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ABSTRACT

Introduction: Sleep supports memory consolidation, attention, executive functioning, emotional regulation, and learning. Medical students are vulnerable to insufficient and poor-quality sleep because of academic workload, examinations, clinical activities, irregular schedules, and stress. Objective: To analyze the relationship between sleep deprivation and cognitive impairment among medical students. Method: An integrative literature review was based mainly on PubMed/MEDLINE and relevant reviews, prioritizing systematic reviews, meta-analyses, prospective cohorts, and observational studies. Results: Sleep problems are highly prevalent. Reduced sleep is associated with impaired sustained attention, slower reaction time, attentional lapses, working-memory deficits, and poorer executive functioning, with possible effects on academic and clinical performance. Conclusion: Sleep deprivation is an important and potentially modifiable risk factor in medical education.

Keywords: Sleep Deprivation. Cognition. Students, Medical. Memory. Attention.

INTRODUCTION

Sleep is essential for cognitive, emotional, and physiological functioning. Newly acquired information undergoes consolidation during sleep, making memory, attention, executive control, and information processing closely related to sleep quality and duration.[1,2] Adults should regularly obtain at least seven hours of sleep per night according to the American Academy of Sleep Medicine and Sleep Research Society.[3]

Medical students face extensive content, examinations, practical training, clinical responsibilities, early schedules, and psychological demands. These conditions may encourage students to reduce sleep to increase study time, potentially sacrificing the cognitive functions needed for learning.[4]

A meta-analysis of 109 studies involving 59,427 medical students estimated poor sleep quality in 55.6%, excessive daytime sleepiness in about one-third, and average sleep duration of 6.5 hours per night.[5] A 2024 meta-analysis of 44 studies also found that a single night with two to six hours of sleep opportunity increased sleepiness and impaired sustained attention, with slower reaction times and more attentional lapses.[6] This review examines the relationship between sleep deprivation and cognition in medical students.

METHOD

This integrative literature review used PubMed/MEDLINE as the main biomedical database, complemented by scientific platforms and reference lists. Searches combined terms including “medical students,” “sleep deprivation,” “sleep restriction,” “sleep quality,” “sleep duration,” “cognitive function,” “attention,” “working memory,” “executive function,” “academic performance,” and “clinical performance,” using AND and OR. Priority was given to systematic reviews, meta-analyses, prospective cohorts, longitudinal studies, and relevant observational studies, particularly from 2020 onward. No independent quantitative pooling was performed.

RESULTS

Prevalence and sustained attention

Binjabr et al. estimated poor sleep quality in 55.64% of medical students, excessive daytime sleepiness in 33.32%, and average sleep duration of 6.5 hours per night.[5] Seoane et al. reported poor sleep quality in approximately 39.8%, insufficient sleep duration in 29.1%, and excessive daytime sleepiness in 35.9%.[4] Differences between estimates may reflect variation in instruments, populations, and definitions.

Sustained attention is one of the cognitive domains most consistently affected by sleep restriction and is essential for lectures, clinical encounters, diagnostic reasoning, and procedures. Wüst et al. found increased sleepiness, slower reaction times, and more attentional lapses after one night of restricted sleep.[6] Albuquerque et al. similarly found that medical students slept less during academic periods than during vacation; reduced sleep was accompanied by worse psychomotor vigilance and more attentional lapses, with changes in sleep duration correlated with changes in lapses.[9]

Executive functions

Executive functions include inhibitory control, cognitive flexibility, planning, monitoring, and working-memory regulation. A 2025 meta-analysis of 79 publications found significant effects of sleep loss on reaction time and deficits in working-memory maintenance and cognitive flexibility, depending on the task.[7] Another meta-analysis of 24 studies involving 712 participants found a moderate negative effect of sleep deprivation on inhibitory control.[8] Thus, sleep loss may affect both basic alertness and higher-order processes relevant to medical reasoning.

Working memory and information processing

Working memory permits temporary maintenance and manipulation of information and is central to medical learning. Students must retain clinical data, integrate findings, compare differential diagnoses, and apply previous knowledge. Meta-analytic evidence indicates that sleep loss can impair working-memory maintenance, while evidence among medical students also links sleep quality with short-term memory.[7,11]

Academic performance

Seoane et al. found that academic grades were associated with sleep quality and daytime sleepiness, although sleep duration alone was not significantly associated with grades in their meta-analysis.[4] In a three-month longitudinal study of first-year Indian medical students, mean sleep duration decreased from 6.8 to 5.9 hours per night. The decline was accompanied by poorer reaction time, working-memory and Stroop performance; sleep duration was positively correlated with academic performance and independently predicted achievement after adjustment for behavioral and psychological factors.[12]

Clinical performance

Falloon et al. evaluated 216 third-year medical students during a high-stakes OSCE. Poor sleep quality was reported by 56.9% during the preceding month, and 38.4% slept six hours or less on the night before the examination. Sleep quality and sleep duration before the OSCE were significantly associated with clinical assessment performance.[10] Although observational data do not establish causality, these findings suggest that inadequate sleep may have consequences for clinically relevant assessments.

Mechanisms

Sleep contributes to memory consolidation, synaptic plasticity, and functional reorganization of neural networks involved in learning.[1,2] Sleep deprivation may interfere with hippocampal memory processes and alter cortical activity involved in attention and executive functioning. Prolonged wakefulness also increases sleep pressure and may produce microsleeps, contributing to attentional lapses and inconsistent performance.

The paradox of sacrificing sleep to study

Students may sacrifice sleep to increase study time before examinations, assuming that more wakefulness improves performance. However, sleep loss can impair the cognitive processes required to benefit from those additional hours. The evidence therefore challenges sleep reduction as an efficient academic strategy, with attention appearing especially sensitive even after acute restriction.[6]

CONCLUSION

The evidence indicates a consistent relationship between inadequate sleep and cognitive vulnerability among medical students. Poor sleep quality, insufficient duration, and excessive daytime sleepiness are highly prevalent, while objective studies demonstrate impairments particularly in sustained attention, reaction time, working memory, and executive functioning.[4-9] Studies involving medical students also suggest associations with academic and clinical performance.[9,10,12]

Sleep should therefore be regarded as a physiological requirement for effective learning rather than merely an individual lifestyle choice. Medical schools may consider strategies that protect sleep duration and quality, reduce unnecessary schedule-related restriction, provide sleep-hygiene education, and identify students with persistent sleep problems. Future longitudinal and intervention studies should determine whether institutional measures that improve sleep produce measurable gains in cognition, academic achievement, clinical skills, and patient-safety-related competencies.

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