



THE IMPACT OF SLEEP QUALITY ON CLINICAL OUTCOMES IN HOSPITALIZED CHILDREN: A SYSTEMATIC REVIEW

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ABSTRACT

Sleep is an essential physiological need in children that plays an important role in physical growth, neurological development, and the recovery process during illness. Hospitalized children are at high risk of experiencing sleep quality disturbances due to environmental, clinical, and psychological factors. Sleep disturbances during hospitalization are known to be associated with various adverse clinical outcomes. To identify the relationship between sleep quality and clinical outcomes in hospitalized children based on the latest scientific evidence. This systematic review was conducted in accordance with the PRISMA guidelines. Literature searches were performed in PubMed, ScienceDirect, Scopus, and Wiley. “poor sleep quality” AND “hospitalized children” AND “length of stay.” Included studies were quantitative studies involving hospitalized children aged 0–18 years that reported the relationship between sleep disturbances and clinical outcomes. Study quality was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist, and the findings were analyzed using narrative synthesis. A total of six studies years 2021-2026 met the inclusion criteria. All studies reported decreased sleep quality during hospitalization, characterized by reduced sleep duration, increased nighttime awakenings, and decreased sleep efficiency. Sleep disturbances were associated with slower recovery, increased psychological distress, and a potential increase in length of hospital stay. The main contributing factors include environmental noise, medical interventions, pain, and anxiety. Non-pharmacological interventions were found to be effective in improving sleep quality. Sleep quality disturbances are common and multifactorial problems among hospitalized children and have a significant impact on clinical outcomes. Optimizing sleep quality should be integrated into clinical practice through simple interventions and family-centered approaches.

Keywords: clinical outcomes; hospitalization; hospitalized children; sleep quality; systematic review

How to cite (in APA style)

Putri, M. M., Nurhaeni, N., & Astuti, A. (2026). The Impact of Sleep Quality on Clinical Outcomes in Hospitalized Children: A Systematic Review. *Indonesian Journal of Global Health Research*, 8(4), 155–164. <https://doi.org/10.37287/ijghr.v8i4.2090>.

INTRODUCTION

Sleep is an essential physiological need for children because it plays a critical role in physical growth, neurological development, emotional regulation, immune function, and the recovery process during illness. Adequate sleep supports memory consolidation, cellular repair, brain development, and hormonal balance that contribute to maintaining children's health (Burger et al., 2022). Conversely, sleep deprivation in children is associated with behavioral disturbances, impaired cognitive function, emotional problems, increased pain perception, and metabolic and immunological disorders (Stremmler et al., 2021). Children's higher sleep requirements compared to adults make sleep disturbances in this population potentially more detrimental to health and quality of life (Byeon et al., 2025).

Hospitalization is a condition that places children at high risk for sleep disturbances due to changes in the environment and daily routines. Sleep disturbances among hospitalized children are influenced by various factors, including environmental noise, nighttime light exposure, repeated medical procedures, pain, anxiety, and changes in daily activity patterns (Burger et al., 2024).

Studies have shown that hospitalized children sleep only about 384–475 minutes per night, which is lower than the recommended sleep duration for their age (Stremmler et al., 2021). In addition, exposure to noise levels above 80 dB and light exposure exceeding 150 lux significantly increases the risk of nighttime awakenings (Stremmler et al., 2021). Other studies have also reported that hospitalized children experience shorter sleep duration, more frequent awakenings, and poorer sleep quality compared to when they are at home (Fidler et al., 2023). Sleep disturbances during hospitalization not only affect children's comfort but may also influence various clinical outcomes during treatment.

Sleep disturbances during hospitalization are associated with several adverse clinical outcomes. Inadequate sleep may impair immune function, increase physiological stress, intensify pain perception, disrupt metabolic regulation, and delay healing processes (Burger et al., 2022). Among pediatric patients admitted to intensive care units, sleep fragmentation has been associated with impaired neurological development, increased risk of delirium, memory disturbances, and a higher risk of Pediatric Post-Intensive Care Syndrome (Byeon et al., 2025). Furthermore, sleep disturbances during hospitalization have also been linked to decreased quality of life, prolonged length of hospital stay, and lower perceptions of hospital service quality (Hassinger et al., 2023).

Although sleep disturbances among hospitalized children have been widely reported, available studies still demonstrate substantial variability in findings. Some studies reported reduced sleep duration as the primary disturbance, whereas others increased nighttime awakenings, wake after sleep onset, low sleep efficiency, or alterations in circadian rhythm (Burger et al., 2022). These variations may be influenced by differences in age groups, disease types, hospital units, sleep assessment methods, and discrepancies between subjective and objective sleep measurements (Burger et al., 2024). In addition, studies involving pediatric intensive care unit (PICU) patients remain limited, and most employ observational designs with relatively small sample sizes (Hassinger et al., 2023).

To date, there is still a lack of recent systematic reviews specifically addressing the relationship between sleep quality and clinical outcomes among hospitalized children in a comprehensive manner. Most existing studies focus on specific populations, such as PICU patients, oncology patients, or particular age groups, thus failing to provide an overall understanding of hospitalized pediatric patients in general (Hassinger et al., 2023). Furthermore, heterogeneity in sleep assessment methods and variations in study findings make it difficult to draw consistent conclusions regarding the impact of sleep quality on clinical outcomes during hospitalization (Burger et al., 2022). Therefore, a systematic review is needed to evaluate the relationship between sleep quality and various clinical outcomes among hospitalized children, including length of stay, complications, recovery processes, and quality of life. This systematic review is expected to provide a more comprehensive understanding of the impact of sleep quality on clinical outcomes in hospitalized children and serve as a basis for developing interventions to improve sleep quality during hospitalization. The aim of the study was to identify and synthesize scientific evidence regarding the impact of sleep quality disturbances on clinical outcomes among hospitalized children.

METHOD

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Studies included in this systematic review were selected based on predetermined inclusion and exclusion criteria using the PEO framework (Population, Exposure, Outcome, Study Design). The study population consisted of children aged 0–18 years who were hospitalized. The exposure of interest was sleep quality disturbance or sleep disturbance during hospitalization, including poor sleep quality, fragmented sleep, sleep deprivation, and other sleep pattern disorders. Outcomes assessed included various clinical conditions such as length of hospital stay, recovery process, complications, pain levels,

fatigue, behavioral changes, emotional disturbances, and quality of life. Eligible studies included quantitative research designs such as randomized controlled trials (RCTs), cohort studies, and case-control studies.

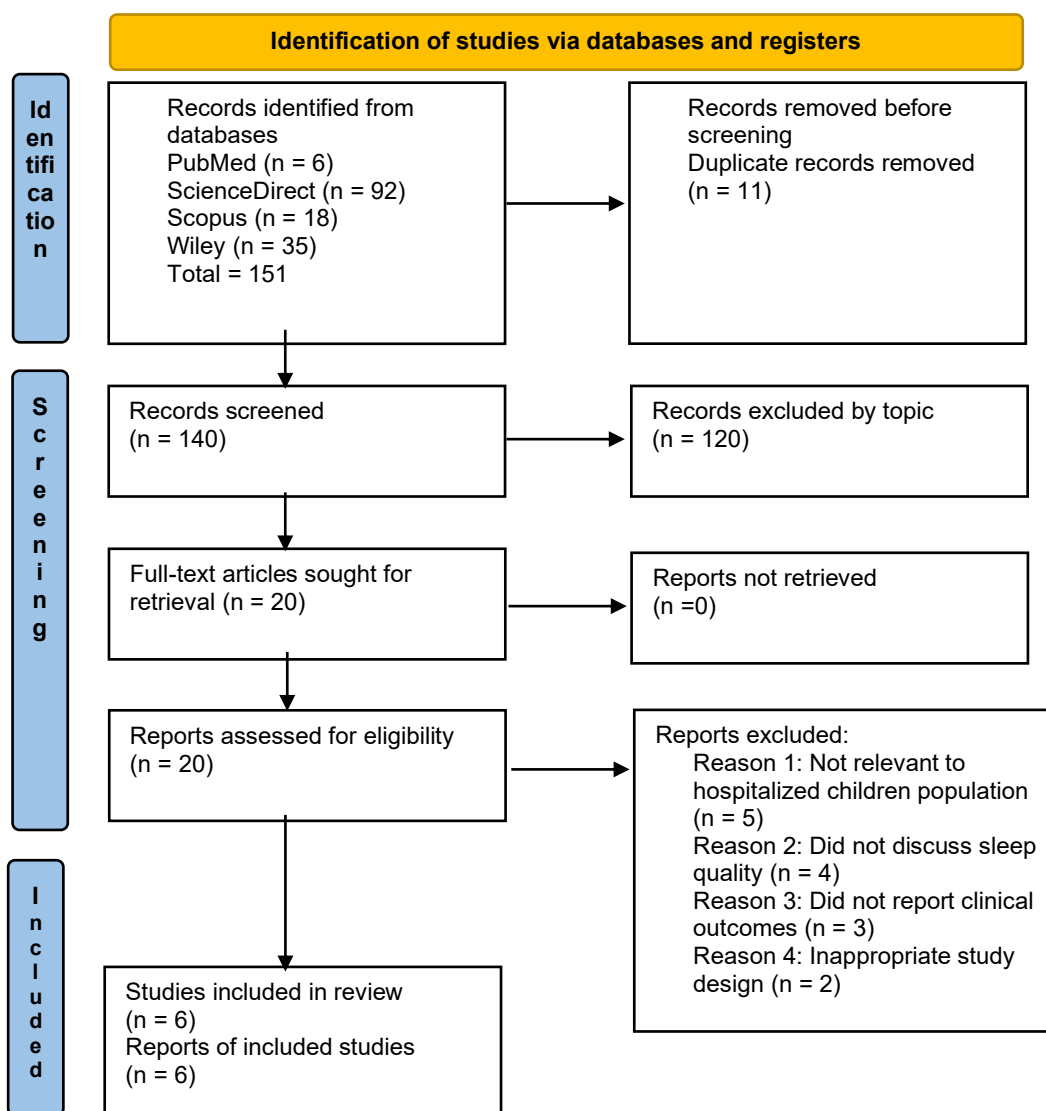


Figure 1 PRISMA Flowchart

The inclusion criteria consisted of research articles published within the last five years, available in abstract and full-text form, written in English or Indonesian, and discussing the relationship between sleep quality and clinical outcomes among hospitalized children. Selected articles were obtained from scientific journal sources. Exclusion criteria included duplicate articles, editorials, letters to the editor, animal studies, laboratory research, case reports, case series, articles without full text, and studies not focusing on hospitalized pediatric populations.

A systematic literature search was conducted through four databases: PubMed, ScienceDirect, Scopus, and Wiley. The search strategy used combinations of keywords and Boolean operators AND and OR. In PubMed, the keywords used were (“sleep disturbance” OR “sleep quality”) AND (“hospitalized children” OR “pediatric patients”). In ScienceDirect, the search used the keywords (“sleep disturbance” OR “sleep quality”) AND (“hospitalized children” OR “pediatric inpatient”) AND (“clinical outcome” OR “length of stay” OR “recovery”). The literature search was conducted using electronic databases including PubMed, Scopus, and Wiley Online Library for articles published between 2021 and 2026. The same search strategy was applied in Scopus. Meanwhile,

Wiley Online Library searched the keywords “poor sleep quality” AND “hospitalized children” AND “length of stay.”

The initial search yielded 6 articles from PubMed, 92 articles from ScienceDirect, 18 articles from Scopus, and 35 articles from Wiley. All articles were screened based on title, abstract, and relevance to the inclusion criteria. The article selection process was conducted in several stages according to the PRISMA flow diagram. After duplicate articles were removed, title and abstract screening was performed. Eligible articles were then reviewed in full text to determine their suitability for the study objectives.

Data from eligible studies were extracted using a standardized table that included author names, year of publication, country, study design, sample size, participant characteristics, sleep quality assessment instruments, measured clinical outcomes, and key findings. Methodological quality assessment for each study was conducted using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist according to the respective study designs. The assessment was independently performed by two reviewers to minimize bias. Any discrepancies were resolved through discussion until consensus was achieved.

Due to potential variations in participant characteristics, sleep assessment instruments, and reported clinical outcomes, the findings were analyzed using narrative synthesis. This approach enabled the researchers to categorize findings based on the types of sleep disturbances and clinical outcomes identified among hospitalized children.

RESULT

Based on the article selection process using the PRISMA diagram, six articles met the inclusion criteria. The included articles comprised various research designs, including prospective observational, retrospective observational, randomized controlled trials, cross-sectional pre-post intervention, and comparative observational. The sample size for each study ranged from 83 to 447 respondents, including hospitalized children, PICU patients, and caregivers.

In general, all studies show that sleep quality in hospitalized children declines during hospitalization. This decline is characterized by reduced sleep duration, increased frequency of nighttime awakenings, lower sleep efficiency, and increased wake after sleep onset. Furthermore, sleep disturbances during hospitalization are also associated with various clinical outcomes, such as length of hospitalization, recovery process, quality of life, psychological distress, and parental anxiety.

Table 1.
Characteristics of Included Studies

No	Author, Year	Research Design	Sample	Sleep Quality Variables	Clinical Outcomes	Key Results	Conclusion
1	Impact of an Intervention Aimed at Improving Sleep Quality in Hospitalized Children	Cross-sectional pre-post intervention	200 children hospitalized	Sleep hours, frequency of waking up at night, reasons for waking up	Recovery, sleep quality	The frequency of nighttime awakenings decreased by 17% after the intervention. The average number of awakenings per night decreased from 1.98 to 1.34.	Simple interventions in hospitals effectively improve the sleep quality of hospitalized children.

No	Author, Year	Research Design	Sample	Sleep Quality Variables	Clinical Outcomes	Key Results	Conclusion
2	Sleep Disturbances in Hospitalized Children: A Wake-Up Call	Prospective observational	272 children aged 1–12 years	Total sleep time, wake after sleep onset, sleep efficiency, awakenings	Sleep quality, comfort, recovery	Children sleep worse in the hospital than at home. Parents report shorter sleep duration, more frequent awakenings, and lower sleep satisfaction.	Hospitalization negatively impacts sleep quality and can hinder a child's recovery.
3	The Impact of the COVID-19 Pandemic on Nighttime Room Entries and Sleep Disruptions for Pediatric Patients	Comparative observational	447 caregivers and children hospitalized	Nocturnal sleep disturbance, sleep duration, frequency of disturbance	Caregiver mood, anxiety, sleep quality	Children slept 61 minutes less during the pandemic. Sleep disturbances increased due to testing, pain, and anxiety.	Psychological factors and the hospital environment play a major role in the sleep quality of hospitalized children.
4	Melatonin Use in Pediatric Intensive Care Units: A Single-Center Experience	Observational retrospective	182 PICU patients	Melatonin use, sleep quality	Length of hospital stay, recovery	Earlier use of melatonin is associated with shorter hospital stays.	Melatonin can help support sleep quality and speed recovery in PICU patients.
5	Effect of Diary Intervention on Sleep Quality and Risk of Stress Disorders among Critically Ill Children in Pediatric Intensive Care Units and on Their Parents' Anxiety Level	Randomized Controlled Trial	83 child-parent dyads	Duration of waking, sleep quality	Stress disorders, parental anxiety, depression	Diary intervention reduced children's wakefulness duration and reduced stress, anxiety, and depression in parents.	Non-pharmacological interventions can improve children's sleep quality and family well-being.
6	Effect of Illuminated Musical Mobile on Sleep Quality of Children Hospitalized in Pediatric Emergency Departments	Randomized Controlled Trial	124 children aged 1–3 years	Night sleep duration, frequency of awakenings, sleep problems	Sleep quality	The intervention group had longer sleep duration, fewer awakenings, and returned to sleep more quickly.	Musical mobiles are effective in improving the sleep quality of hospitalized children.

Table 2.
Assessment of Risk of Bias of the Study

No	Author, Year	Study Design	Selection Bias	Measurement Bias	Confounding	Attrition Bias	Overall Quality
1	Lechosa-Muñiz et al., 2024	Cross-sectional pre-post	Unclear	Unclear	Unclear	Low	Unclear
2	Burger et al., 2024	Prospective observational	Low	Unclear	Unclear	Low	Unclear
3	Riehm et al., 2021	Comparative observational	Currently	Unclear	Unclear	Low	Unclear
4	Jacobson et al., 2023	Observational retrospective	High	Unclear	High	Low	Low
5	He et al., 2026	Randomized Controlled Trial	Low	Low	Low	Low	High
6	Topsakal & Ekici, 2022	Randomized Controlled Trial	Low	Low	Low	Low	High

Table 3.
Synthesis of the Relationship between Sleep Disorders and Clinical Outcomes in Hospitalized Children

Domain	Aspects of Sleep Disorders	Evidence from Studies	Related Clinical Outcomes	Synthesis of Findings
Sleep Quantity	Decreased sleep duration during hospitalization	Burger et al., 2024; Riehm et al., 2021	Slower recovery, decreased quality of life	Decreased sleep duration is a consistent finding across observational studies and has the potential to hinder the recovery process.
Sleep Fragmentation	Increased frequency of awakenings (nocturnal awakenings)	He et al., 2026; Topsakal & Ekici, 2022	Increased stress, impaired sleep quality	Sleep fragmentation is a dominant form of disturbance that is directly related to psychological distress.
Sleep Continuity	Sleep continuity disorder (increased wake after sleep onset)	Burger et al., 2024	Fatigue, daytime dysfunction	Sleep continuity disorders reduce sleep efficiency and worsen physiological and cognitive function.
Sleep Quality	Decreased subjective sleep quality and sleep efficiency	Lechosa-Muñiz et al., 2024	Worsening of comfort and clinical recovery	Sleep quality is a comprehensive indicator that can be improved through intervention.
Circadian Disruption	Circadian rhythm disorders and melatonin regulation	Jacobson et al., 2023	Length of stay (LOS), recovery	Disruption of biological rhythms contributes to poorer clinical outcomes.
Environmental Factors	Noise, lighting, medical intervention	Burger et al., 2024; Riehm et al., 2021	Sleep disturbances, increased stress	Environmental factors are the main determinants of sleep disorders and are modifiable.
Psychological Impact	Anxiety, stress, emotional discomfort	He et al., 2026; Riehm et al., 2021	Child emotional disturbance, parental anxiety	Sleep disorders have a wide impact on the psychological well-being of patients and their families.
Intervention Effects	Non-pharmacological interventions (music, diary, environmental education)	Topsakal & Ekici, 2022; He et al., 2026; Lechosa-Muñiz et al., 2024	Improved sleep quality, decreased awakenings	Simple interventions effectively improve sleep quality and have clinical applicability.

Table 4.
Factors Causing Sleep Disorders in Hospitalized Children

Domain	Specific Factors	Mechanism of Sleep Disorders	Evidence from Studies	Clinical Implications
Environment	Noise (alarms, staff conversations), night lighting	Disrupts sleep onset and sleep maintenance, thereby increasing awakenings.	Burger et al., 2024; Riehm et al., 2021	Environmental modifications such as noise reduction and light control can improve sleep quality.
	Nighttime medical interventions (monitoring, routine actions)	Causes sleep fragmentation due to repeated external disturbances	Burger et al., 2024	Scheduling non-urgent actions during the day
Clinical	Pain due to disease or procedure	Activation of the nociceptive system causes difficulty sleeping and frequent awakenings.	Riehm et al., 2021	Optimizing pain management is important for improving sleep.
	Acute or critical illness conditions	Physiological discomfort and biological stress	Jacobson et al., 2023	A supportive approach during the acute phase is necessary.
	Drug effects (sedative, stimulant)	Changes in sleep architecture and circadian rhythms	Jacobson et al., 2023	Evaluation of sleep-related medication regimens
Psychological	Anxiety, stress, unfamiliar environment	Activation of the stress system (increased cortisol) causes sleep onset disturbances.	He et al., 2026; Riehm et al., 2021	Psychosocial interventions and family support are needed
	Farewell to the home environment	Emotional discomfort causes situational insomnia	He et al., 2026	Family-centered care approach
Biological (Circadian/Physiological)	Circadian rhythm disruption	Impaired melatonin secretion causes a disturbed sleep-wake cycle.	Jacobson et al., 2023	Consider rhythm therapies such as melatonin and light control
Service System (Health care-related)	Staff work patterns and hospital routines	Recurring disturbances at night	Burger et al., 2024	Need for sleep-friendly hospital policies
Intervention Factors (Protective/Modifiable)	Lack of sleep promotion interventions	Lack of strategies to maintain sleep quality	Topsakal & Ekici, 2022; Lechosa-Muñiz et al., 2024	Simple interventions such as music, diaries, and education are effective in improving sleep quality.

DISCUSSION

The results of this systematic review indicate that sleep quality disturbances are a consistent phenomenon among children during hospitalization. All studies included in this review reported decreased sleep quality, characterized by reduced sleep duration, increased nighttime awakenings, and disrupted sleep continuity. These findings were clearly demonstrated in the prospective observational study by Burger et al. (2024), which showed that hospitalized children had shorter total sleep time, longer wake after sleep onset, and poorer sleep quality compared to when they were at home. Similar findings were also reported by Riehm et al. (2021), where children experienced a reduction in sleep duration of up to 61 minutes and increased sleep disturbances due

to environmental and psychological factors. The consistency of these findings suggests that sleep disturbance is a systemic issue in pediatric hospital care rather than merely an individual variation.

Sleep disturbances among hospitalized children are multifactorial and influenced by the complex interaction of environmental, clinical, and psychosocial factors. The included studies demonstrated that noise, lighting, and repeated medical interventions were the primary factors disrupting children's sleep (Burger et al., 2024; Riehm et al., 2021). In addition, clinical factors such as pain and discomfort caused by illness, as well as psychological factors such as anxiety and stress, further worsened sleep quality during hospitalization. In patients with acute or critical conditions, such as those described in the study by Jacobson et al. (2023), circadian rhythm disturbances and altered melatonin secretion also contribute to sleep disruption. Therefore, sleep disturbances among hospitalized children should not be viewed solely as a consequence of the hospital environment, but rather as the result of a complex multidimensional interaction.

In terms of clinical outcomes, the findings of this review demonstrate that sleep disturbances have significant implications for children's recovery processes. The study by Lechosa-Muñoz et al. (2024) showed that improving sleep quality through educational and environmental modification interventions reduced the frequency of nighttime awakenings by up to 17%, potentially supporting the recovery process. This finding was reinforced by Jacobson et al. (2023), who reported that melatonin use in PICU patients was associated with shorter hospital stays. Furthermore, the study by Topsakal and Ekici (2022) demonstrated that simple interventions such as the use of musical mobiles significantly improved sleep duration and reduced nighttime awakenings. These findings indicate that sleep quality is a modifiable factor that plays an important role in supporting clinical outcomes during hospitalization.

In addition to physical effects, sleep disturbances also have significant implications for the psychological well-being of both children and their families. A randomized controlled trial conducted by He et al. (2026) demonstrated that improving sleep quality through diary intervention not only reduced wake duration in children but was also associated with a lower risk of stress disorders in children and reduced anxiety and depression among parents. These findings suggest that sleep disturbances during hospitalization have far-reaching effects on the family system and emphasize the importance of a family-centered care approach. Furthermore, the study by Riehm et al. (2021) also reported that sleep disturbances were associated with declining caregiver mood, further strengthening the relationship between sleep quality and family psychological well-being.

Among patients admitted to intensive care units, sleep disturbances appear to be more complex and have broader impacts. The study by Jacobson et al. (2023) showed that PICU patients were at high risk for sleep disturbances due to intensive medical interventions, light exposure, and environmental noise. In addition, evidence presented in the introductory literature indicated that sleep fragmentation in critically ill patients is associated with impaired neurological development, increased risk of delirium, and the potential development of Pediatric Post-Intensive Care Syndrome (Byeon et al., 2025). These findings suggest that sleep disturbances in PICU patients affect not only short-term recovery but also have long-term implications for child development.

Overall, the findings of this systematic review demonstrate that sleep quality disturbances among hospitalized children are common, multifactorial, and have broad impacts on both clinical and psychological outcomes. However, most included studies still employed observational designs with high heterogeneity in sleep assessment methods and clinical outcome measures, thereby limiting the strength of causal inference. Therefore, further research using stronger study designs, such as randomized controlled trials with larger sample sizes and standardized sleep assessment instruments, is needed. In addition, the development of integrated environmental and non-

pharmacological interventions within clinical practice should become an important focus for future research.

CONCLUSION

Sleep quality among hospitalized children consistently declines and is associated with various adverse clinical outcomes, including slower recovery, increased psychological disturbances, and the potential for prolonged hospital stays. Sleep disturbances in hospitalized children are multifactorial, involving interacting environmental, clinical, and psychological factors. The findings of this systematic review also demonstrate that sleep quality is a modifiable factor. Simple interventions such as environmental modifications, non-pharmacological interventions, and family-centered approaches can improve sleep quality and potentially enhance clinical outcomes. Therefore, optimizing sleep quality should become an integral part of pediatric hospital care.

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