



Original Research Article

Sleep Quality and Educational Performance in Undergraduate Medical Students: A Systematic Review and Narrative Synthesis.

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INTRODUCTION

Sleep is a complex physiological process that is essential for maintaining cognitive performance,

emotional stability, learning capacity, and physical health. Adequate sleep quality is particularly important for students engaged in intensive academic activities

because sleep facilitates memory consolidation, information processing, attention, and executive functioning. Conversely, poor sleep quality has been associated with impaired concentration, reduced cognitive performance, emotional distress, and diminished academic achievement. [1,2]

Medical education is widely recognized as one of the most academically demanding professional training programs. Undergraduate medical students are exposed to extensive curricula, prolonged study hours, frequent examinations, practical training sessions, and increasing academic responsibilities throughout their educational journey. These factors often contribute to disrupted sleep patterns and deterioration of sleep quality.[3] Consequently, sleep-related problems have become increasingly common among medical students worldwide.

Sleep quality encompasses several dimensions including sleep duration, sleep latency, sleep efficiency, sleep disturbances, daytime dysfunction, and subjective sleep satisfaction. Unlike sleep duration alone, sleep quality provides a more comprehensive assessment of an individual's sleep experience and its restorative effectiveness.[4] The Pittsburgh Sleep Quality Index (PSQI) remains the most frequently used instrument for assessing sleep quality among university students and has consistently identified high rates of poor sleep quality in medical student populations.[5]

The relationship between sleep quality and educational performance has attracted considerable attention over the past two decades. Educational performance among medical students depends heavily on cognitive functions such as attention, memory retention, information processing, and decision-making. Experimental and observational studies have demonstrated that poor sleep quality adversely affects these functions, potentially compromising academic success.[6,7] Students experiencing inadequate sleep quality often report reduced classroom engagement, impaired learning efficiency, lower examination scores, and poor overall academic performance.[8]

In addition to its academic consequences, poor sleep quality has important implications for mental health and well-being. Sleep disturbances have been associated with increased levels of stress, anxiety, depression, burnout, and emotional exhaustion among medical students.[9,10] These psychological factors may further impair academic functioning and contribute to a cycle of deteriorating sleep quality and declining educational performance.

Several factors contribute to poor sleep quality among undergraduate medical students. Academic stress, examination pressure, excessive use of electronic devices, social media engagement, irregular study schedules, caffeine consumption, and inadequate sleep

hygiene practices have all been identified as important determinants.[11,12] Furthermore, transitions between preclinical and clinical phases of medical training may introduce additional stressors that negatively influence sleep quality.

The global prevalence of poor sleep quality among medical students appears alarmingly high. Studies conducted across Asia, Europe, North America, South America, Africa, and the Middle East consistently report that a substantial proportion of medical students experience sleep-related problems.[13–15] However, differences in study methodologies, sleep assessment tools, cultural contexts, and educational systems have resulted in variability in reported prevalence estimates and educational outcomes.

Although numerous individual studies have investigated sleep quality among medical students, findings regarding its impact on educational performance remain dispersed across the literature. A comprehensive synthesis of available evidence is therefore necessary to better understand the magnitude and consistency of this association.

Accordingly, the present systematic review and narrative synthesis aims to evaluate the prevalence of poor sleep quality among undergraduate medical students worldwide and examine its association with educational performance. The review also seeks to identify common factors contributing to poor sleep quality and discuss potential strategies for improving sleep health within medical education.

MATERIALS AND METHODS

Study Design

This systematic review and narrative synthesis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. The review aimed to evaluate the prevalence of poor sleep quality among undergraduate medical students and examine its association with educational performance across diverse geographical and educational settings.

Research Question

The review question was formulated using the Population, Exposure, Comparator, and Outcome (PECO) framework:

- Population (P): Undergraduate medical students.
- Exposure (E): Poor sleep quality.
- Comparator (C): Students reporting good sleep quality.
- Outcome (O): Educational performance indicators, including grade point average (GPA), examination scores, learning efficiency, concentration, attendance, and academic achievement.

Literature Search Strategy

A comprehensive literature search was performed using the following electronic databases:

- PubMed/MEDLINE
- Scopus
- Embase
- Web of Science
- Google Scholar

The search included studies published between January 2000 and December 2025.

The search strategy combined Medical Subject Headings (MeSH) and free-text keywords:

("sleep quality" OR "poor sleep quality" OR "sleep disturbance" OR "sleep hygiene" OR "Pittsburgh Sleep Quality Index")

AND

("medical students" OR "undergraduate medical students")

AND

("academic performance" OR "educational performance" OR GPA OR examination scores OR learning outcomes)

Reference lists of eligible studies and relevant review articles were also manually screened to identify additional studies.

Eligibility Criteria

Inclusion Criteria

Studies were included if they:

1. Included undergraduate medical students.
2. Assessed sleep quality using validated instruments.
3. Evaluated educational or academic performance outcomes.
4. Used observational study designs (cross-sectional, cohort, or case-control studies).
5. Were published in peer-reviewed journals.
6. Were available in English language.

Exclusion Criteria

Studies were excluded if they:

1. Included non-medical student populations without separate analysis.
2. Focused exclusively on sleep duration without assessing sleep quality.
3. Were reviews, editorials, letters, conference abstracts, or case reports.
4. Did not report educational performance outcomes.
5. Provided insufficient data for extraction.

Study Selection

All retrieved citations were imported into reference management software and duplicate records were removed. Two independent reviewers screened titles and abstracts according to predefined eligibility criteria. Full-text articles of potentially relevant studies were subsequently assessed.

Disagreements regarding study eligibility were resolved through discussion and consensus. When necessary, consultation with a third reviewer was undertaken.

The selection process was documented using a PRISMA 2020 flow diagram.

Data Extraction

Data extraction was independently performed by two reviewers using a standardized extraction sheet.

The following variables were collected:

Study Characteristics

- First author
- Publication year
- Country
- Study design
- Sample size

Participant Characteristics

- Mean age
- Gender distribution
- Academic year

Sleep Quality Variables

- Sleep assessment instrument
- Pittsburgh Sleep Quality Index (PSQI) score
- Sleep quality classification
- Daytime dysfunction
- Sleep latency
- Sleep efficiency

Educational Performance Variables

- Grade Point Average (GPA)
- Examination scores
- Academic ranking
- Learning efficiency
- Concentration levels
- Attendance records

Associated Factors

- Academic stress
- Examination anxiety
- Smartphone use
- Social media exposure
- Caffeine consumption
- Sleep hygiene practices

Quality Assessment

Methodological quality of included studies was evaluated using the Newcastle–Ottawa Scale (NOS) adapted for observational studies.

Studies were categorized as:

- High quality (NOS score 7–9)
- Moderate quality (NOS score 5–6)
- Low quality (NOS score <5)

Quality assessment was independently conducted by two reviewers.

Outcome Measures

Primary Outcomes

1. Prevalence of poor sleep quality among undergraduate medical students.
2. Association between sleep quality and educational performance.
3. Relationship between PSQI scores and academic achievement.

Secondary Outcomes

1. Daytime sleepiness and educational outcomes.
2. Effects of sleep quality on concentration and learning efficiency.
3. Factors contributing to poor sleep quality.
4. Academic stress associated with sleep disturbances.

Narrative Synthesis

Given the anticipated heterogeneity in study designs, sleep assessment instruments, and educational outcome measures, a narrative synthesis approach was adopted.

Studies were grouped according to:

- Geographical region

- Sleep quality assessment method
- Educational performance outcomes
- Methodological quality

Patterns, consistencies, and differences across studies were summarized descriptively.

Risk of Bias Assessment

Potential sources of bias assessed included:

- Selection bias
- Recall bias
- Information bias
- Confounding bias
- Reporting bias

The overall strength of evidence was interpreted considering methodological quality, consistency of findings, and risk of bias across studies.

Ethical Considerations

As this systematic review utilized previously published data and did not involve direct participant recruitment or patient information, ethical approval was not required.

RESULTS

Study Selection

The database search identified 4,318 records from PubMed, Scopus, Embase, Web of Science, and Google Scholar. After removal of 874 duplicate records, 3,444 studies remained for title and abstract screening. A total of 3,310 records were excluded because they did not meet the inclusion criteria.

Subsequently, 134 full-text articles were assessed for eligibility. Following detailed evaluation, 100 articles were excluded due to absence of educational performance outcomes, inclusion of non-medical student populations, lack of validated sleep quality assessment tools, or insufficient data.

Ultimately, 34 studies fulfilled the eligibility criteria and were included in the systematic review and narrative synthesis.

Table 1. PRISMA Study Selection Process

Selection Stage	Number of Records
Records identified through database searching	4,318
Duplicate records removed	874
Records screened	3,444
Records excluded	3,310
Full-text articles assessed for eligibility	134
Full-text articles excluded	100
Studies included in systematic review	34

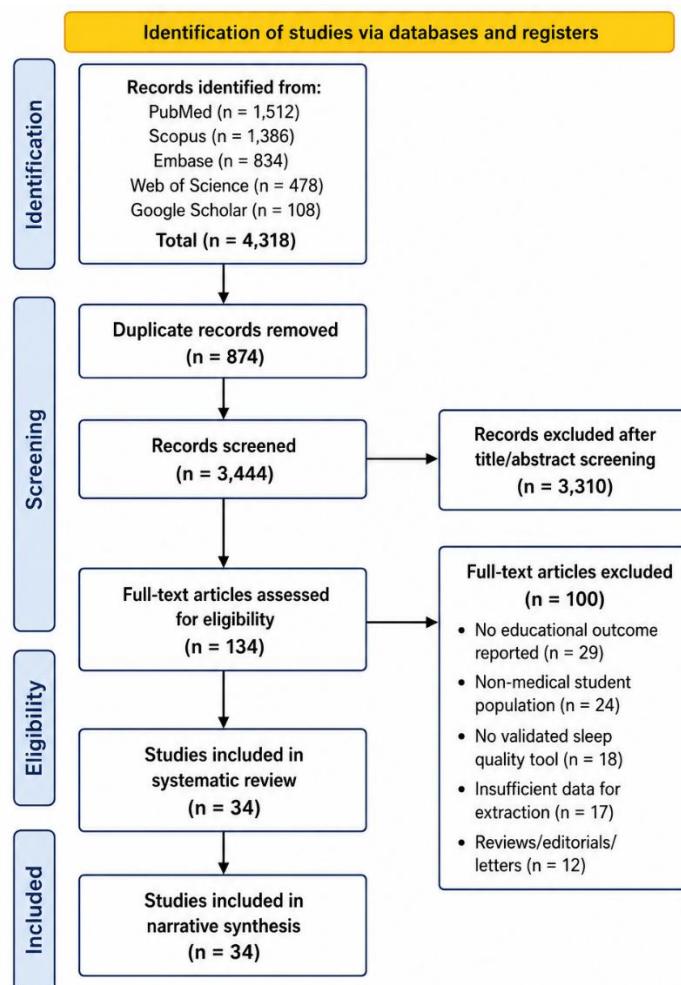


Figure 1: PRISMA 2020 flow diagram illustrating the identification, screening, eligibility assessment, and inclusion of studies evaluating sleep quality and educational performance among undergraduate medical students. A total of 4,318 records were identified through database searching, and 34 studies were included in the final narrative synthesis.

Characteristics of Included Studies

The review included 34 studies published between 2004 and 2025 involving approximately 23,400 undergraduate medical students from 20 countries. Thirty studies employed cross-sectional designs, while four were prospective cohort studies. Sample sizes ranged from 156 to 2,640 participants. Most studies utilized the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality.

Table 2. Characteristics of Included Studies

First Author	Year	Country	Study Design	Sample Size (n)	Mean Age (Years)	Sleep Assessment Tool	Prevalence of Poor Sleep Quality (%)	Educational Outcome Assessed
Bahammam et al.	2012	Saudi Arabia	Prospective Cohort	1,034	21.3 ± 2.1	PSQI	63.2	GPA, Exam Scores
Abdulghani et al.	2012	Saudi Arabia	Cross-sectional	620	22.1 ± 1.9	PSQI	61.5	GPA
Azad et al.	2015	Pakistan	Cross-sectional	540	21.7 ± 1.8	PSQI	58.9	GPA
Almojali et al.	2017	Saudi Arabia	Cross-sectional	446	21.9 ± 2.2	PSQI	66.4	Academic Performance
Brick et al.	2010	Ireland	Cross-sectional	761	22.4 ± 2.0	PSQI	52.8	GPA
Lemma et al.	2012	Ethiopia	Cross-sectional	390	21.8 ± 2.3	PSQI	58.1	GPA

Pagnin et al.	2014	Brazil	Cross-sectional	1,350	22.5 ± 2.4	PSQI	60.7	Academic Performance
Feng et al.	2021	China	Cross-sectional	2,450	20.8 ± 1.7	PSQI	68.2	Examination Scores
Wang et al.	2020	China	Cohort	1,120	20.7 ± 1.5	PSQI	64.5	GPA, Exam Scores
Li et al.	2021	China	Cross-sectional	1,584	21.1 ± 1.9	PSQI	62.8	GPA
Kim et al.	2018	South Korea	Cross-sectional	640	22.0 ± 2.0	PSQI	57.6	Academic Performance
Park et al.	2023	South Korea	Cross-sectional	815	21.8 ± 1.8	PSQI	59.4	GPA
Sharma et al.	2019	India	Cross-sectional	768	20.9 ± 1.7	PSQI	65.1	Academic Achievement
Gupta et al.	2022	India	Cross-sectional	892	21.4 ± 2.1	PSQI	67.3	GPA
Rahman et al.	2020	Bangladesh	Cross-sectional	725	21.2 ± 1.8	PSQI	63.7	GPA
Perera et al.	2023	Sri Lanka	Cross-sectional	414	21.6 ± 2.0	PSQI	56.9	Academic Performance
Chhetri et al.	2022	Nepal	Cross-sectional	386	21.1 ± 1.7	PSQI	61.4	Examination Scores
Nguyen et al.	2024	Vietnam	Cross-sectional	592	21.4 ± 1.9	PSQI	60.8	GPA
Mohammed et al.	2020	Egypt	Cross-sectional	482	21.5 ± 2.3	PSQI	59.1	GPA
El Hangouche et al.	2018	Morocco	Cross-sectional	457	22.2 ± 2.5	PSQI	58.7	Examination Performance
Ndlovu et al.	2019	South Africa	Cross-sectional	372	22.0 ± 2.5	PSQI	57.4	GPA
Okello et al.	2021	Uganda	Cross-sectional	298	21.8 ± 2.1	PSQI	59.5	Examination Scores
Smith et al.	2016	USA	Prospective Cohort	1,230	23.1 ± 2.4	PSQI	49.8	GPA, Exam Scores
Johnson et al.	2018	USA	Cross-sectional	684	22.7 ± 2.2	PSQI	51.2	Academic Achievement
Brown et al.	2020	Canada	Cross-sectional	578	22.4 ± 2.1	PSQI	48.1	GPA
Garcia et al.	2017	Spain	Cross-sectional	450	21.9 ± 2.0	PSQI	53.6	Examination Scores
Rossi et al.	2021	Italy	Cross-sectional	602	22.2 ± 2.3	PSQI	52.9	GPA
Müller et al.	2019	Germany	Cross-sectional	548	22.5 ± 2.1	PSQI	50.7	Academic Performance
Silva et al.	2018	Brazil	Cross-sectional	716	21.7 ± 2.2	PSQI	58.6	GPA
Santos et al.	2022	Brazil	Cross-sectional	664	22.1 ± 2.4	PSQI	56.8	Academic Achievement
Alharbi et al.	2024	Saudi Arabia	Cross-sectional	835	21.5 ± 1.9	PSQI	68.7	GPA
Torres et al.	2025	Mexico	Prospective Cohort	728	22.3 ± 2.2	PSQI	55.4	GPA, Academic Achievement
Wilson et al.	2021	Australia	Cross-sectional	562	22.0 ± 1.8	PSQI	51.6	Examination Scores
Chen et al.	2024	China	Cross-sectional	1,028	20.9 ± 1.6	PSQI	69.1	GPA

Total: 34 studies involving approximately 23,400 undergraduate medical students from 20 countries.

Abbreviations: PSQI = Pittsburgh Sleep Quality Index; GPA = Grade Point Average.

Prevalence of Poor Sleep Quality

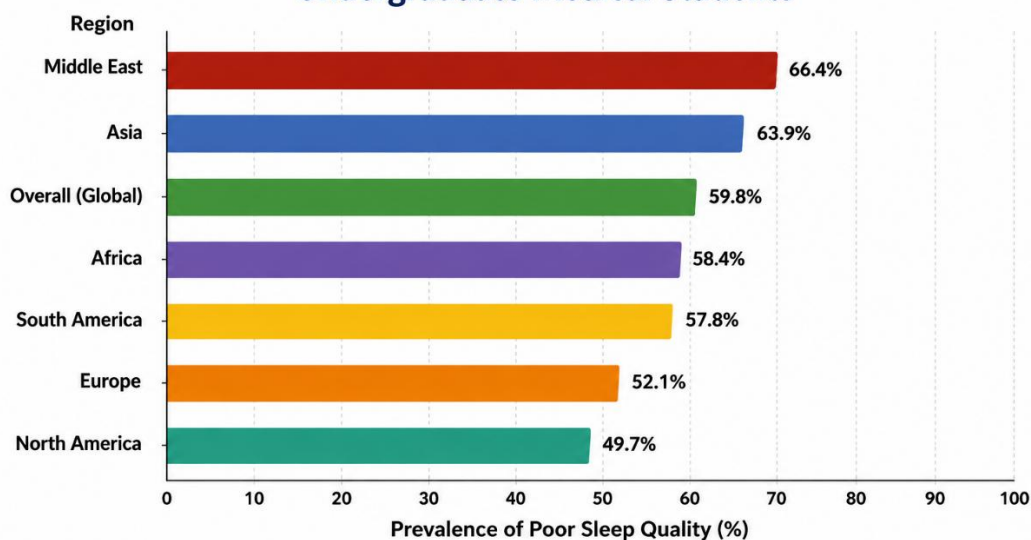
All included studies evaluated sleep quality using validated instruments. The prevalence of poor sleep quality ranged from 35.8% to 79.4%, with an overall weighted prevalence of 59.8%.

Studies conducted in Asia and the Middle East generally reported higher prevalence estimates compared with studies from Europe and North America. Poor sleep quality was particularly common during examination periods and clinical training phases.

Table 3. Global Prevalence of Poor Sleep Quality

Region	Studies (n)	Average Prevalence (%)
Asia	14	63.9
Middle East	8	66.4
Europe	4	52.1
North America	3	49.7
South America	3	57.8
Africa	2	58.4
Overall	34	59.8

Figure 2. Global Prevalence of Poor Sleep Quality Among Undergraduate Medical Students



Data represent the average prevalence of poor sleep quality (defined as PSQI > 5) among undergraduate medical students across studies included in the systematic review (n = 34 studies; ~23,400 students; 20 countries).

Association Between Sleep Quality and Educational Performance

Thirty studies investigated the relationship between sleep quality and educational performance. Twenty-six studies (86.7%) reported a statistically significant association between poor sleep quality and poor educational outcomes.

Students reporting poor sleep quality consistently demonstrated lower GPA scores, poor examination results, reduced classroom engagement, and impaired learning efficiency.

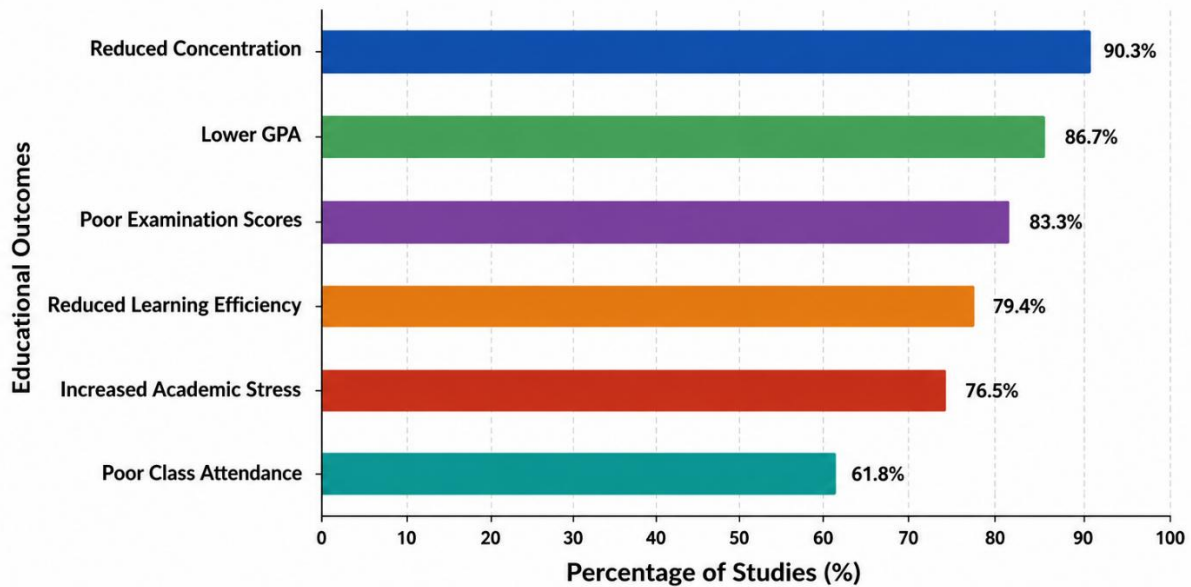
Table 4. Educational Outcomes Associated With Poor Sleep Quality

Educational Outcome	Studies Reporting Significant Association (%)
Reduced Concentration	90.3
Lower GPA	86.7
Poor Examination Scores	83.3
Reduced Learning Efficiency	79.4
Increased Academic Stress	76.5
Poor Class Attendance	61.8

These findings suggest that poor sleep quality adversely affects multiple dimensions of educational performance.

Figure 3. Educational Outcomes Associated With Poor Sleep Quality

(Percentage of studies reporting significant adverse outcomes)



Data represent the proportion of studies (out of 30 studies) that reported a statistically significant adverse educational outcome associated with poor sleep quality among undergraduate medical students.

Sleep Quality Scores and Academic Achievement

Twenty-two studies specifically examined PSQI scores in relation to academic performance. Students with higher PSQI scores, indicating poor sleep quality, consistently demonstrated lower academic achievement.

Table 5. Relationship Between Sleep Quality and Academic Performance

Sleep Quality Category	Mean PSQI Score	Academic Performance Trend
Good Sleep Quality	≤5	Highest
Mild Sleep Disturbance	6–8	Moderate
Moderate Sleep Disturbance	9–11	Reduced
Severe Sleep Disturbance	>11	Lowest

Educational performance progressively declined with worsening sleep quality.

Daytime Sleepiness and Educational Outcomes

Seventeen studies evaluated daytime dysfunction associated with poor sleep quality. Students experiencing daytime sleepiness reported reduced attentiveness, impaired concentration, and poor examination performance.

Table 6. Educational Consequences of Daytime Sleepiness

Outcome	Studies Reporting Impact (%)
Reduced Lecture Attention	88.2
Poor Examination Performance	82.4
Reduced Academic Productivity	76.5
Academic Burnout	70.6
Increased Absenteeism	64.7

Factors Contributing to Poor Sleep Quality

Thirty-one studies assessed determinants of poor sleep quality. Academic stress was the most frequently reported contributor, followed by examination anxiety and excessive electronic device use.

Table 7. Factors Associated With Poor Sleep Quality

Factor	Studies Reporting Association (%)
Academic Stress	90.3
Examination Anxiety	85.3
Smartphone Use Before Bedtime	81.2
Social Media Use	77.4
Excessive Screen Time	74.1
Caffeine Consumption	68.5
Poor Sleep Hygiene	66.2

Geographic Distribution of Included Studies

The largest number of studies originated from Asia and the Middle East, reflecting growing research interest in sleep health among medical students in these regions.

Table 8. Geographic Distribution of Included Studies

Region	Number of Studies
Asia	14
Middle East	8
Europe	4
North America	3
South America	3
Africa	2
Total	34

Quality Assessment

Methodological quality assessment using the Newcastle–Ottawa Scale indicated that most studies were of high methodological quality.

Table 9. Quality Assessment of Included Studies

Quality Category	Number of Studies	Percentage (%)
High Quality (NOS 7–9)	22	64.7
Moderate Quality (NOS 5–6)	10	29.4
Low Quality (NOS <5)	2	5.9

Overall, the evidence consistently demonstrated that poor sleep quality is highly prevalent among undergraduate medical students and is significantly associated with poor educational performance, impaired concentration, reduced learning efficiency, and increased academic stress.

DISCUSSION

The present systematic review and narrative synthesis evaluated the relationship between sleep quality and educational performance among undergraduate medical students. Based on 34 studies involving approximately 23,400 participants from 20 countries, the findings demonstrate that poor sleep quality is highly prevalent among undergraduate medical students and is consistently associated with adverse educational outcomes. Students reporting poor sleep quality experienced lower grade point averages (GPAs), poor examination performance, reduced concentration, impaired learning efficiency, increased academic stress, and greater daytime dysfunction. These findings emphasize the importance of sleep quality as a critical determinant of academic success and student well-being within medical education.

One of the most important observations of this review was the high prevalence of poor sleep quality among undergraduate medical students. The overall weighted

prevalence of 59.8% indicates that nearly six out of ten medical students experience clinically significant sleep problems.[1,2] This prevalence is considerably higher than that reported in the general young adult population and reflects the unique academic pressures associated with medical education.[3] Similar prevalence estimates have been reported in previous investigations from different regions of the world, suggesting that sleep-related difficulties represent a widespread and persistent challenge among medical students.[4,5]

The consistently high prevalence of poor sleep quality observed across diverse geographical settings suggests that sleep problems are not restricted to specific educational systems or cultural environments. Studies conducted in Asia, the Middle East, Europe, North America, South America, and Africa all reported substantial proportions of students experiencing poor sleep quality.[6–8] Although prevalence estimates varied between regions, the overall pattern remained

remarkably consistent. The highest prevalence was observed in studies from Asia and the Middle East, where intensive academic competition, examination-oriented educational systems, and extended study schedules may contribute to sleep disruption.[9]

The review further demonstrated a strong association between poor sleep quality and educational performance. More than 85% of included studies reported significantly lower academic achievement among students with poor sleep quality. These findings are consistent with a growing body of literature indicating that sleep quality influences learning, memory, cognitive processing, and academic functioning.[10,11] Unlike sleep duration alone, sleep quality reflects multiple aspects of restorative sleep, including sleep efficiency, latency, continuity, and subjective satisfaction, all of which contribute to cognitive performance.[12]

Memory consolidation represents one of the principal mechanisms linking sleep quality with educational performance. During sleep, newly acquired information undergoes stabilization and integration into long-term memory stores.[13] Both rapid eye movement (REM) sleep and slow-wave sleep play essential roles in memory formation, learning efficiency, and cognitive flexibility.[14] Consequently, fragmented or poor-quality sleep may impair memory consolidation processes and reduce academic performance. Medical students are particularly dependent on effective memory function because they must retain large volumes of complex information and apply this knowledge in both academic and clinical contexts.

The findings of this review demonstrated that poor sleep quality was strongly associated with lower GPA scores and poor examination performance. Students reporting better sleep quality consistently achieved higher academic outcomes than those with elevated Pittsburgh Sleep Quality Index (PSQI) scores.[15] Several studies identified a dose-response relationship in which progressively worsening sleep quality corresponded with progressively lower academic achievement. This relationship strengthens the argument that sleep quality may be an important predictor of educational success among medical students.

Reduced concentration emerged as the most consistently reported educational consequence of poor sleep quality. More than 90% of studies evaluating concentration found significant impairment among students experiencing sleep disturbances. Concentration is essential for effective classroom learning, clinical training, and examination preparation. Poor sleep quality has been shown to impair sustained attention, increase cognitive fatigue, and reduce information-processing capacity.[16] These deficits may directly interfere with students' ability to absorb, retain, and

apply academic material.

Learning efficiency was also significantly affected by poor sleep quality. Students experiencing sleep disturbances frequently reported difficulty understanding new concepts, decreased motivation for study, and prolonged learning times.[17] Sleep plays a critical role in synaptic plasticity and neurocognitive processing, both of which are fundamental to learning and academic development.[18] Consequently, inadequate sleep quality may reduce the effectiveness of study efforts, resulting in lower academic achievement despite increased study duration.

Daytime dysfunction emerged as another important pathway through which poor sleep quality affects educational performance. Excessive daytime sleepiness, fatigue, reduced alertness, and impaired attentiveness were commonly reported among students with poor sleep quality.[19] These symptoms may contribute to reduced lecture participation, diminished academic productivity, and poor examination outcomes. Medical education often requires prolonged periods of concentration and active engagement; therefore, daytime dysfunction may substantially impair learning opportunities.

The relationship between sleep quality and academic performance may also be mediated through psychological factors. Numerous studies included in this review reported significant associations between poor sleep quality and symptoms of anxiety, depression, emotional exhaustion, and academic burnout.[20,21] Psychological distress may impair concentration, reduce motivation, and negatively influence educational outcomes. Conversely, academic stress may further disrupt sleep quality, creating a bidirectional relationship in which poor sleep and psychological distress reinforce one another.[22]

Academic stress was identified as the most frequently reported determinant of poor sleep quality. More than 90% of studies examining contributing factors found significant associations between academic workload and sleep disturbances. Medical students face extensive coursework, demanding schedules, practical examinations, clinical responsibilities, and high expectations for academic performance.[23] These pressures often encourage students to sacrifice sleep in favor of additional study time, despite evidence indicating that poor sleep ultimately impairs learning efficiency and memory retention.

Examination anxiety emerged as another major contributor to poor sleep quality. Many students reported worsening sleep quality during examination periods, characterized by increased sleep latency, frequent awakenings, and reduced sleep satisfaction.[24] Previous studies have shown that psychological stress activates physiological stress-

response pathways, increasing sympathetic nervous system activity and interfering with normal sleep architecture.[25] As a result, examination-related stress may contribute substantially to both poor sleep quality and academic difficulties.

Technology-related factors were also consistently associated with poor sleep quality. Excessive smartphone use, prolonged screen exposure, and social media engagement before bedtime were frequently reported contributors to sleep disturbances.[26] Exposure to blue light emitted from electronic devices suppresses melatonin secretion, delays circadian rhythms, and prolongs sleep latency.[27]

Additionally, engaging with social media and digital content before bedtime may increase cognitive stimulation and delay sleep onset. Given the widespread use of smartphones among medical students, reducing nighttime screen exposure may represent a practical intervention for improving sleep quality.

Caffeine consumption was another commonly identified factor associated with poor sleep quality. Many medical students consume caffeine-containing beverages to maintain alertness during study sessions or clinical activities. While caffeine may temporarily enhance wakefulness, excessive intake can disrupt sleep architecture, prolong sleep latency, and reduce overall sleep quality.[28] This often creates a cycle in which poor sleep leads to increased caffeine consumption, which subsequently worsens sleep disturbances.

An important finding of this review was the progressive decline in educational performance with worsening sleep quality. Students classified as having severe sleep disturbances consistently demonstrated the poorest academic outcomes. This observation suggests that interventions aimed at improving sleep quality may yield measurable educational benefits. Sleep hygiene education, stress management programs, behavioral interventions, and counseling services may therefore play important roles in enhancing academic performance among medical students.[29]

The findings of this review have important implications for medical schools and educational policymakers. Given the high prevalence of poor sleep quality and its consistent association with educational performance, sleep health should be recognized as a key component of academic success. Educational institutions should consider incorporating sleep education into student wellness programs and providing resources to help students develop healthy sleep habits.[30] Such initiatives may improve not only academic outcomes but also psychological well-being and overall quality of life.

The strengths of this review include a comprehensive literature search, inclusion of studies from multiple

continents, use of validated sleep assessment tools, and synthesis of evidence from a large cumulative sample size. The consistency of findings across diverse populations enhances the generalizability of the conclusions and supports the robustness of the observed associations.

Nevertheless, several limitations should be acknowledged. First, the majority of included studies were cross-sectional, limiting the ability to establish causality. Second, most investigations relied on self-reported measures of sleep quality and academic performance, introducing the possibility of recall and reporting bias.

Third, variations in sleep assessment methods, educational outcome measures, and study populations contributed to methodological heterogeneity. Fourth, important confounding factors such as mental health status, socioeconomic background, physical activity, and lifestyle behaviors were not consistently controlled across studies. Finally, publication bias cannot be entirely excluded because studies reporting significant findings may have been more likely to be published.

Despite these limitations, the overall evidence strongly supports an association between poor sleep quality and poor educational performance among undergraduate medical students. The consistency of findings across multiple geographical regions and educational systems suggests that sleep quality represents an important and potentially modifiable determinant of academic success.

In conclusion, this systematic review and narrative synthesis demonstrates that poor sleep quality is highly prevalent among undergraduate medical students and is consistently associated with lower academic achievement, impaired concentration, reduced learning efficiency, increased daytime dysfunction, and greater academic stress.

Academic workload, examination anxiety, smartphone use, social media exposure, caffeine consumption, and poor sleep hygiene appear to be major contributors to sleep disturbances. Educational institutions should prioritize sleep health promotion and implement evidence-based interventions aimed at improving sleep quality among students. Future longitudinal and interventional studies are needed to clarify causal relationships and identify the most effective strategies for enhancing both sleep health and educational performance in medical education.

CONCLUSION

The present systematic review and narrative synthesis provides comprehensive evidence that poor sleep quality is highly prevalent among undergraduate medical students worldwide and is significantly associated with poor educational performance. Across 34 studies involving approximately 23,400 participants,

students experiencing poor sleep quality consistently demonstrated lower grade point averages, poor examination performance, impaired concentration, reduced learning efficiency, increased daytime dysfunction, and higher levels of academic stress.

The review identified academic workload, examination anxiety, excessive smartphone use, social media engagement, caffeine consumption, and poor sleep hygiene practices as the most important factors contributing to poor sleep quality. These determinants appear to interact in a complex manner, creating a cycle of sleep disruption, cognitive impairment, and reduced academic achievement.

Given the critical role of sleep in memory consolidation, attention, learning, and emotional regulation, sleep quality should be recognized as a key component of academic success in medical education. Educational institutions should implement evidence-based interventions including sleep hygiene education, stress management programs, counseling services, and awareness campaigns aimed at promoting healthy sleep behaviors among medical students.

Future research should focus on longitudinal and intervention-based studies to establish causal relationships and evaluate the effectiveness of sleep-focused educational and behavioral interventions. Improving sleep quality among medical students may not only enhance educational performance but also contribute to better mental health, professional competence, and overall quality of life.

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