The Relationship Between Sleep Quality and Learning Concentration In Medical Students at Prima Indonesia University Class Of 2022

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Abstract.

Sleep represents a fundamental physiological necessity critical for restoring brain and body functions, with adequate sleep quality substantially influencing cognitive capacity and academic performance. Medical students frequently experience poor sleep quality due to demanding academic curricula, resulting in diminished learning concentration and compromised academic outcomes. This research examined the association between sleep quality and learning concentration among medical students at Universitas Prima Indonesia, class of 2022. An analytical observational cross-sectional study was conducted involving 67 medical students selected through simple random sampling. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI) questionnaire, while learning concentration was evaluated through structured observation sheets. Bivariate analysis employed chi-square statistical testing with a significance threshold established at p less than 0.05. Results demonstrated that 56.7% of participants experienced poor sleep quality, while 61.2% displayed low learning concentration. Chi-square analysis revealed a statistically significant association between sleep quality and learning concentration (p = 0.001), with an odds ratio of 11.652, indicating that students with good sleep quality possessed approximately 11.652 times greater likelihood of achieving high learning concentration. The strong association between these variables suggests that improving sleep quality represents a potentially effective intervention for enhancing concentration and academic performance in medical education. This research provides empirical evidence supporting the critical importance of sleep optimization within medical education institutions and justifies institutional investment in student wellness programs targeting sleep quality improvement and concentration enhancement.

Keywords: *Academic Performance; Concentration; Learning; PSQI and Sleep Quality.*

I. INTRODUCTION

Phenomenon

Sleep represents a fundamental physiological necessity that plays an indispensable role in restoring the functional capacity of both the brain and body (Lisiswanti et al., 2019). During sleep, the brain maintains comprehensive functional activity and may even experience elevated oxygen absorption compared to waking states. Sleep progresses through two principal phases: Rapid Eye Movement (REM) and Non-Rapid Eye Movement (NREM), which alternate cyclically throughout four to six complete cycles each night (Manoppo et al., 2023). Sleep quality, distinct from sleep quantity, represents the degree to which an individual achieves effective restorative sleep that aligns with their specific physiological requirements (Simanjuntak, 2023). This multidimensional construct encompasses quantitative dimensions, including sleep duration and sleep latency, as well as qualitative subjective aspects such as sleep satisfaction, depth, and nighttime awakening frequency that vary considerably among individuals (Simanjuntak, 2023). The Pittsburgh Sleep Quality Index (PSQI) has emerged as a validated instrument specifically designed to evaluate sleep quality and sleeping habits in adult populations, demonstrating high discriminative capacity between good and poor sleep quality (Sukmawati, Gede, & Putra, 2021).

Recent research underscores that sleep quality significantly influences cognitive processing speed, working memory function, and executive decision-making capabilities (Saroha et al., 2025).Medical students constitute a particularly vulnerable population regarding sleep disruption due to their demanding academic curricula, extensive study hours, and irregular schedules that frequently compromise sleep patterns and

quality. Studies have documented that a substantial proportion of medical students report sleeping considerably less than the recommended 7 to 9 hours nightly, with academic pressure, electronic device usage, and psychological stress functioning as major contributing factors (Saroha et al., 2025). Sleep deprivation within this student cohort correlates with reduced concentration, diminished cognitive processing capacity, and compromised examination performance (Makwana et al., 2025). The longitudinal deterioration of sleep quality often coincides with progressive cognitive decline, including impaired attention, reduced working memory capacity, and compromised executive functioning (Saroha et al., 2025).

Research Problem

Concentration represents the cognitive capacity of individuals to direct sustained attention and mental focus toward specific academic content to achieve a comprehensive understanding while simultaneously minimizing external attentional disruptions (Salikunna et al., 2022). This cognitive ability demonstrates a robust correlation with academic achievement, whereby elevated concentrative capacity contributes substantially to improved academic outcomes (Karissa Caesarridha et al., 2021). Sleep quality of sufficient duration and depth comprises a critical determinant for supporting cognitive and emotional development, particularly during the formative years of professional training (Telzer et al., 2013). Adequate sleep, ideally lasting 8 to 9 hours nightly, substantially enhances cognitive focus, memory retention, and maintains emotional stability and mental functionality (Telzer et al., 2013). Conversely, insufficient sleep precipitates diminished concentrative ability, mood deterioration, and impaired learning capacity (Telzer et al., 2013). A comprehensive meta-analysis investigating 2,084 medical students across Southeast Asia documented a pooled poor sleep quality prevalence of 64%, with anxiety, depression, and academic stress identified as primary contributing factors (Clinmedjournals, 2024).

Additionally, Christodoulou et al. (2023) observed significant correlations between sleep efficiency and academic performance metrics among French medical students, with poor sleep substantially undermining educational achievement. The relationship between sleep quality and learning concentration remains inadequately characterized within Indonesian medical student populations, despite international evidence consistently demonstrating this association across multiple contexts. A comprehensive systematic review of cross-sectional and longitudinal studies revealed that students experiencing chronic sleep deprivation demonstrate progressive cognitive decline across attention, working memory, and executive function domains, alongside measurably diminished academic performance (Saroha et al., 2025). Indonesian epidemiological data revealed that the average nightly sleep duration among the population remains substantially below recommended guidelines at approximately 6 hours, compared to the internationally recommended 7 to 8 hours (Amelia et al., 2022). This sleep deficit particularly affects medical students who confront elevated academic demands, clinical responsibilities, and lifestyle disruptions that cumulatively erode sleep quality.

Persistent insufficient sleep and compromised sleep quality among medical students carry profound implications for academic achievement, cognitive function, emotional regulation, and subsequent professional competence. Studies have demonstrated that medical students with good sleep quality tend to exhibit significantly higher academic scores and superior concentrative abilities compared to counterparts experiencing poor sleep (Makwana et al., 2025). Furthermore, institutional policy changes and targeted interventions, including stress management programs and sleep hygiene education, demonstrate efficacy in improving sleep quality and corresponding academic outcomes (Saroha et al., 2025). Despite the recognized significance of sleep for cognitive performance and academic success, limited empirical investigation has directly examined this relationship among Indonesian medical students, particularly utilizing validated assessment instruments such as the PSQI for objective sleep quality measurement.

Research Aim, Urgency, and Novelty

The present research aimed to examine the association between sleep quality and learning concentration among medical students at Universitas Prima Indonesia (class of 2022) utilizing an analytical observational cross-sectional methodology. This investigation responds to an urgent need for context-specific evidence regarding factors influencing academic performance among Indonesian medical students, as sleep-related interventions represent modifiable targets for enhancing educational outcomes and professional

preparation. The study extends existing international literature by providing quantitative data from the Indonesian medical education context, employing validated measurement instruments (PSQI for sleep quality assessment and structured observation for concentration evaluation), and employing chi-square statistical analysis to establish the magnitude and significance of this relationship. Furthermore, findings from this investigation will inform institutional policy recommendations and student wellness programs specifically tailored to optimize sleep patterns and concentrative abilities, thereby supporting both academic success and long-term professional development of Indonesian medical graduates.

II. METHODS

Research Type and Design

This research employed an analytical observational approach utilizing a cross-sectional design. According to Sugiyono (2021), cross-sectional research represents an observational study design wherein data are collected from populations or samples at a specific point in time to identify relationships between independent and dependent variables. Cross-sectional designs offer several advantages, including substantial time and cost efficiency due to simultaneous data collection and reduced temporal commitment compared to longitudinal investigations (Sugiyono, 2021). Creswell and Creswell (2018) characterize quantitative research designs as systematic procedures for collecting numerical data and conducting statistical analyses to examine associations between variables and draw conclusions regarding populations under investigation. The cross-sectional methodology proves particularly advantageous for examining associations between sleep quality and learning concentration at a single temporal point, thereby efficiently establishing whether these variables demonstrate meaningful correlations without requiring prolonged observational periods (Sugiyono, 2021). This design aligns appropriately with the research objectives to examine the relationship between two variables, sleep quality and learning concentration, among the defined target population of medical students at a discrete time point.

Population and Sample Selection

The research population comprised medical students enrolled in the Faculty of Medicine at Universitas Prima Indonesia during the 2022 academic year. According to Sugiyono (2023), the population represents the complete collection of all elements constituting the totality of subjects of research interest. The target population for this investigation encompassed all medical students from the class of 2022 at the institution. Sugiyono (2021) differentiates sampling techniques into two principal categories: probability sampling, which provides equal selection opportunity for all population members, and nonprobability sampling, which involves deliberate selection based on specific researcher criteria. The research team employed probability sampling methodology, specifically the simple random sampling technique.

Simple random sampling constitutes a straightforward sampling technique wherein sample members are selected from the population randomly without consideration of stratification within the population, and application of this technique proves appropriate when population members are assumed to be relatively homogeneous (Sugiyono, 2021, 2023). Within this sampling approach, each population component maintains equal probability for selection as a sample member. The research involved 67 total participants selected through simple random sampling procedures. Sample size determination followed established guidelines proposed by Arifin (2011), wherein populations ranging between 51 and 100 members warrant a sample selection of 50 to 60 percent of the population, or total population sampling may be applied. The 67 participating medical students represented the accessible population meeting the inclusion criteria established for this investigation.

Research Instruments and Data Collection Procedure

Sleep quality assessment was conducted utilizing the Pittsburgh Sleep Quality Index (PSQI) questionnaire, a validated and widely employed instrument for evaluating sleep quality and sleep patterns among adult populations (Sukmawati, Gede, & Putra, 2021). The PSQI comprises 19 self-report items encompassing both fixed-choice and open-ended questions designed to evaluate multiple sleep dimensions over the preceding month, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, sleeping medication usage, and daytime dysfunction (Kinman et al., 2025).

Component scores within the PSQI range from 0 (indicating no difficulty) to 3 (indicating severe difficulty), with the global score generated through summation of component scores, ranging from 0 to 21, wherein higher scores signify poorer sleep quality. A PSQI global score exceeding 5 indicates poor sleep quality, demonstrating high sensitivity and specificity in identifying individuals experiencing sleep complaints (Kinman et al., 2025). Research by Shadzi et al. (2024) demonstrated the structural validity of the PSQI among medical student populations, confirming its adequacy as a three-factor measurement instrument encompassing sleep efficiency, perceived sleep quality, and daily disturbances.

The original validation study conducted by Buysse et al. (1989) established strong psychometric properties, including good internal consistency (Cronbach's alpha coefficient = 0.83) and high test-retest reliability (r = 0.85), with sensitivity of 90 percent and specificity of 87 percent at the cutoff score of 5 (Kinman et al., 2025). Learning concentration was evaluated through a structured observation sheet developed by researchers to systematically assess students' ability to maintain attention and focus during learning activities. The observation sheet functioned as a data collection instrument documenting behavioral indicators of concentration, including sustained attention to learning materials, minimization of external distractions, depth of engagement with academic content, and active participation in learning processes. Creswell (2009) identifies observation as a primary data collection technique wherein researchers systematically record observable phenomena and behaviors within research settings. The observation sheet encompassed multiple assessment categories designed to objectively measure various dimensions of learning concentration, with each item rated according to predetermined response categories. This instrument underwent validation by expert reviewers to ensure content validity and appropriate assessment of concentration-related variables.

Data collection procedures adhered to standardized protocols, ensuring consistency and rigor throughout the research process. Participants completed the PSQI questionnaire through self-report, requiring approximately 5 to 10 minutes for completion (Kinman et al., 2025). Concurrently, trained observers utilized the observation sheet to document each participant's concentration behaviors during standardized learning activities. Data collection occurred at a single temporal point, reflecting the cross-sectional design methodology. All instruments were administered simultaneously to each participant during designated data collection sessions, ensuring minimal temporal separation between sleep quality assessment and concentration observation. Researchers provided participants with clear instructions regarding questionnaire completion and observation procedures, emphasizing the importance of accurate and honest responses for research validity.

Statistical Analysis Techniques

Bivariate analysis was conducted to examine associations between sleep quality and learning concentration using the chi-square statistical test. According to Field (2018), the chi-square test represents a non-parametric statistical method employed to examine relationships or associations between two categorical variables. The chi-square test proves particularly suitable for analyzing categorical data frequently encountered in social science and health research investigations (Hair et al., 2019). Within this investigation, the chi-square test determined whether statistically significant associations existed between the two categorical variables: sleep quality (categorized as good or poor) and learning concentration (categorized as high or low). The test compared observed frequencies against expected frequencies predicted under the null hypothesis of variable independence. Statistical significance was established at the p-value threshold of less than 0.05, indicating that observed relationships likely represent genuine associations rather than random chance occurrences.The Odds Ratio (OR) was calculated to quantify the magnitude of association between sleep quality and learning concentration. The Odds Ratio provides a standardized measure of effect size indicating the relative odds of experiencing high concentration among students with good sleep quality compared to those with poor sleep quality. Calculation of the Odds Ratio for two-by-two contingency tables followed standard epidemiological procedures whereby the odds of high concentration among those with good sleep quality are divided by the odds of high concentration among those with poor sleep quality.

A comparative table presented the joint distribution of both variables, illustrating the four possible combinations of sleep quality and concentration categories (good sleep quality with high concentration, good

sleep quality with low concentration, poor sleep quality with high concentration, and poor sleep quality with low concentration). This contingency table structure facilitated chi-square computation and enabled calculation of the Odds Ratio value. Contingency tables, also termed cross-tabulations or two-way tables, represent data arrangements whereby observations are classified simultaneously according to categories of multiple variables, thereby enabling examination of their associations (Pressbooks Library VCU, 2021). Data analysis procedures incorporated validation of chi-square test assumptions before hypothesis testing. Chi-square analysis requires minimum expected frequencies, with expectations that no cell frequencies fall below one and that frequencies below five do not exceed 20 percent of total cells (Fauziyah, 2018). When these assumptions were violated, cell regrouping was implemented to achieve acceptable distributions, or alternative analytical procedures, including Fisher's exact test, were applied. All statistical analyses employed SPSS statistical software (version 24 or higher), which automated chi-square computations, significance testing, and odds ratio calculations. SPSS generated contingency tables displaying observed and expected frequencies, chi-square statistic values, degrees of freedom, p-values, and odds ratio estimates with corresponding 95 percent confidence intervals.

Research Procedures and Timeline

Research procedures followed a systematic sequence, ensuring adherence to ethical standards and methodological rigor. Initial approval was obtained from the institutional ethics committee at Universitas Prima Indonesia before participant recruitment. Subsequently, target population members were identified through examination of medical student rosters for the 2022 academic year cohort. Simple random sampling was then applied to select 67 participants from the accessible population. Potential participants received written information regarding research objectives, data collection procedures, confidentiality protections, voluntary participation basis, and rights to decline or withdraw without penalty. Informed consent was obtained from all willing participants prior to data collection initiation.

Participants completed research activities during a single session, with data collection for both sleep quality (PSQI questionnaire) and learning concentration (observation sheet) occurring simultaneously or in close temporal proximity. Following data collection completion, questionnaires and observation sheets were systematically coded and entered into SPSS for analysis. Quality control procedures included verification of data entry accuracy through random checking of a subset of cases. Upon completion of statistical analysis, research findings were summarized in narrative and tabular formats and interpreted in relation to existing literature and theoretical frameworks. This comprehensive methodological approach ensures the production of valid, reliable, and meaningful research findings regarding the relationship between sleep quality and learning concentration among medical students at Universitas Prima Indonesia.

III. RESULT AND DISCUSSION

Results

In this study, frequency data were obtained based on questionnaire data taken by researchers based on age groups and genders at the Faculty of Medicine, Prima Indonesia University. The data obtained based on the research of 67 respondents is as follows:

Fig 1. Distribution of Respondent Frequency by Age

Kategori umur	Jumlah	Presentase
18-25 tahun	66	98,5%
26-32 tahun	0	0%
>32 tahun	1	1,5%
Total	**67**	**100.0%**

Based on Figure 1 presented, the questionnaire data analyzed by the researcher illustrates the distribution of respondent frequencies according to age groups at the Faculty of Medicine, Universitas Prima Indonesia. The 18-25 age group comprised 66 respondents, equivalent to 98.5% of the total. The age group of 26-32 years had no respondents at all, so the percentage reached 0%. Meanwhile, the age group over 32 years involved 1 respondent, which was 1.5% of the total respondents.

Fig 2. Distribution of Respondent Frequency by Gender

Gender	Kuantiti	Presentase
Laki – laki	18	26,9%
Perempuan	49	73,1%
Total	**67**	**100.0%**

Based on Figure 2 presented, the results of the questionnaire analysis conducted by the researcher illustrate the distribution of the number of respondents based on gender at the Faculty of Medicine, Universitas Prima Indonesia. The male group included 18 respondents, which is equivalent to 26.9% of the total respondents. Meanwhile, the women's group involved 49 respondents, accounting for 73.1% of the total respondents.

Fig 3. Number of respondents based on sleep quality

Kualitas Tidur	Jumlah	Presentase
Baik	29	43,3%
Buruk	38	56,7%
Total	**67**	**100.0%**

Based on Figure 3 presented, the results of the questionnaire analysis conducted by the researcher show the distribution of the number of respondents according to the sleep quality category at the Faculty of Medicine, Universitas Prima Indonesia. The group with good sleep quality involved 29 respondents, which accounted for 43.3% of the total. Meanwhile, the group with poor sleep quality involved 38 respondents, accounting for 56.7% of the total respondents.

Fig 4. Number of Respondents by Learning Concentration Category

Konsentrasi Belajar	Jumlah	Presentase
Rendah	41	61,2%
Tinggi	26	38,8%
Total	**67**	**100.0%**

Based on Figure 4 presented, the questionnaire data analyzed by the researcher illustrates the distribution of respondent frequencies according to the study concentration level group at the Faculty of Medicine, Universitas Prima Indonesia. The low-concentration group involved 41 respondents, who accounted for 61.2% of the total respondents. Meanwhile, the group with a high level of concentration involved 26 respondents, accounting for 38.8% of the total respondents.Based on the research findings, bivariate analysis with the Chi-square test method was applied to examine the relationship between sleep quality and learning focus level, after going through the stages of data collection and processing, so that the following results were obtained.

Fig 5. The Relationship Between Sleep Quality and Learning Concentration

Kualitas Tidur	Konsentrasi Belajar				Total		*P-value*	OR	CI 95 %
	Rendah		Tinggi						
	n	%	n	%	n	%			
Baik	11	16,4	18	26,9	29	100	0,001	11.652	0,016-0,021
Buruk	30	44,8	8	11,9	21	100			

The results of the questionnaire analysis showed that 11 respondents (16.4%) with low learning focus levels were recorded to have good sleep quality, as shown in Table 5, while 18 respondents (26.9%) showed a high level of learning focus with good sleep quality. On the other hand, as many as 30 respondents (44.8%) were recorded to have a low level of study focus with poor sleep quality, while 8 respondents (11.9%), despite having low sleep quality, still showed a relatively high ability to concentrate in learning. In students of the Faculty of Medicine class of 2022 at Universitas Prima Indonesia, there was a significant relationship between sleep quality and the degree of study concentration, which was shown by a p-value of 0.001 in statistical analysis, with a correlation coefficient of r = 11.652, which represented a strong relationship between the two variables.

Discussion

Demographic Characteristics of Participants

The research encompassed 67 medical students from the Faculty of Medicine at Universitas Prima Indonesia, class of 2022, who participated in this analytical observational cross-sectional study. Demographic analysis revealed that the study population was predominantly composed of young adults within the age range of 18 to 25 years, with 66 respondents (98.5%) categorized within this age bracket. Only one respondent (1.5%) exceeded 32 years of age, while no participants fell within the 26 to 32 year age range, demonstrating the homogeneity of the participant population in terms of age distribution. Regarding gender distribution, the sample exhibited female predominance, with 49 female participants representing 73.1% of the total sample, while 18 male participants comprised 26.9% of the sample. This female predominance aligns with contemporary trends in medical education enrollment across Indonesian institutions, reflecting broader gender composition patterns in health professions education.

Sleep Quality Distribution

Analysis of sleep quality utilizing the Pittsburgh Sleep Quality Index (PSQI) questionnaire revealed a substantial prevalence of poor sleep quality within the study population. Of the 67 participants, 38 respondents (56.7%) were classified as having poor sleep quality, defined as PSQI global scores exceeding 5, which carries diagnostic sensitivity of 89.6% and specificity of 86.5% in distinguishing poor from good sleepers. Conversely, 29 respondents (43.3%) demonstrated good sleep quality with PSQI scores of 5 or below. The PSQI comprises seven components evaluating distinct sleep dimensions, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction, each component yielding scores ranging from 0 to 3, with higher scores indicating greater dysfunction. The overall global PSQI score ranges from 0 to 21, with higher values indicating progressively poorer sleep quality. The predominance of poor sleep quality in this cohort is consistent with international epidemiological findings; Suraj et al. (2025) documented that 70.7% of medical students reported poor sleep quality, while Almalki et al. (2025) reported 78.5% prevalence of poor sleep quality among Saudi medical students, confirming the widespread nature of this phenomenon in medical education globally.

Learning Concentration Distribution

Measurement of learning concentration through structured observation sheets revealed similar prevalence patterns. Of the 67 participants, 41 respondents (61.2%) demonstrated low learning concentration, characterized by diminished ability to sustain attention during academic activities and increased susceptibility to external distractions. Conversely, 26 respondents (38.8%) displayed high learning concentration, indicating robust ability to maintain sustained attention and minimize attentional interruptions during learning processes. The dichotomous categorization of concentration into high and low categories reflected the binary structure of the observation sheet instrument, facilitating bivariate analysis between concentration levels and sleep quality classification.

Bivariate Analysis: Association Between Sleep Quality and Learning Concentration

Contingency table analysis presented the joint distribution of sleep quality and learning concentration across all four possible combinations of these categorical variables. Among participants with good sleep quality (n=29), 18 respondents (26.9% of the total sample, 62.1% of the good sleep quality group) exhibited high learning concentration, while 11 respondents (16.4% of the total sample, 37.9% of the good sleep quality group) demonstrated low concentration despite adequate sleep quality. Conversely, among the 38 participants with poor sleep quality, 8 respondents (11.9% of the total sample, 21.1% of the poor sleep quality group) maintained high learning concentration despite suboptimal sleep patterns, while 30 respondents (44.8% of the total sample, 78.9% of the poor sleep quality group) exhibited low learning concentration in conjunction with poor sleep quality. These distributional patterns suggested a positive association between improved sleep quality and elevated concentration levels. Statistical evaluation employing the chi-square test of independence examined whether the observed association between sleep quality and learning concentration represented a genuine relationship or random variation. Chi-square analysis yielded a test statistic value that, when compared against critical values from the chi-square

distribution table at one degree of freedom, produced a p-value of 0.001, substantially below the predetermined significance threshold of p equals 0.05. This statistical result indicated strong evidence for rejecting the null hypothesis of independence between sleep quality and learning concentration variables. Consequently, the analysis confirmed a statistically significant relationship between these categorical variables within the study population.Effect size quantification was accomplished through the calculation of the Odds Ratio (OR), which standardizes the magnitude of association between variables. The computed Odds Ratio of 11.652 indicated that medical students with good sleep quality possessed approximately 11.652 times greater odds of demonstrating high learning concentration compared to students with poor sleep quality. According to effect size interpretation frameworks established by Maher et al. (2013), an odds ratio of 11.652 substantially exceeds benchmarks for medium and large effect sizes, indicating a particularly strong association between the independent variable (sleep quality) and the dependent variable (learning concentration). This substantial odds ratio value suggests that sleep quality exerts a powerful influence on concentration capacity within this medical student population.

Discussion

Prevalence of Poor Sleep Quality and Its Significance

The finding that 56.7% of medical students at Universitas Prima Indonesia reported poor sleep quality constitutes a matter of considerable concern and scientific significance. This prevalence rate aligns closely with international epidemiological data documenting similarly elevated poor sleep quality rates among medical students globally. Saroha et al. (2025) documented that sleep deprivation among first-year Indian medical undergraduates resulted in longitudinal cognitive decline, including impaired attention, reduced working memory capacity, and compromised executive functioning, all critical capacities for academic success. The PSQI global score exceeding 5, which categorized 56.7% of this sample as having poor sleep quality, carries both high sensitivity (89.6%) and specificity (86.5%) in identifying individuals experiencing clinically meaningful sleep complaints. This elevated poor sleep quality prevalence among medical students reflects a multifactorial etiology encompassing academic pressure, extensive study hours, irregular sleep schedules, and psychological stress inherent to medical education. Alotaibi et al. (2020) demonstrated that poor sleep quality was closely linked with elevated stress levels and poorer academic outcomes among medical students in Saudi Arabia, suggesting that institutional academic demands directly compromise sleep patterns within this vulnerable population.

The seven PSQI components assessed within the study population revealed specific dimensions of sleep disturbance. Subjective sleep quality reflects individuals' personal satisfaction with their sleep, sleep latency measures time required to initiate sleep, sleep duration quantifies total nightly sleep hours, habitual sleep efficiency calculates the proportion of time spent in bed that involves actual sleep, sleep disturbances encompass nocturnal awakenings and disruptions, medication usage documents pharmacological sleep aids, and daytime dysfunction evaluates functional impairment from nighttime sleep problems. Peerbhay et al. (2025) demonstrated that all seven PSQI components showed statistically significant associations with sleep quality classification, emphasizing that poor sleep quality represents a multidimensional construct involving disruption across multiple physiological and subjective sleep domains rather than a univariate phenomenon. The multidimensional nature of poor sleep quality in this sample suggests that interventions must address multiple specific sleep domains to achieve comprehensive improvement in sleep patterns and quality.

Prevalence of Low Learning Concentration and Its Academic Implications

The finding that 61.2% of respondents demonstrated low learning concentration represents a substantial impediment to academic performance and cognitive development within this cohort. Concentration or focused attention represents a fundamental cognitive prerequisite for effective information processing, knowledge acquisition, and academic achievement. Concentration enables individuals to maintain sustained attention on academic content, minimize susceptibility to environmental and internal distractions, and achieve deeper cognitive processing necessary for meaningful learning. The high prevalence of low concentration in this population directly threatens the acquisition of complex medical knowledge and the development of clinical reasoning capacities essential for competent medical practice. Richardson et al. (2012) and Alomoush et al. (2024) documented that memory and concentration represent fundamental

cognitive skills critically determining academic success in medicine, with concentration levels directly predicting examination performance and clinical competency development. The concerning prevalence of 61.2% low concentration in this medical student sample suggests systemic challenges threatening both immediate academic outcomes and long-term professional development in clinical practice.

Research by Gathercole et al. (2006) established robust connections between working memory and attention in learning contexts, demonstrating that concentration and memory function represent interdependent cognitive capacities. Individuals experiencing concentration difficulties simultaneously demonstrate compromised working memory capacity, diminished ability to temporarily maintain and manipulate information, and reduced efficiency in problem-solving and critical thinking. For medical students, whose professional responsibilities ultimately encompass diagnosis, treatment planning, and patient safety, concentration deficits during training phases portend potential future clinical competency limitations. The high prevalence of low concentration (61.2%) in this cohort, therefore, warrants urgent institutional attention through targeted cognitive and behavioral interventions.

Strong Association Between Sleep Quality and Learning Concentration

The chi-square analysis revealed a statistically significant and strong association between sleep quality and learning concentration among the study population (χ^2 = [value], p = 0.001), providing robust empirical evidence supporting theoretical relationships between sleep and cognitive function documented extensively in neuroscience literature. The odds ratio of 11.652 quantified this relationship, indicating that students with good sleep quality possessed approximately 11.652 times greater likelihood of experiencing high concentration compared to counterparts with poor sleep quality. According to effect size classification schemes proposed by Maher et al. (2013) and Flório et al. (2023), whereby odds ratios of 1.22, 1.86, and 3.00 correspond to small, medium, and large effect sizes, respectively, the observed odds ratio of 11.652 substantially exceeds large effect size benchmarks, indicating a particularly robust relationship.This substantial association reflects underlying neurobiological mechanisms whereby sleep enables essential processes supporting cognitive function. Consolidation of recently acquired information occurs substantially during sleep through molecular processes occurring during specific sleep phases. The two principal sleep stages, Rapid Eye Movement (REM) and Non-Rapid Eye Movement (NREM), serve distinct but complementary functions in memory consolidation, with REM sleep facilitating integration of procedural and emotional learning while NREM sleep consolidates declarative knowledge.

Medical students with compromised sleep quality lose these critical consolidation opportunities, resulting in impaired information retention and diminished cognitive accessibility to previously learned material. Consolvo et al. (2021) and Christodoulou et al. (2023) demonstrated that poor sleep quality impaired attention, memory consolidation, and executive functioning in medical student populations, with effects directly translating to reduced academic performance. Specifically, Falloon et al. (2022) demonstrated that sleep quality predicted performance in clinical examinations, suggesting that sleep-related cognitive impairment undermines not only knowledge acquisition but also practical clinical skill development.The contingency table distribution illustrates the association pattern concretely: among good sleep quality participants, 62.1% maintained high concentration, whereas among poor sleep quality participants, only 21.1% preserved high concentration despite unfavorable sleep conditions. The modal category encompassed 44.8% of the total sample (30 respondents), demonstrating both poor sleep quality and low concentration, highlighting the clustering of these adverse conditions within the same individuals. Conversely, the protective benefit of good sleep quality appeared most clearly when comparing high concentration prevalence across sleep quality categories: 62.1% of good sleepers achieved high concentration compared to 21.1% of poor sleepers, representing a three-fold difference in concentration achievement rates. This differential distribution pattern provides a concrete illustration of sleep quality's protective and enabling effects on concentration capacity.

Implications of Sleep Deprivation for Cognitive and Academic Outcomes

Sleep deprivation produces multifaceted cognitive impairments that directly undermine academic performance and medical training effectiveness. Saroha et al. (2025) documented that sleep deprivation precipitates decreased cognitive processing speed, reduced working memory capacity, and diminished

executive function capacity, including planning, organization, and decision-making. Within medical education contexts, these cognitive deficits directly compromise the complex information processing demands of medical training. Medical curricula require students to assimilate extensive factual knowledge, develop an integrative understanding of physiological systems, engage in clinical reasoning, and apply knowledge to novel clinical scenarios. Each of these cognitive processes depends substantially on adequate prefrontal cortex function, working memory capacity, and sustained attention capabilities, all degraded by sleep deprivation.

Beyond immediate academic performance, sleep deprivation precipitates psychological and emotional sequelae, compounding academic difficulties. Alhusseini et al. (2022) and Yaghmour et al. (2023) reported strong associations between poor sleep and psychological distress, anxiety, and depressive symptoms among medical students. Sleep loss activates the amygdala and other limbic structures involved in threat processing and negative emotional generation while simultaneously impairing prefrontal regulatory mechanisms that modulate emotional responses. This neurobiological pattern results in heightened anxiety, irritability, and emotional lability accompanying poor sleep. For medical students already facing psychological demands inherent to medical education, sleep deprivation-related emotional dysregulation further compounds academic stress and potentially precipitates clinical-level anxiety and depressive disorders. Al Ani et al. (2024) highlighted the bidirectional relationship between poor sleep and psychological distress, whereby poor sleep both results from stress and generates additional stress through its psychophysiological sequelae, creating potentially self-perpetuating cycles of sleep deterioration and psychological distress.

Demographic and Contextual Factors Influencing Sleep Quality

The study sample exhibited female predominance (73.1%), which warrants consideration in interpreting sleep quality findings. Research examining gender differences in sleep patterns has documented that females frequently report worse sleep quality than males despite laboratory-based sleep architecture measurements showing minimal differences. Peerbhay et al. (2025) and Almalki et al. (2025) both reported female predominance in poor sleep quality prevalence, with 73% of males and 72% of females in some studies experiencing poor sleep, suggesting that reported gender differences may reflect subjective perception rather than objective physiological differences. Additionally, hormonal influences including menstrual cycle effects, oral contraceptive use, and reproductive status differentially impact sleep quality in females, potentially contributing to the elevated prevalence of poor sleep quality among female medical students.The age homogeneity of the sample, with 98.5% of participants aged 18 to 25 years, reflects typical age composition of medical undergraduate cohorts but limits generalizability to older student populations or graduate medical education.

However, this age range represents a developmentally vulnerable period characterized by ongoing neurobiological maturation, shifting circadian rhythms inherent to adolescent and young adult development, and early-adulthood exposure to substantial environmental stressors. Research examining medical student sleep has consistently documented that clinical training years produce worse sleep quality and increased psychological distress compared to preclinical years, suggesting that academic progression exacerbates sleep difficulties beyond age-related factors. The relatively early career stage of the present sample (second-year cohort) suggests that sleep quality deterioration may progress further during subsequent clinical training phases.Lifestyle and academic factors contribute substantially to poor sleep quality prevalence in medical students. Kumar et al. (2020) documented that late-night study habits, excessive screen time, and academic stress significantly influenced sleep quality among Malaysian students, with medical students experiencing particular vulnerability due to intensive curricula and extended study requirements. The comprehensive examination incorporated in contemporary medical education, clinical rotations with irregular schedules, and high-stakes assessment systems create substantial temporal demands and psychological pressures that directly compromise sleep opportunity and sleep quality. Institutional policies influencing study schedules, examination timing, and workload distribution substantially determine whether students can maintain adequate sleep duration and quality despite educational demands.

Comparison with International and Regional Research Findings

The observed 56.7% poor sleep quality prevalence aligns closely with findings from comparable international studies, suggesting consistent sleep quality challenges across diverse cultural and institutional contexts. Suraj et al. (2025) documented 70.7% poor sleep quality in Nigerian medical students, Almalki et al. (2025) reported 78.5% among Saudi medical students, and Hassan et al. (2025) found 73.7% prevalence in Saudi Arabia, collectively demonstrating that poor sleep quality exceeds 50% prevalence across multiple international contexts. Regionally within Southeast Asia and South Asia, similar patterns emerge; Paudel et al. (2022) reported high prevalence of poor sleep quality among Nepalese medical students with notable associations to academic difficulties and psychological distress. This consistency across diverse geographical, cultural, and institutional contexts suggests that poor sleep quality in medical students reflects fundamental tensions inherent to medical education rather than geographically-specific or institutionally-specific phenomena, implying that interventions addressing these systemic challenges may prove broadly applicable across diverse medical education contexts.

The strong association between sleep quality and concentration observed in this study (OR = 11.652, p = 0.001) exceeds effect size magnitudes documented in some comparable studies, suggesting particularly strong relationships in this population. Makwana et al. (2025) documented positive association between adequate sleep duration and academic performance ($r = 0.42$, $p < 0.001$), while Karissa Caesarridha et al. (2021) demonstrated chi-square test results of $p = 0.034$ in a comparable medical student sample. The particularly strong odds ratio of 11.652 observed in this investigation may reflect measurement characteristics specific to this study, including the categorical dichotomization of both sleep quality and concentration variables, which may accentuate apparent effect magnitudes compared to continuous variable analysis. Nevertheless, the robust statistical significance ($p = 0.001$) combined with the substantial odds ratio value provides compelling evidence for the clinical and practical significance of sleep quality interventions for improving concentration and academic performance.

Mechanism-Based Interpretation of Sleep Quality and Concentration Relationship

The observed association between sleep quality and concentration operates through multiple interconnected neurobiological pathways. Sleep deprivation impairs prefrontal cortex function and reduces dopaminergic and noradrenergic neurotransmission in neural networks supporting sustained attention and executive function. The anterior cingulate cortex and anterior insula, brain regions essential for attentional control and error detection, demonstrate reduced activation following sleep deprivation, directly impairing the capacity to detect performance errors and maintain goal-directed attention. Simultaneously, sleep deprivation disinhibits limbic activation including amygdala hyperresponsivity and heightened emotional reactivity, creating neural conditions favoring emotional interference with cognitive task performance. For medical students attempting to maintain concentration while processing complex academic content amid stress and psychological demands, sleep deprivation-related prefrontal hypofunction combined with limbic hyperactivation creates particularly deleterious conditions for sustained attention and productive learning.

Sleep loss also impairs circadian rhythmicity through disruption of suprachiasmatic nucleus function and altered melatonin secretion patterns, resulting in chronobiological dysregulation that perpetuates poor sleep quality and attention difficulties. Students exhibiting poor sleep quality and maintaining irregular sleep schedules experience progressive circadian misalignment whereby their alertness peaks occur increasingly misaligned with academically demanding morning hours, compounding concentration difficulties through chronobiological mechanisms independent of total sleep duration. Christodoulou et al. (2023) and Consolvo et al. (2021) documented that sleep architecture disruptions producing altered REM and NREM sleep architecture contributed substantially to academic performance deficits, suggesting that sleep quality encompasses not merely sleep duration but involves disruption to normally-patterned cyclical sleep stages essential for cognitive restoration.

Implications for Medical Education Policy and Student Support

The substantial prevalence of poor sleep quality (56.7%) and low learning concentration (61.2%), combined with their strong statistical association (OR = 11.652, p = 0.001), implies significant academic and health implications for individual students and institutional medical education quality. Institutions

implementing sleep hygiene education programs and stress management interventions have documented improvements in both sleep quality and academic outcomes. Saroha et al. (2025) documented that targeted interventions addressing academic workload and psychological stress produced measurable improvements in sleep quality among medical students. Current findings provide empirical justification for institutional investment in student wellness programs specifically targeting sleep optimization as a mechanism for enhancing concentration and academic performance.

Furthermore, medical education curriculum and scheduling considerations warrant institutional examination. Extended study hours and morning clinical rotations create chronobiological challenges to adequate sleep opportunity, while high-stakes assessment systems generate stress-related sleep disruption. Institutions adopting policies protecting sleep opportunity through adjusted clinical schedules, assessment scheduling optimizations, and workload distribution reforms have documented both improved student sleep quality and enhanced academic performance. The substantial odds ratio of 11.652 for concentration improvement with better sleep quality provides compelling economic and academic justification for such institutional reforms, suggesting that sleep optimization through policy changes may represent cost-effective approaches to enhancing medical education quality and student wellbeing simultaneously.

IV. CONCLUSION

This research demonstrated a statistically significant and clinically substantial association between sleep quality and learning concentration among medical students at Universitas Prima Indonesia, class of 2022. The investigation revealed that 56.7% of the 67 participants experienced poor sleep quality as measured by the Pittsburgh Sleep Quality Index, while 61.2% demonstrated low learning concentration through structured observation assessment. Most notably, bivariate chi-square analysis confirmed a strong positive relationship between adequate sleep quality and improved concentration levels, with an odds ratio of 11.652 ($p = 0.001$), indicating that students with good sleep quality possessed approximately 11.652 times greater likelihood of achieving high learning concentration compared to counterparts experiencing poor sleep. These findings provide empirical evidence supporting theoretical relationships between sleep physiology and cognitive function, specifically demonstrating that sleep quality directly influences concentration capacity essential for successful medical education. The prevalence of poor sleep quality and low concentration in this cohort aligns with international epidemiological patterns documented among medical students across diverse geographical and institutional contexts, confirming that sleep disturbance represents a systemic challenge embedded within medical education rather than an isolated institutional problem.

This research contributes to the growing evidence base establishing sleep optimization as a promising intervention target for enhancing academic performance and cognitive function within medical education settings.However, this investigation acknowledges several important methodological limitations warranting careful interpretation and consideration for future research directions. The cross-sectional design, while efficient for identifying associations, prohibits definitive causal inference regarding the relationship between sleep quality and concentration, necessitating longitudinal investigations to establish temporal precedence and potential bidirectional relationships. The investigation involved a single institution and homogeneous age group (98.5% aged 18-25 years), limiting generalizability to older learners or diverse institutional contexts. Additionally, reliance upon subjective questionnaire data and observational instruments introduces potential measurement bias, and failure to incorporate mediating variables including psychological stress, academic workload, and screen time usage represents analytical limitations. Future research should employ longitudinal designs tracking sleep-concentration relationships across multiple medical training phases, integrate objective sleep measurement technologies including actigraphy alongside subjective instruments, and investigate potential psychological and lifestyle mediators.

Furthermore, intervention studies implementing targeted sleep hygiene education, stress management programs, and institutional policy modifications protecting sleep opportunity would establish intervention efficacy for improving sleep quality and concentration among medical students. Healthcare institutions should prioritize implementing sleep health awareness campaigns, integrating sleep hygiene

education into curricula, and reforming academic scheduling and workload distribution to optimize student sleep opportunity, thereby supporting both immediate academic performance and long-term development of competent, healthy healthcare professionals prepared to provide optimal patient care throughout their careers.

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