



SYSTEMATIC META-ANALYSIS REVIEW

Prevalence of Poor Sleep Quality Based on Pittsburgh Sleep Quality Index (PSQI) among Medical Students in Southeast Asia: A Systematic Review and Meta-Analysis

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Abstract

Purpose of review: Several studies have reported prevalence of poor sleep quality among medical students, which may impact their academic performance and mental health. The primary objective of this systematic review is to evaluate the prevalence of poor sleep quality among medical students in Southeast Asia utilizing the Pittsburgh Sleep Quality Index (PSQI). Databases including PubMed/MEDLINE, Google Scholar and relevant studies were assessed for quality. A random-effects meta-analysis was conducted to estimate the pooled prevalence of poor sleep quality in this group.

Recent findings: The meta-analysis, which included 10 studies and 2084 participants, showed a pooled prevalence of poor sleep quality of 64% (95% CI: 53-75%) among medical students in Southeast Asia. Factors leading to poor sleep included anxiety, depression and stress level and academic demands. Despite the recognized advantages of sufficient sleep, many students consistently scored above the PSQI threshold, reflecting ongoing sleep issues.

Summary: The results of this review emphasize the widespread problem of poor sleep quality among medical students in Southeast Asia region, highlighting the necessity for targeted strategies to tackle sleep disturbances in this demographic. Introducing sleep hygiene programs and stress management techniques might alleviate these challenges. More research is required to identify effective methods for enhancing sleep quality and overall health in medical students.

Keywords

Sleep quality, Medical students, Southeast Asia, Pittsburgh Sleep Quality Index (PSQI), Sleep disturbances, Meta-analysis

Introduction

Insufficient sleep, is characterized by an inadequate duration or quality of sleep, and has been shown to exhibit a variety of detrimental effects on numerous health conditions, including but not limited to cardiovascular diseases, neurocognitive functioning, psychological disorders, levels of empathy and interpersonal skills, metabolic abnormalities, immunological response, and academic performance [1-3]. The American Academy of Sleep Medicine, in conjunction with the Sleep Research Society, advocates for a minimum 7 hours of nocturnal sleep for adults, while endorsing a duration of up to 9 hours of sleep per night for adolescents and younger adults in order to foster optimal health outcomes [1]. Despite the fact that this particular recommendation has been put forth with the intention of promoting better sleep habits, a substantial amount of empirical evidence clearly demonstrates that roughly one third of the entire global population is not able to meet

the recommended duration of sleep that is deemed necessary for optimal health and well-being [2,4].

Medical students represent a distinct and particularly unique demographic group when compared to their counterparts who do not pursue studies in the field of medicine.

This cohort experiences a greater prevalence of sleep disturbances, which can be attributed to numerous factors including academic workload, the overall quality and quantity of their sleep, as well as the pervasive stress, anxiety, and various sleep disorders that they frequently encounter throughout their educational journey [5,6]. These sleep disturbances are not merely incidental; they are intricately linked to the demanding nature of medical studies, which often require students to juggle a plethora of responsibilities, including extensive reading, clinical rotations, and preparation for examinations, all of which can severely disrupt their natural sleep patterns and lead to a cascade of negative consequences for their overall health and well-being [7,8]. Numerous studies and research investigations have consistently reported and emphasized that experiencing sleep disorders or having poor quality of sleep among medical students can significantly have a detrimental impact on a wide range of important aspects; which includes overall academic performance, cognitive functioning, emotional and mental well-being, physical health, all of which may lead to various long-term negative consequences thus affecting their future professional lives [7,9-14].

As per the global medical school directory, there currently exist a total of 590 active medical schools within Southeast Asia, thereby establishing this region as possessing the second largest number of such establishments globally, following the Americas [15]. The comprehension of the prevalence of poor sleep quality among medical students in Southeast Asia is imperative, considering its profound implications for both academic achievement and psychological well-being. The academic pressures, demanding schedules, as well as the competitive and frequently stressful nature of the educational milieu encountered by medical students can significantly aggravate sleep-related disturbances. By evaluating the magnitude of inadequate sleep quality among these students, it becomes feasible to formulate targeted interventions aimed at enhancing their overall health and academic performance. Furthermore, the unique heterogeneous cultural and educational landscapes in Southeast Asia may introduce specific elements that influence sleep quality, thereby necessitating a thorough examination of these factors [16]. Acquiring an understanding of the prevalence of sleep-related challenges within these demographics can also inform policymakers and educators in their efforts to establish healthier and more conducive training environments for aspiring medical professionals.

Numerous investigations have been undertaken regarding the prevalence of sleep quality among medical student's globally and in particular geographic regional areas such as Middle East, North Africa and South Asia [17-19]. Nevertheless, to the best of our knowledge a thorough review explicitly targeting this phenomenon in Southeast Asia region remains absent. This deficiency underscores the necessity for concentrated scholarly inquiry to comprehend and ameliorate poor sleep quality among medical students in this particular region.

The Pittsburgh Sleep Quality Index (PSQI) is a validated instrument utilized to distinguish between individuals exhibiting suboptimal or optimal sleep quality through the assessment of seven distinct dimensions: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, consumption of sleep medication, and daytime dysfunction experienced over the preceding month. This instrument comprises 19 meticulously formulated questions, each of which is assigned a specific weight and score, culminating in a total score that ranges from 0 to 21. Elevated scores (5-21) are indicative of compromised sleep quality, whereas diminished scores (0-4) suggest favourable sleep quality [20]. A comprehensive score exceeding 5 has demonstrated a sensitivity of 98.7% alongside a specificity of 84.4%. The PSQI exhibits a Cronbach's alpha coefficient ($\alpha = 0.85$) and a test-retest reliability coefficient ($r = 0.87$) [21].

The primary objective of this investigation is to conduct a systematic review concerning the prevalence of poor sleep quality among medical students in Southeast Asia, utilizing the PSQI. The second objective is to identify the pertinent factors influencing poor sleep quality among medical students within Southeast Asia.

Methods

Study design

The documentation of this systematic review adheres to the guidelines established by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [22]. The predefined protocol was not registered. Ethical approval was considered unnecessary since the data were derived from published research in which informed consent was secured by the primary investigators.

Study selection

Our comprehensive review encompassed observational research designs (including cross-sectional, cohort, or observational studies) that sought to investigate the prevalence of sleep disorders among medical students. To qualify for inclusion, research studies were required to adhere to the following parameters: 1) Published in the English language, 2) Date of publication prior to the second week of September 2024, 3) Studies featuring medical students

from Southeast Asian nations, 4) Studies employing the PSQI as a measurement instrument. The exclusion criteria consisted of: 1) Case reports and case series, 2) Studies that presented findings for medical students alongside non-medical students in the same cohort without offering a subgroup analysis, 3) Lack of accessibility to the study and inability to procure the full text after reaching out to the authors, and 4) Studies that concentrated on specific sleep disorders (e.g., sleep apnea) among medical students.

Search strategy

Two members of our review team (MHH and SLH) independently executed a systematic electronic literature search across four databases, specifically MEDLINE, Google Scholar, and other pertinent academic databases. The subsequent keywords employed were: (“medical students”) AND (“poor sleep quality” OR “sleep problems” OR “sleep disorders”) AND (“PSQI” OR “Pittsburgh Sleep Quality Index”) AND (“Southeast Asia” OR “ASEAN” OR “Thailand” OR “Vietnam” OR “Indonesia” OR “Malaysia” OR “Philippines” OR “Singapore” OR “Myanmar” OR “Cambodia” OR “Laos” OR “Brunei” OR “East Timor”) AND (“prevalence” OR “epidemiology” OR “survey” OR “cross-sectional” OR “case-control”). The search parameters were restricted to English language scholarly publications disseminated from the inception of the databases until the second week of September 2024. The review team meticulously screened the references of the identified publications for potential inclusion in the review.

Data extraction

Data were extracted independently by two reviewers (MHH and SLH) and subsequently verified by a third reviewer (FDS). The ensuing information was systematically extracted and tabulated, encompassing the following elements: Authors of the study, country, sample size, study design, study time, COVID-19 period, sample population, prevalence of poor sleep quality and key finding.

Quality assessment

The quality of the studies was evaluated with the Newcastle-Ottawa Scale [23] each individual study was assigned a quality score that was derived from the characteristics of the cohorts encompassed in the investigation, the comparability of such groups, and the evaluation of both outcomes and exposures. Cumulatively, the scores ranged from 0 to 9, with classifications of 0-4, 5-7, and exceeding 8 denoting low, moderate, and high risk of bias in the studies, respectively. In accordance with the quality evaluation, none of the studies were excluded from the analysis. Two investigators (MHH and SLH) independently assessed the risk of bias, and any discrepancies between their evaluations were resolved through a discussion

involving FDS.

Statistical analysis

Data were pooled using random-effects model according to the DerSimonian-Laird method was used to pool the prevalence of poor sleep quality as higher heterogeneity was expected. Results reported prevalence and corresponding 95% confidence intervals (CI). An assessment of study heterogeneity using the I^2 (% residual variation due to heterogeneity) statistic was performed, with a value of 75-100% considered to represent high heterogeneity [24]. Between-study heterogeneity was also assessed by the Cochran (Q) statistic test and τ^2 (τ^2) [25]. Furthermore, data were presented graphically using forest plots. Funnel plots as a visual tool and regression test are used for examining publication bias in meta-analysis [26]. All analysis was done by using jamovi software desktop version 2.3.28.

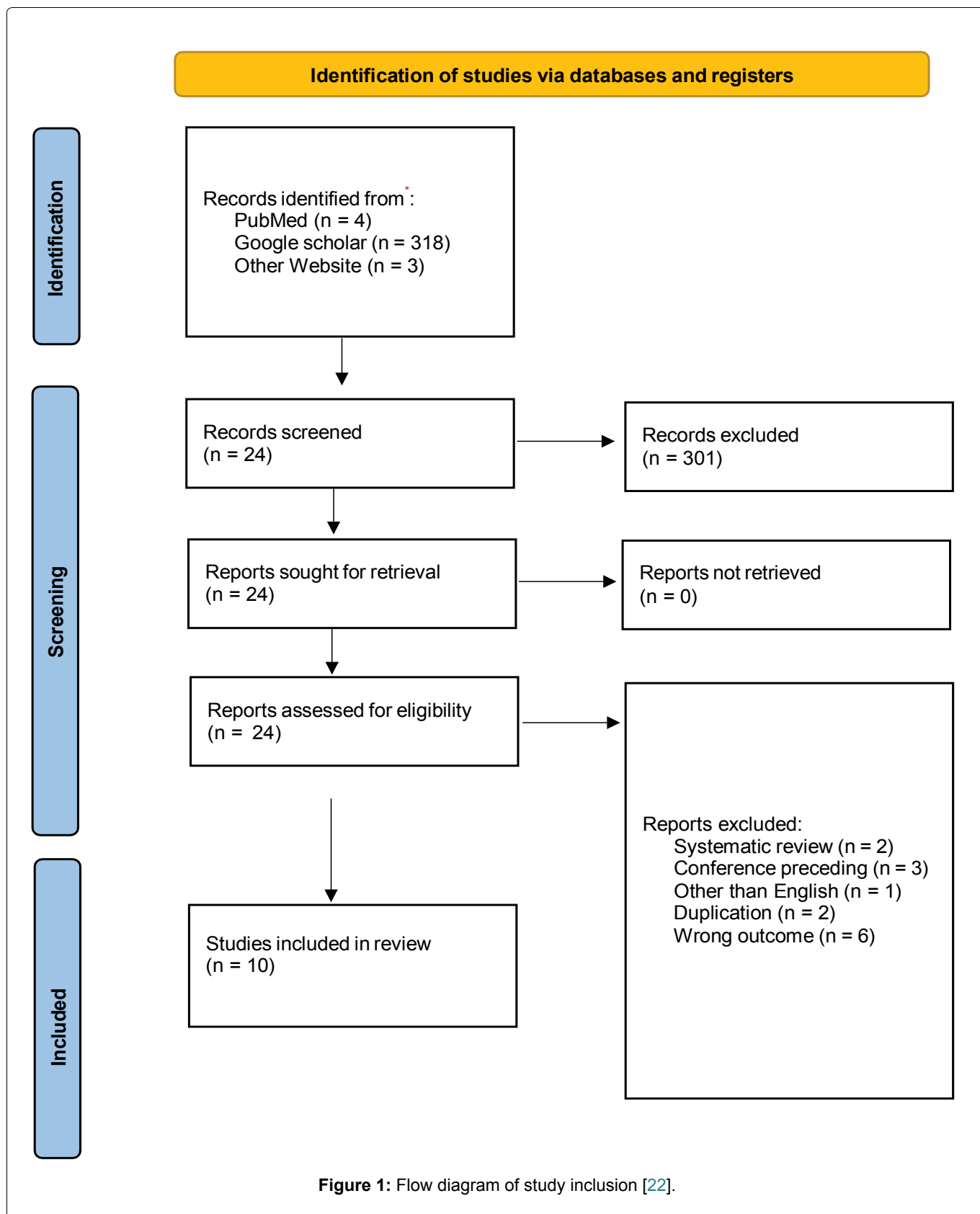
Results

Study selection

A total of 322 records were identified from PubMed/MEDLINE and Google scholar, three records from other website. After examining the titles, abstracts, and reference lists, 24 articles were retrieved. After careful reading and quality assessment, 10 articles were included in this study [27-36]. Fourteen articles were excluded as they did not fulfill the criteria we followed (Figure 1).

Table 1 represents the demographic and methodological information of the selected studies from 2014 to 2024 before August. The overall sample size in the current review was 2804 with a minimum of 94 and a maximum of 1023. Five out of the ten studies were carried out in Indonesia, two in Malaysia and Thailand and one in Philippines. All were cross-sectional studies. Moreover, all studies were cross-sectional studies. Eight of 10 studies were done during pandemic of COVID-19, one study prior the pandemic and one study not reported the period of study. Five of 10 study population was preclinical and clinical student, four studies were preclinical year and one study was not reported sample study. Poor sleep quality among studies were reported from 23.4% to 87.2%.

Figure 2 shows the meta-analysis forest plot of poor sleep quality among medical students. A random effects meta-analysis of all the available studies evaluated sleep quality in medical students (K = 10, N = 2084). The prevalence rates of poor sleep quality of the ten studies ranged between 23% (95% CI: 15-32%) and 87% (95% CI: 82-93%). The overall pooled prevalence for poor sleep quality among medical students was 64% (95% CI: 55-73%), statistically evidence of high heterogeneity with $\tau^2 = 0.0319$ (SE = 0.0156); $I^2 = 97.56\%$; Q = 241.56 and $p < 0.001$.



Discussion

Our systematic review and meta-analysis examining the prevalence of poor sleep quality among medical students in Southeast Asia encompasses a total of 2,084 participants. The prevalence rates of poor sleep quality among medical students in Southeast Asia range from 23.4%, as indicated by Madihah, et al. in Malaysia, to

87.2%, as reported by Yuniarti, et al. in Indonesia [27,36]. The pooled prevalence stands at 64% (95% CI: 53-75%), reflecting a troubling incidence of inadequate sleep quality among medical students across diverse nations. This statistic surpasses the global pooled prevalence of poor sleep quality among medical students, which is reported to be 55.64% (95% CI: 51.45-59.74%) according to Binjabr, et al., his study incorporates 109 investigations

Table 1: Selected characteristics of studies on poor sleep quality among medical students included in systemic reviews and meta-analysis.

No	Study Author	Country	Sample Size	Study Design	Study Time	COVID-1G Period	Sample Population	Prevalence of poor sleep quality	Key Finding
1	Ursula, et al. [35]	Indonesia	208	Cross-sectional	December 2020 to February 2021	Yes	N/A	146 (70.2%)	significant association between anxiety and poor sleep quality
2	Ballebas, et al. [34]	Philippines	271	Cross-sectional	January to May 2022	Yes	Year 1 to Year 5 (preclinical and clinical year)	57.93%	Significant association between stress and poor sleep quality
3	Pattanasari, et al. [33]	Thailand	224	Cross-sectional	October 2019	Yes	Year 1 to Year 6 (preclinical and clinical year)	181 (80.8%)	High prevalence of depression, stress, and poor sleep was found among medical students during the COVID-19 pandemic
4	Madihah, et al. [36]	Malaysia	94	Cross-sectional	April 2020 to January 2021	Yes	Year 1 and year 2 (preclinical year)	22 (23.4%)	The overall prevalence of physical inactivity and poor sleep quality among pre-clinical MBBS students in University of Cyberjaya was relatively low
5	Rachmawati, et al. [32]	Indonesia	111	Cross-sectional	September to November 2021	Yes	Year 1 to Year 3 (preclinical)	91 (82%)	There was no association between stress level, sleep quality, physical activity with cardiorespiratory fitness among medical students
6	Said, et al. [30]	Malaysia	456	Cross-sectional	July to August 2019	NO	Year 1 to Year 5 (preclinical and clinical year)	271 (59.6%)	Students who were in the pre-clinical year and had depression were independently associated with the occurrence of poor sleep quality
7	Wiguna, et al. [31]	Indonesia	1023	Cross-sectional	October 2020 to June 2021	YES	Year 1 to Year 4 (preclinical year)	624 (61%)	There is association between current mental health disturbances and depression, sleep quality, and screen time in Indonesian preclinical medical students.
8	Thaipisuttikul, et al. [29]	Thailand	169	Cross-sectional	October 2019	NO	Year 2 to Year 5 (preclinical and clinical year)	105 (63.6%)	This study found that the prevalence of poor sleep quality and daytime sleepiness in Thai medical students

9	Yuniarti, et al. [27]	Indonesia	148	Cross-sectional	NR	NR	NR	NR	129 (87.2%)	There is a relationship between moderate severe stress levels and sleep quality in medical students
10	Farhana, et al. [28]	Indonesia	100	Cross-sectional	2021	YES	Year 1 to Year 3 (preclinical)	52 (52%)	Students who have a screen time of more than 6 hours per day, they have a risk of sleep disorders	

from 31 countries worldwide, encompassing a total of 54,894 participants [37]. Furthermore, this figure is notably greater than the pooled prevalence of sleep disorders, specifically insomnia, in South Asian countries, which is documented at 52.1% (95% CI: 41.1-63.1%); this analysis includes seven studies from four nations involving 3,739 medical student participants [19]. Rao, et al. conducted a systematic meta-analytic review encompassing 50 studies from 50 distinct nations. The comprehensive analysis of poor sleep quality in their investigation demonstrates the greatest prevalence occurring in Europe (65.13%), succeeded by the Americas (59.92%), Africa (54.54%), Asia (47.44%), and Oceania (30.51%) within a sample of 24,884 medical students. Furthermore, the pooled prevalence of poor sleep quality was assessed to be 52.7% (95% CI: 45.3-60.1%), which is lower in comparison to the findings of our investigation [38].

Variations emerged across different nations, indicating that cultural values, regional condition, and environmental factors significantly influence sleep behaviours and attitudes [39,40]. High prevalence rates of poor sleep quality observed in our investigation indicate that medical students exhibit a heightened susceptibility to sleep disturbances, presumably attributable to the rigorous demands inherent in their academic pursuits. The results highlight the imperative for targeted interventions aimed at enhancing sleep quality within this demographic region.

The COVID-19 pandemic has brought significant mental stress to the community and disruptions to learning, especially to medical students, due to the increasing stress on the health system. Eight of the studies in this review took place during the COVID-19 pandemic, one study occurred prior to the pandemic, and one study was unclear due to a lack of start date for data collection. In the course of our investigation, various mental health factors were identified that exhibit an association with poor sleep quality in medical students, such as anxiety, elevated stress levels and depressive symptoms. Sedentary lifestyle, academic workload, and prolonged exposure to screens also have association with poor sleep quality in medical students.

Many studies revealed that anxiety and depressive symptoms are relatively common in medical students [39-41]. A study conducted by Ursula and colleagues found a strong link between anxiety and low sleep quality among medical students in Indonesia. Furthermore those respondents who have anxiety are 1.5 times more at risk of having poor sleep quality [35] these findings are similar to those found in the study by Chowdhury, et al. with a systematic review of prevalence of insomnia in medical students in South Asian region. From 7 studies they found that one study reported anxiety among medical students and an association with a sleep disorder [19]. Chaabane, et al. also reported in

the systematic review of sleep disorders in medical students in the region of Middle East and North Africa showing that anxiety has a negative impact on the risk of insomnia depends on the severity of the level of anxiety. Insomnia as a sleep disorder is associated with an increased risk of depression and anxiety in adults and adolescents which suggests that this relationship is bi-directional [17].

Research conducted in this systematic review in the Southeast Asian region has indicated a significant association between mental health conditions (including anxiety, depression, and stress) and poor sleep quality. Wiguna, et al. examined a cohort of 1,023 medical students in Indonesia, exploring the relationship between screen time and sleep quality in the context of mental health disturbances during the COVID-19 pandemic; their findings revealed varying levels of depression, with 4.7% categorized as minimal, 18% as mild, 35.3% as moderate, and 10.4% as severe. This investigation provided robust statistical evidence of a significant association ($p < 0.001$) between depression and poor sleep quality [31]. Yuniarti, et al. reported findings from a sample of 124 medical students, revealing that nine participants (33.1%) experienced low stress, while 83 (56.1%) exhibited moderate stress, and 16 (10.8%) reported high perceived levels of stress. This study demonstrated a significant association between stress levels and poor sleep quality, indicating that students with moderate to high stress levels were 4.26 times more likely to experience poor sleep quality compared to their counterparts with low stress levels [27]. Ballebas, et al. conducted a study involving 271 medical students in the Philippines, where a high prevalence of stress (79.71%) and poor sleep quality (59.73%) was identified, along with a statistically significant positive correlation ($p = 0.44$) 95CI [0.33-0.55] (p -value < 0.001) [34]. Pattanaseri, et al. reported findings from Thailand involving 224 medical students, noting a high prevalence of depression (35.7%), moderate to high perceived stress (71.4%), and poor sleep quality (80.8%) among this population [33]. Said, et al. presented data from Malaysia, with 456 medical student participants, indicating that the prevalence of poor sleep quality was 59.6%. Multiple logistic regression analysis indicated that depression (AOR: 1.71, 95% CI: 1.03-2.83) was an independent contributor to poor sleep quality among medical students [30]. These findings are consistent with those of Chowdhury, et al., who reported that two out of seven studies indicated a correlation between depression, anxiety, and sleep disorders among medical students in the South Asian region.

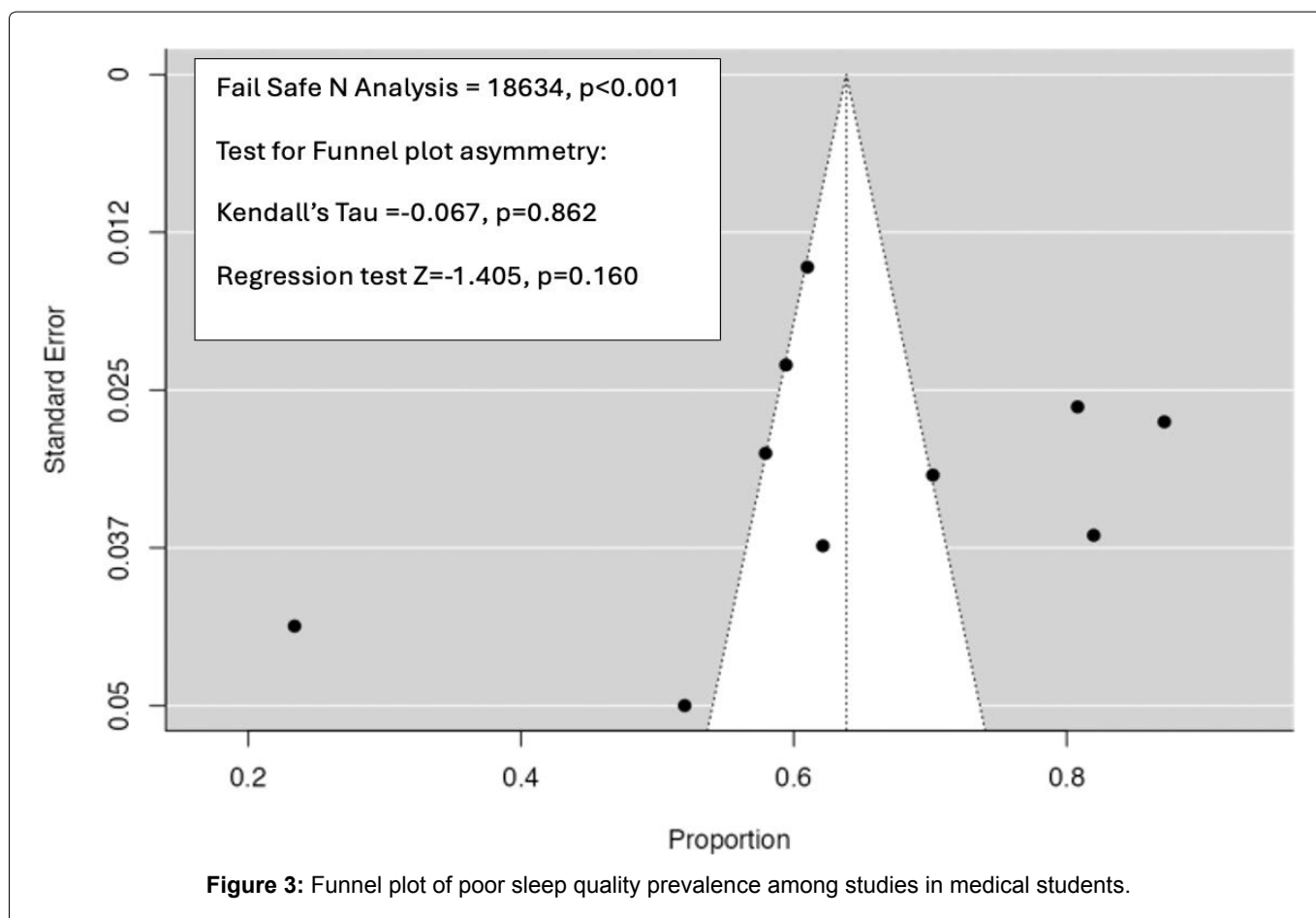
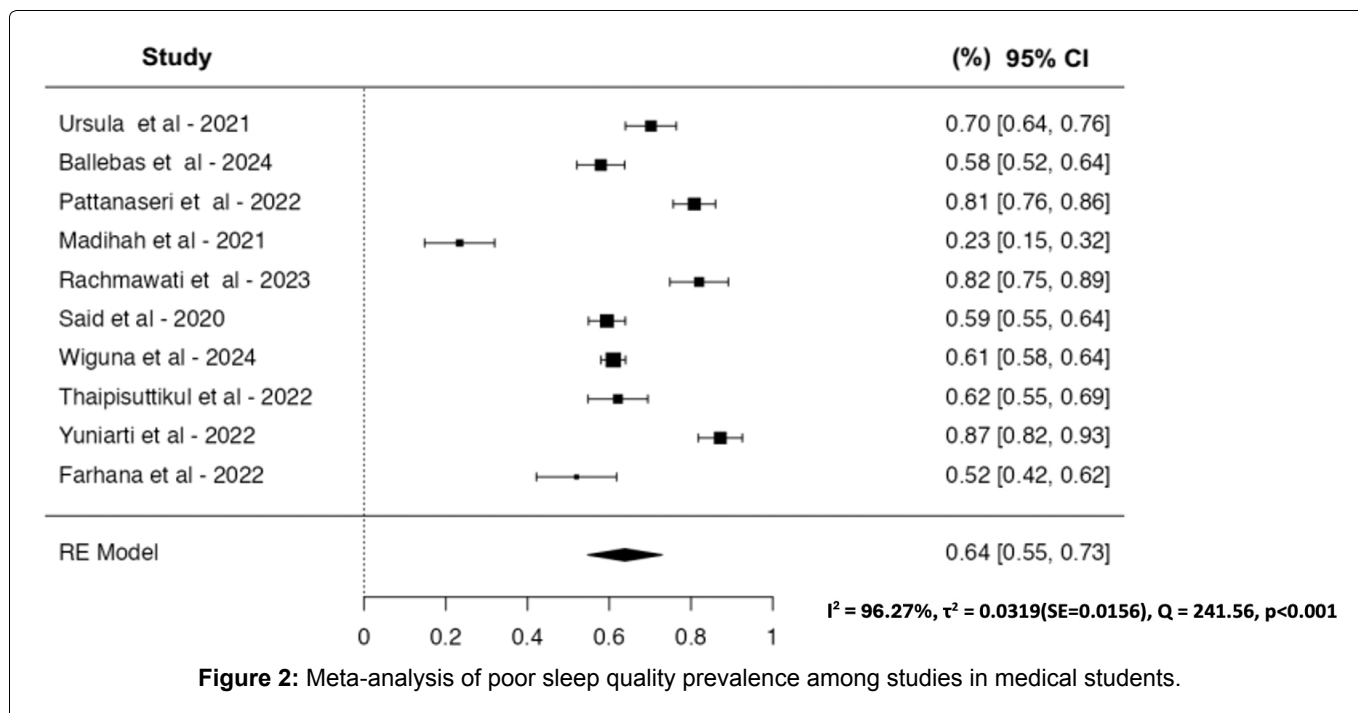
Owing to the rigorous demands inherent in medical education and the potential ramifications of inadequate sleep on academic performance, clinical efficacy, and psychological well-being, the quality of sleep represents a significant concern for individuals pursuing a medical degree. Medical students encounter

substantial academic pressure, extended hours of study and clinical practice, as well as various other factors that may contribute to sleep disturbances and sleep-related disorders [18]. The participant cohorts in these investigations predominantly comprised of medical students across diverse academic years, encompassing both preclinical and clinical phases. For instance, a research endeavour conducted in Malaysia incorporated students ranging from Year 1 to Year 5, thereby facilitating a holistic examination of sleep quality across various educational strata. Conversely, certain studies concentrated exclusively on preclinical students, exemplified by research in Indonesia, which yielded valuable insights into the distinctive challenges encountered by novice medical scholars. The heterogeneity in participant populations across different nations augments the generalizability of the results, as it accurately mirrors the experiences of medical students situated within varying educational frameworks. This diversity further underscores the necessity of contemplating academic year and regional variables when addressing issues related to sleep quality. Moreover, the interplay between academic pressures and sleep patterns warrants further investigation, particularly in light of emerging evidence suggesting that chronic sleep deprivation can adversely affect cognitive function and overall well-being [7]. Understanding these dynamics is crucial for developing targeted interventions that can enhance the academic performance and health of medical students globally.

Strength and Limitation

A main strength of this systematic review is its detailed examination of poor sleep quality among medical students in Southeast Asia, offering insights that have not been widely studied in global research. By utilizing the PSQI as a common and recognized metric, this review guarantees uniformity and comparability across the included studies. Concentrating on Southeast Asia allows for a closer look at cultural, educational, and lifestyle aspects that could affect sleep quality in this distinct group. Moreover, the review includes a wide variety of studies from different Southeast Asian nations, providing a more accurate representation of the region. Despite the presence of considerable heterogeneity between studies, the meta-analysis findings are strong and unlikely to be affected by publication bias. This implies that while the study effects are variable, the overall conclusions of the meta-analysis are reliable and robust (Figure 2 and Figure 3). This comprehensive method lays a solid groundwork for future efforts to enhance sleep health among medical students in these nations.

Nevertheless, this systematic review exhibits several limitations: Firstly, the investigation exclusively encompassed studies published in the English language. Secondly, it is anticipated that epidemiological



meta-analyses will inherently exhibit considerable heterogeneity. Thirdly, all studies included in this review were conducted as cross-sectional surveys. In order to elucidate the factors associated with sleep disturbances in this population, longitudinal investigations that assess variations in sleep quality throughout the course of medical education are essential. Fourthly, a significant proportion of our studies concerning poor

sleep quality were conducted during the COVID-19 pandemic, indicating that the overarching context of poor sleeps quality is likely correlated with pandemic-related conditions. Therefore, there is a necessity for longitudinal studies conducted post-COVID-19 pandemic to accurately identify the determinants influencing poor sleep quality among medical students. Finally, the prevalence rates analysed in this review

were derived from self-reported measures. Although the PSQI is a validated tool widely utilized in both clinical and research settings, the components utilized to assess sleep quality are relatively constrained. Future investigations are strongly recommended to explore additional dimensions of sleep, including objective measures of sleep quality, such as polysomnography.

Conclusion

This systematic review highlighted the pooled prevalence of poor sleep quality among medical students in Southeast Asian countries is 64% (95% CI: 53-75%), despite certain limitations. The overall pooled prevalence of poor sleep quality is significantly higher than in other regions, indicating that this is a widespread health problem among medical students, and it calls for increased focus on this issue within this region.

Our research shows an association between poor sleep quality and the occurrence of mental health problems such as anxiety, depression, and stress. Medical students with poor sleep quality face a greater risk of these mental health issues, indicating a two-way direction where poor mental health can worsen sleep problems and the other way around. This connection highlights the need to focus on good sleep habits as an essential part of mental health treatments, since improving sleep quality could be an effective way to reduce symptoms of anxiety, depression, and stress.

Medical students should seek help from the faculty and other resources in the campus if they are having trouble managing their workload or are feeling overwhelmed.

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