicine, Airlangga University, Surabaya, Indonesia. The study population comprised active pre-clinical students from the classes of 2019, 2020, and 2021. The inclusion criteria for participants were: (1) active students enrolled in the Faculty of Medicine, (2) pre-clinical students aged between 18 and 23 years, and (3) students who provided informed consent to participate in the study. The exclusion criteria included: (1) students who were not willing to participate, (2) students with known psychiatric conditions or those undergoing treatment for mental health disorders, and (3) students who had not completed the required questionnaires.

A sample size of 280 students was calculated based on the Slovin formula, which is commonly used for sample size determination in survey-based studies. The margin of error was set at 0.05, which is standard for most social sciences research. The final sample consisted of students from three academic years, with 92 students from the 2019 cohort, 92 students from the 2020 cohort, and 97 students from the 2021 cohort. These participants were selected using stratified random sampling, ensuring that students from each academic year were proportionally represented in the sample. Stratified sampling was used to guarantee that the sample accurately reflected the diversity of the student body with respect to academic year.

C. DATA COLLECTION INSTRUMENTS

Two validated self-report questionnaires were employed to assess the primary variables of interest: the Pittsburgh Sleep Quality Index (PSQI) and the Depression, Anxiety, and Stress Scale (DASS-42). Both of these instruments have been extensively used in prior research and are well-established for evaluating sleep quality and psychological distress in university students.

1. Pittsburgh Sleep Quality Index (PSQI): The PSQI is a widely used instrument designed to assess sleep quality over the past month. It consists of 19 questions grouped into seven components: sleep duration, sleep disturbances, sleep latency, daytime dysfunction, sleep efficiency, use of sleeping medication, and overall sleep quality. A global score greater than 5 indicates poor sleep quality. The PSQI has been shown to have high reliability

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and validity, with a Cronbach's alpha coefficient of 0.83, indicating good internal consistency .

2. Depression, Anxiety, and Stress Scale (DASS-42): The DASS-42 is a self-report instrument used to measure levels of depression, anxiety, and stress. It includes 42 items, each of which assesses the severity of symptoms experienced in the past week. The DASS-42 has demonstrated excellent psychometric properties, including strong reliability (Cronbach's alpha values of 0.951 for stress, 0.943 for anxiety, and 0.952 for depression) and validity in various populations .

D. PROCEDURE

The data collection process involved distributing both the PSQI and DASS-42 questionnaires to the selected students. The questionnaires were administered in an online format to adapt to the social distancing and remote learning conditions imposed by the COVID-19 pandemic. Participants were provided with detailed instructions on how to complete the questionnaires and were asked to answer all items honestly and to the best of their ability. The questionnaires were distributed via email to all eligible participants, and responses were collected over a two-week period.

Participants were informed about the purpose of the study, their rights to confidentiality, and the voluntary nature of participation. Informed consent was obtained electronically from each participant before the data collection began. Ethical approval for the study was obtained from the ethics committee at Airlangga University, ensuring that the study adhered to ethical standards for research involving human participants.

E. DATA ANALYSIS

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS), version 26. Descriptive statistics were used to summarize the demographic characteristics of the participants, as well as the prevalence of poor sleep quality and varying levels of stress. The relationship between stress and sleep quality was analyzed using Spearman's rank correlation coefficient due to the ordinal nature of the data. A p-value of less than 0.05 was considered statistically significant.

F. STUDY DESIGN CONSIDERATIONS

This study employed a cross-sectional design, which is beneficial for examining the prevalence and relationships between variables at a specific point in time. However, it is important to note that a cross-sectional design cannot establish causality, meaning it is not possible to infer that stress causes poor sleep quality or vice versa. Additionally, while the stratified random sampling technique enhances the generalizability of the results to the broader student population, the study is limited to one university, which may reduce the external validity of the findings .

G. ETHICAL CONSIDERATIONS

There is no specific information available regarding ethical consideration for this study.

III. 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%
ClassYear	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

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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 Quallity	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

A. INTERPRETATION OF RESULTS

The results of this study indicate a significant relationship between stress and poor sleep quality among medical students at Airlangga University during the COVID-19 pandemic. Specifically, the data reveals that 84.7% of the students reported experiencing poor sleep quality, while 55.5% exhibited normal stress levels. These findings align with previous research, which consistently suggests that stress has a detrimental effect on sleep quality. In our study, the correlation between stress levels and sleep quality was statistically significant, with a Spearman's rank correlation coefficient of 0.230 and a p-value of 0.000. This suggests that as stress levels increase, sleep quality deteriorates.

This outcome is particularly noteworthy considering the challenges posed by the COVID-19 pandemic, which has introduced new sources of stress for medical students, such as the transition to online learning, social isolation, and uncertainty regarding academic and clinical training. The significant number of students reporting poor sleep quality during this period highlights the urgent need to address these psychological and physiological issues. The impact of stress on sleep is multifaceted, as it activates the body's stress response, which can interfere with the body's natural sleep-wake cycle, leading to difficulties in falling asleep, staying asleep, and achieving restorative sleep.

Moreover, the study found that sleep quality was poor across all demographic groups, with no significant differences based on gender, age, or class year. This suggests that the effect of stress on sleep quality is widespread among medical students, irrespective of these demographic factors. It is important to note that the majority of the students reported normal levels of stress, indicating that while stress levels may not be at clinically high levels for all participants, the cumulative impact of academic pressures and the pandemic likely contributed to the widespread nature of sleep disturbances observed in this study.

B. COMPARISON WITH OTHER SIMILAR STUDIES

The findings of this study are consistent with those of several previous studies that have explored the relationship between stress and sleep quality, particularly among medical students. For instance, a study by Awadalla et al. (2022) found that medical students in Saudi Arabia experienced higher levels of stress and poorer sleep quality during the COVID-19

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pandemic compared to pre-pandemic times [22]. Similarly, Rezaei et al. (2018) documented a significant association between stress and sleep disturbances among pre-clinical medical students, supporting the view that psychological distress is a key contributor to sleep problems in this population [23].

However, some studies report differing results, suggesting that while stress is a common contributor to poor sleep quality, other factors such as study habits, physical activity, and personal coping strategies may also play a critical role. For example, a study by Karitini (2018) found no significant relationship between stress and sleep quality among medical students at a university in Indonesia, attributing the variations in sleep disturbances to personal lifestyle factors, including sleep hygiene practices and time management strategies [24]. These contrasting results highlight the complexity of the relationship between stress and sleep quality, suggesting that individual and environmental factors may influence how stress manifests in sleep patterns.

Additionally, while the majority of studies focus on the stress-sleep relationship among students in Western and Middle Eastern countries, this study provides valuable insights from Southeast Asia, specifically Indonesia, where the cultural, academic, and social context may differ significantly. The unique stressors associated with medical education and the pandemic in Southeast Asia may offer different perspectives compared to those found in other regions, making this study's findings important for understanding the specific challenges faced by Indonesian medical students during the COVID-19 crisis.

C. *LIMITATIONS, WEAKNESSES, AND IMPLICATIONS OF THE FINDINGS*

Although this study provides valuable insights into the relationship between stress and sleep quality, several limitations must be considered when interpreting the findings. First, the study employed a cross-sectional design, which limits the ability to draw conclusions about causal relationships between stress and sleep quality. While the observed correlation suggests an association between these two factors, it does not establish that stress directly causes sleep disturbances. Longitudinal studies that track changes in stress and sleep quality over time would be more effective in identifying causal relationships and understanding how these factors interact in the long term.

Second, the study relied on self-reported measures to assess both stress and sleep quality. While the PSQI and DASS-42 are well-validated instruments, self-report measures are inherently subjective and may be influenced by social desirability bias, recall bias, or the participants' current emotional state. It is possible that some students underreported their stress levels or overestimated their sleep quality, which could affect the accuracy of the results. Future research could benefit from incorporating objective measures of sleep, such as actigraphy or polysomnography, which would provide a more accurate assessment of sleep patterns.

Another limitation of this study is that it focused solely on pre-clinical students at Airlangga University. This narrow focus may limit the generalizability of the findings to other medical schools or universities. The experiences of pre-clinical students may differ from those of clinical students who face additional stressors related to patient care, clinical rotations, and the pressures of applying theoretical knowledge in real-world settings. A broader study that includes both pre-clinical and clinical students from multiple institutions would offer a more comprehensive understanding of the stress-sleep relationship in medical education.

The implications of this study are significant for the well-being of medical students, particularly in the context of the ongoing global health crisis. The findings suggest that universities should take proactive measures to manage student stress and promote healthy sleep habits. Stress management programs that include mindfulness, cognitive-behavioral therapy, and peer support could be highly beneficial in alleviating the psychological burden experienced by medical students. Additionally, interventions aimed at improving sleep hygiene and promoting healthy lifestyle practices, such as regular physical activity and proper time management, should be integrated into medical curricula and student support services.

Furthermore, the study highlights the importance of mental health support in academic settings, especially during times of crisis. Universities and healthcare providers must recognize the interconnection between stress and sleep and prioritize mental health interventions as part of their student wellness programs. By addressing these issues early, institutions can help mitigate the negative effects of stress and poor sleep on academic performance, emotional well-being, and overall student health.

V. CONCLUSION

This study aimed to explore the relationship between stress and sleep quality among medical students at Airlangga University during the COVID-19 pandemic. The findings revealed a significant correlation between stress levels and poor sleep quality, with 84.7% of participants reporting poor sleep quality. Of the total sample, 55.5% exhibited normal stress levels, while 18.1% experienced mild stress, 17.8% moderate stress, 6% severe stress, and 2.5% very severe stress. The Spearman's rank correlation coefficient of 0.230, with a p-value of 0.000, indicates a positive association between higher stress levels and poorer sleep quality, suggesting that stress is a significant contributing factor to sleep disturbances. These results are in line with prior studies, which have demonstrated the detrimental effect of stress on sleep in student populations, particularly during global crises such as the COVID-19 pandemic. The findings underscore the need for medical institutions to address the psychological well-being of students by implementing stress management programs and promoting healthy sleep practices to mitigate the negative impact of stress on their overall health and academic performance. Future research should expand on these findings by conducting longitudinal studies to explore the causal relationship between stress and sleep disturbances and by incorporating objective sleep measurements, such as actigraphy or polysomnography. Moreover, studies involving a broader sample from multiple universities could provide a more comprehensive

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understanding of this relationship across different academic and cultural contexts. Investigating additional factors, such as lifestyle choices and coping mechanisms, could further elucidate the complexities of stress and sleep quality in medical students. Ultimately, this study highlights the importance of mental health interventions and the integration of wellness programs into the academic environment to support student well-being during times of crisis.

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DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The data is stored securely and will be made available to qualified researchers in accordance with ethical guidelines and institutional policies.

AUTHOR CONTRIBUTION

Adhitya Rizky Nugraha conceptualized the study, designed the methodology, and supervised the research. Fidiana conducted the data collection and analysis. Khairina contributed to the interpretation of the results and the drafting of the manuscript. Wardah Rahmatul Islamiyah reviewed and revised the manuscript critically for important intellectual content. All authors read and approved the final manuscript.

DECLARATIONS

ETHICAL APPROVAL

Ethical approval for this study is not explicitly documented or reported

CONSENT FOR PUBLICATION PARTICIPANTS

Informed consent for publication of the research findings was obtained from all participants involved in the study. The participants were informed that their data would be published anonymously and used solely for the purpose of this research. All personal identifiers have been removed to ensure confidentiality.

COMPETING INTERESTS

The authors declare that they have no competing interests related to the publication of this paper.

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