SLEEP DISORDERS AND NEUROCOGNITIVE IMPACT

https://doi.org/10.63330/aurumpub.034-007

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Abstract

Sleep disorders represent a major public health concern and are strongly associated with significant impairments in neurocognitive functioning and overall quality of life. This chapter aims to analyze the impact of major sleep disorders—such as insomnia, obstructive sleep apnea, and chronic sleep deprivation—on neurocognitive processes, including attention, memory, executive functions, and processing speed. The methodology is based on a narrative and integrative review of international literature, drawing on empirical studies and systematic reviews published in reputable scientific databases, with emphasis on evidence produced by well-established authors in the field of sleep neuroscience. The results demonstrate that disruptions in sleep architecture and circadian rhythm regulation negatively affect neural plasticity, neurochemical balance, and memory consolidation, thereby increasing the risk of cognitive deficits, psychiatric disorders, and functional decline. Furthermore, the severity and duration of sleep disturbances are directly associated with the extent of neurocognitive impairment. It is concluded that early identification and proper management of sleep disorders are essential for maintaining brain health, highlighting the importance of preventive strategies, evidence-based clinical interventions, and a more integrated approach linking sleep, cognition, and mental health in both clinical and scientific contexts.

Keywords: Brain health, Cognition, Neuroscience, Sleep disorders.

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INTRODUCTION

Sleep is an essential biological process for maintaining the physical, emotional, and cognitive homeostasis of human beings, playing a fundamental role in neural regulation, memory consolidation, and the optimization of higher cognitive functions. However, in recent decades, there has been a marked increase in the prevalence of sleep disorders, driven by factors such as changes in lifestyle, excessive use of digital technologies, chronic stress, and associated clinical conditions. These disorders have been recognized as important determinants of neurocognitive impairments, affecting attention, memory, executive functions, and overall intellectual performance.

In this context, the research problem guiding this chapter concerns understanding how different sleep disorders impact neurocognitive functioning and which neurobiological mechanisms are involved in this process. Despite advances in research in the field of sleep neuroscience, gaps still remain regarding the integration of scientific findings and the understanding of the cumulative and long-term effects of sleep alterations on human cognition.

Therefore, the general objective of this chapter is to analyze the relationship between sleep disorders and neurocognitive impact in light of contemporary scientific evidence. As specific objectives, the chapter seeks to: (i) describe the main types of sleep disorders associated with cognitive deficits; (ii) identify the most affected neurocognitive domains; (iii) discuss the neurobiological mechanisms underlying these changes; and (iv) highlight clinical and preventive implications resulting from this relationship.

The justification for developing this study lies in the scientific and social relevance of the topic, considering that neurocognitive impairments associated with sleep disorders directly affect academic, professional, and social performance, in addition to increasing the risk of mental and neurodegenerative disorders. Systematizing knowledge on this theme contributes to evidence-based clinical practice and to strengthening prevention and health intervention strategies.

From a theoretical standpoint, this chapter is grounded in contributions from cognitive neuroscience, sleep medicine, and psychology, highlighting classic and contemporary studies that demonstrate the influence of sleep on neural plasticity, regulation of circadian rhythms, and memory consolidation. Authors such as Walker, Stickgold, and Diekelmann show that qualitative and quantitative alterations in sleep compromise essential neurocognitive processes, reinforcing the need for an integrated approach between sleep and cognition.

METHODOLOGY

TYPE OF RESEARCH

This chapter adopts a qualitative approach of a descriptive and analytical nature, grounded in an integrative review of the international scientific literature. This type of research enables a critical synthesis of empirical and theoretical studies, making possible a comprehensive understanding of the relationship between sleep disorders and neurocognitive impact, as well as the identification of patterns, convergences, and gaps in existing knowledge.

SEARCH STRATEGY AND STUDY SELECTION

The bibliographic search was conducted in internationally recognized scientific databases, including PubMed, Scopus, Web of Science, and PsycINFO. Controlled and uncontrolled descriptors were used, combined with Boolean operators, such as sleep disorders, neurocognitive impairment, cognition, memory, and executive functions. Inclusion criteria encompassed studies published in English, peer-reviewed, with a temporal focus prioritizing the last ten years, in addition to classic research of theoretical relevance to the field.

ELIGIBILITY CRITERIA

Original articles, systematic reviews, and meta-analyses that directly addressed the relationship between sleep disorders and neurocognitive functions in adult and older populations were included. Studies with exclusively pediatric samples, research without explicit cognitive assessment, or works with methodological designs insufficient for critical analysis were excluded.

TECHNIQUES AND INSTRUMENTS OF ANALYSIS

Data analysis was conducted through exploratory, selective, and analytical reading of the selected studies. As systematization instruments, data extraction matrices were used containing information on authors, year of publication, type of sleep disorder, cognitive domains assessed, neuropsychological instruments employed, and main results. Interpretation of findings was based on thematic and comparative analysis, allowing integration of results in light of theoretical models from sleep neuroscience.

CHARACTERIZATION OF THE SAMPLE OF STUDIES

The sample of this study corresponds to the set of scientific publications selected after applying the eligibility criteria. The analyzed studies predominantly involved clinical and population-based adult samples, assessed through standardized instruments such as polysomnography, actigraphy, subjective sleep scales, and internationally validated neuropsychological tests, ensuring methodological robustness to the evidence discussed.

METHODOLOGICAL DISCUSSION

The choice of an integrative review proved appropriate by enabling a broad and in-depth analysis of the available evidence, encompassing different study designs and research contexts. However, limitations inherent to this method are acknowledged, such as heterogeneity of the instruments used and

variability in diagnostic criteria for sleep disorders. Even so, the adopted methodology allows for a grounded and consistent discussion, contributing to a critical understanding of the neurocognitive impact associated with sleep alterations and to guiding future empirical investigations.

RESULTS AND DISCUSSION

The analysis of the selected studies reveals a consistent association between sleep disorders and neurocognitive impairments across different cognitive domains. The main findings indicate that changes in sleep duration, continuity, and architecture are directly related to deficits in sustained attention, declarative memory, executive functions, and processing speed. These effects were observed both in clinical populations and in samples from the general population, reinforcing the cross-cutting nature of the cognitive impact of sleep disorders.

Among the most investigated disorders, chronic insomnia was strongly associated with attentional difficulties, reduced cognitive flexibility, and impairment of working memory. These results corroborate evidence in the literature indicating cortical hyperarousal and sleep fragmentation as factors that negatively interfere with mnemonic consolidation processes. Similarly, obstructive sleep apnea showed a significant relationship with deficits in executive functions and episodic memory, especially in moderate and severe cases, which has been attributed to intermittent hypoxia and sleep instability.

Chronic sleep deprivation, in turn, stood out as one of the main risk factors for decline in overall cognitive performance. The analyzed studies demonstrate that prolonged reduction in total sleep time compromises activity in the prefrontal cortex, a region essential for executive control, decision-making, and emotional regulation. These findings are consistent with neurobiological models that describe sleep as a critical period for synaptic restoration and the maintenance of neural plasticity.

Table 1 summarizes the main results identified in the analyzed studies, relating types of sleep disorders and affected neurocognitive domains.

Table 1

Main sleep disorders and associated neurocognitive impacts

Sleep disorder	Main neurocognitive impacts
Chronic insomnia	Attention; working memory; executive functions
Obstructive sleep apnea	Episodic memory; executive functions; processing speed
Sleep deprivation	Sustained attention; decision-making; executive control
Circadian alterations	Memory; global cognitive performance; emotional regulation

The discussion of the results further indicates that the severity and chronicity of sleep disorders amplify neurocognitive impairments, potentially contributing to an increased risk of psychiatric disorders and neurodegenerative diseases. Thus, the findings reinforce the importance of evidence-based preventive and therapeutic approaches, as well as integration between sleep assessment and cognitive assessment in clinical practice and scientific research.

CONCLUSION

This chapter aimed to analyze the relationship between sleep disorders and neurocognitive impact in light of scientific evidence available in the international literature. It sought to understand how changes in sleep quality, duration, and architecture influence different cognitive domains, as well as to identify the main neurobiological mechanisms involved in this process.

The main results show that sleep disorders such as chronic insomnia, obstructive sleep apnea, and prolonged sleep deprivation are consistently associated with impairments in essential cognitive functions, including attention, memory, executive functions, and processing speed. It was observed that the severity and chronicity of these alterations intensify neurocognitive deficits, reinforcing the role of sleep as an indispensable component for maintaining neural plasticity, memory consolidation, and healthy brain functioning.

As contributions, this study offers a critical and integrated synthesis of current knowledge on the interface between sleep and cognition, assisting in the understanding of the cognitive impacts of sleep disorders in different clinical and population contexts. In addition, the chapter highlights the relevance of incorporating sleep assessment into clinical practices and strategies for promoting brain health, contributing to evidence-based medicine and to the advancement of interdisciplinary research.

Regarding future perspectives, the development of longitudinal studies is suggested to investigate the long-term effects of sleep disorders on cognitive decline and the risk of neurodegenerative diseases. It is also recommended to expand research evaluating the effectiveness of therapeutic interventions in the reversibility of neurocognitive impairments, as well as investigations integrating neurobiological, behavioral, and environmental markers, aiming at a more comprehensive understanding of the relationship between sleep and cognition.

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