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Review Article

Potentially effective interventions for improvement of children's sleep quality: A systematic review

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Abstract

This systematic review aims to assess the effectiveness of various interventions in enhancing sleep quality for hospitalized children. The study analyzed a decade's worth of literature, focusing on interventions targeting sleep improvement in children aged 0-18 years old within a hospital setting. The review encompassed 15 selected articles that met the criteria, exploring interventions such as cognitive-behavioral therapy, physical exercise, storytelling, music therapy, environmental adjustments, and massage therapy. However, notably absent were studies on pharmacological approaches to enhance sleep or alternative interventions akin to those used in older adults. The findings underscore the need for future research to bridge existing gaps, considering a broader spectrum of pediatric age groups and providing updated insights on medication-based approaches.

Keywords: Sleep, Sleep-Promoting, Nursing, Children, Hospital, Systematic Review.

1 | Introduction

Sleep is a vital physiological process that plays a crucial role in the growth and development of children [1]. However, hospitalized children often experience sleep disturbances due to the stressful hospital environment, frequent disruptions, and medical interventions [2]. Inadequate sleep, in hospitalized children can result in a range of negative outcomes, such as delayed recovery, increased pain, decreased immune function, and emotional distress [1, 3, 4].

Given the adverse consequences of sleep disturbances in hospitalized children, healthcare providers should prioritize interventions to promote quality sleep. Previous studies have examined various pharmacological and non-pharmacological interventions to enhance sleep quality in hospitalized children [1, 2, 5]. However, the effectiveness and feasibility of these interventions remain unclear. Despite the availability of several interventions to promote sleep in hospitalized children, the effectiveness of these interventions remains unclear. A systematic review by Cho et al. [6] found that the evidence on the effectiveness of non-pharmacological interventions is limited, and the quality of the studies is low.

Therefore, a systematic review of the literature is necessary to evaluate the effectiveness of interventions in promoting sleep in hospitalized children and provide guidance for healthcare providers in selecting and implementing effective interventions to promote sleep in hospitalized children. The systematic review also helps identify gaps in the literature and inform future research in this area. Therefore, this systematic review aims to evaluate the effectiveness of interventions in promoting sleep in hospitalized children.

2 | Methods

2.1 | Design & information sources

This systematic review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [7]. The study design is a systematic review of randomized controlled trials (RCTs). The following databases were searched: PubMed, Scopus, and Cochrane Library.

2.2 | Search methods

Search terms and keywords included "sleep", "hospitalized children", "intervention", "medication", "environmental modification", "non-pharmacological", "nursing", and variations of these terms. Reference lists of relevant articles are also manually searched for additional studies in Google Scholar search engine. We used the Boolean operators "OR" and "AND". The search approach in this systematic review is presented in Supplementary Table 1.

2.3 | Patient/population, interventions, comparators, outcomes, and time (PICOT) framework

The PICOT framework was used to clarify the purpose of the study:

- ***Participants (P):*** The study population includes hospitalized children (aged 0-18 years) in any clinical setting.
- ***Interventions (I):*** Any intervention that aims to promote sleep in hospitalized children is included.
- ***Comparators (C):*** Studies with any type of control group, including placebo or no intervention, will be included.
- ***Outcomes (O):*** The primary outcome is the effect of the intervention on sleep duration and quality.
- ***Time (T):*** We systematically reviewed the literature on interventions to promote sleep in hospitalized children, focusing on studies published between January 2013 and March 2023.

2.4 | Inclusion & exclusion Criteria

Our search was restricted to studies published in English free full texts, and we included RCTs, quasi-experimental studies, and pilot studies that assessed the effectiveness of interventions for promoting sleep in hospitalized children.

2.5 | Outcomes

This systematic review looked for the following outcomes:

- The interventions done to promote the sleep quality of hospitalized children.
- The measures used to assess the quality of sleep of hospitalized children.
- The effectiveness of the interventions done to promote the sleep quality of hospitalized children.
- Subgroup sleep-promoting interventions in the pediatric population.

2.6 | Data extraction and quality assessment

Two reviewers independently extracted data from eligible studies using a standardized data extraction form. Data included study design, sample size, characteristics of the study population, type of intervention, comparator, outcome measures, and results. Any discrepancies were resolved through discussion or by consulting a third reviewer. Two reviewers independently assessed the quality of included studies using the Cochrane Risk of Bias tool [8]. Any discrepancies were resolved through discussion or by consulting a third reviewer.

3 | Results

Searches of the electronic databases yielded a total of 8,109 records. After removing 1,320 duplicates using EndNote 8, and excluding 1,297 articles due to inappropriate study design (reviews) and 1,058 publication status (conferences), we were left with 4,434 records. Titles and keywords of these records were screened, and 4,053 records were excluded due to ineligible subjects, not involving pediatric populations or sleep, and containing protocols. Abstracts of the remaining were screened and 381 records were assessed for eligibility, and 351 records were excluded for various reasons, including only abstract publication, insufficient data, language barriers, and irrelevancy. Finally, a total of 30 records were included in the systematic review of which 15 articles met the inclusion criteria for the systematic review (Figure 1).

Of the 93 articles included, the majority of the studies (n=5) were conducted in Iran, with the remaining studies conducted in America (n=3), Indonesia (n=2), Netherlands (n=1), Canada (n=1), Greece (n=1), India (n=1), and Egypt (n=1). The interventions used in the studies varied widely, including cognitive-behavioral therapy, physical exercise, storytelling, music therapy, environmental adjustments, and massage therapy.

Overall, the results suggest that interventions aimed at promoting sleep in hospitalized children are effective, with studies reporting statistically significant improvements in sleep outcomes. Characteristics of the selected studies are shown in Table 1.

The quality of the studies of the RCTs (n=15) was rated as high quality using the Cochrane Risk of Bias tool. This suggests that the studies were conducted with a high level of methodological rigor and were less likely to be biased, which adds strength to the findings of this systematic review (Figure 2).

In analyzing subgroups, it is found that some of the studies included in the current systematic review had different sample sizes and ages of the participants, as well as varying interventions to promote sleep. We conducted a subgroup analysis based on the age group of the participants and the type of intervention used. Moreover, some studies did not report adverse effects related to the sleep-promoting interventions used. Another limitation of the studies was the lack of control for confounding variables, such as comorbidities and medication use, which may have affected sleep quality. Though, the current study highlights the need for further research to address these limitations and improve the quality of future studies (Figure 3).

5 | Discussion

The current systematic review aimed to evaluate the effectiveness of various interventions in promoting sleep in hospitalized children. The results of the review revealed 15 articles that met the inclusion criteria, which included cognitive-behavioral therapy, physical exercise, storytelling, music therapy, environmental adjustments, and massage therapy.

Cognitive-behavioral therapy is an effective intervention for promoting sleep in various populations, including children [9-12]. Our findings are consistent with those of previous which also reported a positive effect of sleep interventions in hospitalized children. In a study conducted by Dewald-Kaufmann et al., in 2019, cognitive-behavioral therapy was found to significantly improve sleep quality and quantity in children with insomnia [13]. Similarly, in a study by Sciberras et al., in 2019, cognitive-behavioral therapy was found to be effective in improving sleep outcomes in children with attention-deficit/hyperactivity disorder [14].

Physical exercise has also been shown to have a positive effect on sleep outcomes in children [15]. Our findings are in agreement with the conclusions of several other studies that have examined sleep interventions in children. In a study conducted by Hedlund et al., in 2019, physical exercise was found to significantly improve sleep quality in children with Fontan circulation [16]. Similarly, in a study by Tse et al., in 2022, it was found that physical exercise is effective to improve sleep with an increase in melatonin levels and also reduces repetitive behaviors in children with autism spectrum disorder [17].

Storytelling has been identified as a non-pharmacological intervention that can promote sleep in hospitalized children [18, 19]. In a study by Ebrahimi et al., in 2021, storytelling was found to be an effective intervention for improving sleep outcomes in children with autism [20]. The study found that the intervention significantly improved average sleep-in. In another study in 2022, Hoseinpour et al., showed that educating storytelling parents decreases sleep disorder scores in children with autism [21].

Music therapy has also been identified as an effective intervention for promoting sleep in hospitalized children. Music therapy was found to be an effective intervention for improving sleep outcomes in children hospitalized in the pediatric intensive care unit [6, 18, 22, 23]. Loewy et al., in 2005 found out that live music therapy is a safe alternative and/or complementary means of achieving sleep/sedation in infants and toddlers undergoing electroencephalogram [24]. Although this study included worthy results, it was excluded from this systematic review due to the old publication date. In another study in 2019, Naulia et al., found that music therapy could improve sleep quality in children with chronic diseases [25].

Environmental adjustments, such as reducing noise levels and improving lighting, are effective in improving sleep outcomes in hospitalized children [11, 26, 27]. In a study by Cook et al., in 2020, environmental adjustments were found to significantly improve sleep quality and duration in hospitalized children [28]. This study showed that clinical education decreased overnight blood pressure checks, increased pediatric inpatient sleep duration, and reduced nighttime disruptions by clinicians. Similarly, in a study by Firmino et al., in 2022, it is shown that nurses can positively affect preterm newborns' sleep by controlling environmental stimuli and applying relaxation techniques and therapeutic positioning to their care practices [29]. However, Arregi et al., in 2022, found that no effect of environmental noise was found on sleep variables such as sleep habits and duration [30].

Massage therapy has also been identified as an effective intervention for promoting sleep in hospitalized children [31-33]. In a study by Arbianingsih et al., in 2020, massage therapy with lavender aromatherapy was found to significantly reduce sleep disturbances in infants, especially in the dimension of starting and maintaining sleep, somnolence disorders, and interruption of wakefulness sleep transition dimension [34]. Similarly, in a study by Pados et al., in 2019, massage therapy was found to be effective in improving sleep outcomes in hospitalized neonates and teaching parents infant massage techniques, promoting the health and well-being of parent–infant dyads [35].

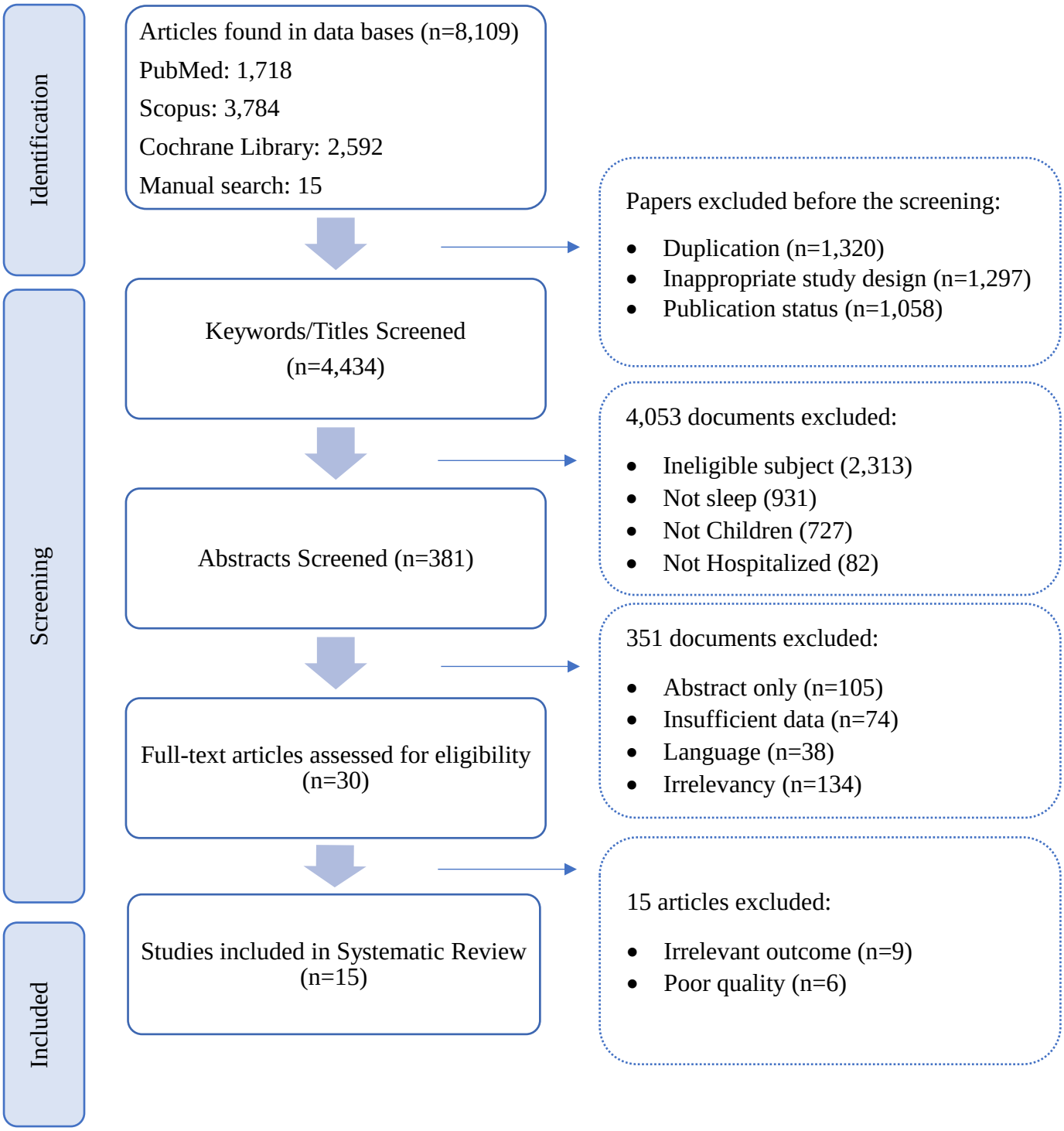

Figure 1. PRISMA Flow Diagram of data base search.

Table 1. Characteristics of the included studies in this systematic review.

Authors (Year)	Age of participants (n)	Health problem	Intervention/Duration of intervention	Variable/Measure	Outcomes
Hayati & Afiyanti, 2019 [15]	8-18 years (n=64)	Cancer	AeRop exercise consists of aerobic exercise and progressive muscle relaxation (PMR). AeRop was performed for 15 min in 5 days.	Fatigue and sleep problems were measured on day 1 and day 5, using Allen's Fatigue in Childhood Fatigue Scale and Sleep Disturbance Scale for Children (SDSC).	A significant difference in sleep problems. No significant difference in fatigue levels (P=0.05).
Rogers *et al.*, 2019 [11]	4-19 years (n=33)	CNS Tumor	A relaxation technique (e.g. storytelling, book reading, massage) before lights out. Stimulus control measures, including establishing a lights-out time (including turning off electronic equipment) and morning lights-on time; choice of white noise program; thick black fabric placed over room windows to minimize light entry; and 90-minute protected sleep periods with bundled care between periods. Multi-component cognitive and behavioral interventions were performed for 5 days.	Sleep patterns measured by Actigraphy and Sleep Diary (reported by parents). Fatigue measured by Fatigue Scale-Child (10 items) & Fatigue Scale-Adolescent (13-item).	A significant difference in nighttime sleep (P=0.009 for interaction). There were few other differences in sleep between groups. Controlling for age and baseline fatigue, higher nighttime activity score and lower percent sleep were significantly associated with higher next-day adolescent-reported fatigue (P<0.05); longest sleep was significantly positively associated with next-day child-reported fatigue (P=0.018).
Khaksar & Kalhor, 2022 [9]	12-36 months (n=40)	Pneumonia	Each father made an online video communication with the infant and the mother and was asked to bring with them material as well as storybooks containing colorful pictures and fun characters, musical instruments, their child's latest artwork such as a painting, or whatever they intended to show him. At the end of the video call, people could play music and sing with each other or play age-appropriate games, and at the end, they were asked to use a "kiss" to say goodbye. video calls were performed twice a day (once before bedtime) for 15 to 30 minutes each time.	Sleep patterns, parental perception, and sleep-related behaviors, measured by the brief infant sleep questionnaire-revised (BISQ-R).	A significant difference in daytime sleep duration, setting time, and total 24-hour sleep time in the intervention group. A significant change in parents' behavior toward their child's sleep improved in the intervention group compared to the control group. No significant change in parents' perceptions of their child's sleep in the intervention group.
Kamal et al., 2018 [32]	4-16 years (n=66)	Leukemia	Therapeutic massage was used with effleurage, petrissage, friction, and tapotement movements with mild to moderate pressure using non-scented olive oil. The pressure was guided by the child's feedback and tolerance. The children's massage included the back, legs, arms, and neck. The massage sessions were 20 min, 24 hours, and half an hour before receiving chemotherapy and 24 hours after chemotherapy administration.	Fatigue was measured by Multidimensional Fatigue Scale (18 items).	A significant difference between both groups in fatigue scores at P< 0.001.
Karbandi et al., 2020 [22]	8-12 years (n=83)	Chronic diseases	Music therapy with the music of their interest through headphones. Distraction cards using five-eight-cm cards, each containing a different image and shape followed by interactive playing for a minimum of 20 minutes.	Anxiety was measured by The Spence Children's Anxiety Scale (SCAS) with 45 items.	A significant difference in anxiety scores in children using distraction cards followed by cards+music (P=0.038).

Authors (Year)	Age of participants (n)	Health problem	Intervention/Duration of intervention	Variable/Measure	Outcomes
			The third group included a combination of music therapy and distraction cards.		Music therapy made a less significant difference in anxiety scores than the other two interventions.
Anggerainy et al., 2019 [18]	4 months to 13 years (n=31)	Gastrointestinal diseases Respiratory diseases Urinary diseases Immunology diseases	Music therapy using Lullabies music without lyrics softly played through a tape recorder or mobile phone in the ward. Storytelling was provided by the parent using story books (from a fictional series about Franklin the Turtle by Paulette Bourgeois and Brenda Clark translated into Indonesian).	Sleep disturbance measured by the SDSC.	A significant impact on sleep disturbance scores (P=0.0001).
Salarfard et al., 2023 [36]	6-12 years (n=70)	Pneumonia Common cold	Orange essential oil aromatherapy was conducted every day for three days at three times of the day (10 am, 4 pm, and at night before bedtime). Two drops of orange essential oil made by Gorgan Essential Oil Company with the main ingredients of limonene (96.5%), beta-pinene (0.37%), alpha-pinene (0.3%), and myrcene (0.2%) were put on a sterile gauze using a dropper. This gas was kept at a 5 cm distance from the child's nose in an open box, and the child was asked to breathe deeply for two minutes. The intervention method at night was putting the impregnated gauze under the pillow's outer layer.	Sleep quality was measured by the BEARS sleep quality questionnaire.	A significant difference in the domains of difficulty in falling asleep, waking up during the night, and disturbance in the regularity and duration of sleep (P<0.05).
Jacobs et al., 2016 [31]	12-21 years (n=34)	Cancer	Massage therapy was conducted between 20 and 30 min in length and consisted of primarily Swedish massage techniques. Each session was tailored to the patient and may have addressed feet, legs, hands, arms, back, neck, shoulders, and/or face/head.	Sleep periods and quality were measured by Actigraphy. Fatigue was measured by the Fatigue Scale Adolescent with 14 items. Anxiety was measured by the State-Trait Anxiety Scale, State Portion (adolescent/adult version) with 20 items. Mood was measured by the Behavioral, Affective, and Somatic Experiences Scale Revised, Parent-Report, and Child-Report (BASES) with 22 items.	A significant increase in nighttime and overall sleep. No differences between groups in the patient-reported outcome measures.
Van Bindsbergen et al., 2022 [12]	8-12 years (n=18)	Hemato oncology Neuro-oncology Solid tumor	Interactive sleep education with the NAO6 robot (hardware produced by SoftBank Robotics ©). It used six health behaviors that are important for healthy sleep hygiene to implement in the education session: (1) minimal activities and screens before bedtime, (2) a consistent sleep routine, (3) an adequate sleep environment, (4) management strategies for worries, (5) daytime exercise, and (6) limiting food and drinks. The robot then discussed the sleep hygiene topics through 14 questions. The robot provided feedback	Sleep hygiene was measured by the Dutch version of the Children's Sleep Hygiene Scale (CSHS).	A significant improvement in sleep hygiene (P=0.047).

Authors (Year)	Age of participants (n)	Health problem	Intervention/Duration of intervention	Variable/Measure	Outcomes
			on the children's answers and delivered explanatory information. A tablet visually supported the information provided by the robot, and children were able to select a virtual avatar to represent themselves when performing exercises, such as creating a bedtime routine. Each session's duration was 10 min.		
Valizadeh et al., 2022 [19]	8-12 years (n=102)	Fracture	Storytelling with mp3 player and headphones to listen to a CD of stories for 30 min. Simultaneously other children were provided with a storybook to read and look at while listening to the same story.	Anxiety was measured by the Revised Children's Manifest Anxiety Scale (RCMA). Sleep onset time was measured by the SDSC	A significant decrease in mean SOT and mean pulse rate (P<0.001) in the three groups. No significant change in mean manifest anxiety in any of the groups (P>0.05).
Papaconstantinou et al., 2018 [10]	4-10 years (n=48)	Chronic illness Acute illness Planned surgery	The Relax-to-Sleep intervention was comprised of a one-on-one educational session for the parent that was guided by a standardized booklet containing information on sleep and instructions for training the child in the use of a diaphragmatic breathing exercise. The RTS intervention was performed for 3 days.	Sleep pattern, measured by Actigraphy. Pain, measured by Faces Pain Scale–Revised (FPS-R). Sleep habits, measured by the Children's Sleep Habits Questionnaire (CSHQ). Anxiety, measured by the 38-item SCAS and the 28-item Spence Preschool Anxiety Scale (SPAS). Posthospital behaviors, measured by the Post-Hospital Behavior Questionnaire (PHBQ).	No significant difference in Sleep pattern (P>0.05). The RTS group reported less pain than the control group (no P-value calculated). A significant change in Sleep habits followed by P=0.037. No significant difference in anxiety and posthospital behaviors score (P>0.05).
Loewy et al., 2013 [23]	Premature Infants (n=272)	RDS Sepsis SGA	Music therapy with live music sounds entrained in the infant's breath rate. Music applications of 55 to 65 dB for short-timed interventions were offered exclusively to them at their incubator or bassinet. Infants received 3 interventions per week within 2 weeks.	Vital signs (HR, RR, Oxygen saturation) are measured by routine tools in NICU. Activity level, feeding, sleeping, and caloric intake were recorded by blinded research assistants and charted by nurses in a nursing flow sheet.	A significant decrease in heart rates (P=0.001) and rhythm intervention (P=0.04). A significant sucking behavior difference with rhythm sound interventions (P=0.03). A significant difference in sleep patterns (P=0.001). A significant increase in caloric intake (P=0.01) and sucking behavior (P=0.02).
Varvara et al., 2016 [27]	Neonates (n=32)	Feeding problems Transient tachypnea Prematurity Hypocalcemia Possible perinatal infection	Sound intensity reduction using specific ear plugs. Light intensity reduction using incubator covers. The recordings were in two consecutive meal intervals between 8:00 a.m. and 12:00 a.m., for three successive days.	NREM sleep was estimated by the distinct period of discontinuous activity with an increased range of potential differences (voltages) and more marked periodic patterns in electroencephalogram recordings.	A significant increase in the duration of NREM sleep by reducing sound or light intensity (P<0.001 and P<0.001). No significant statistical differences were found in REM and total sleep duration among the 3 different days.
Bazregari et al., 2019 [26]	Preterm Neonates (n=60)	Prematurity	Clustered nursing care educates that before feeding, the participants in the test group received all nursing care, such as replacing diapers, weighing, replacing	The neonates' sleep behaviors, were observed and recorded every 2 min by	A significant increase in the time of quiet and active sleep in newborns.

Authors (Year)	Age of participants (n)	Health problem	Intervention/Duration of intervention	Variable/Measure	Outcomes
			pulse oximetry probe, and one of the invasive interventions that could be a blood vessel replacement, suctioning, or blood sampling by a trained nurse. During the whole period of observation of the sleep behaviors in the newborns within 45 min, no intervention was performed on the infants.	2 observers using the Prechtl instrument.	
Yuliani et al., 2020 [33]	5-18 years (n=34)	Thalassemia B Major	Massage movement using 2 movements, namely effleurage, and petrissage. Massage movements are carried out on the legs and back of the child by repeating 8 times, for 6 consecutive days, with the implementation of the massage at night before the child goes to bed.	The quality of the child's sleep is measured by the SDSC.	A significant difference in sleep quality in the intervention group before and after massage therapy (P=0.005).

Figure 2. Cochrane Risk of Bias tool for assessing the quality of included studies.

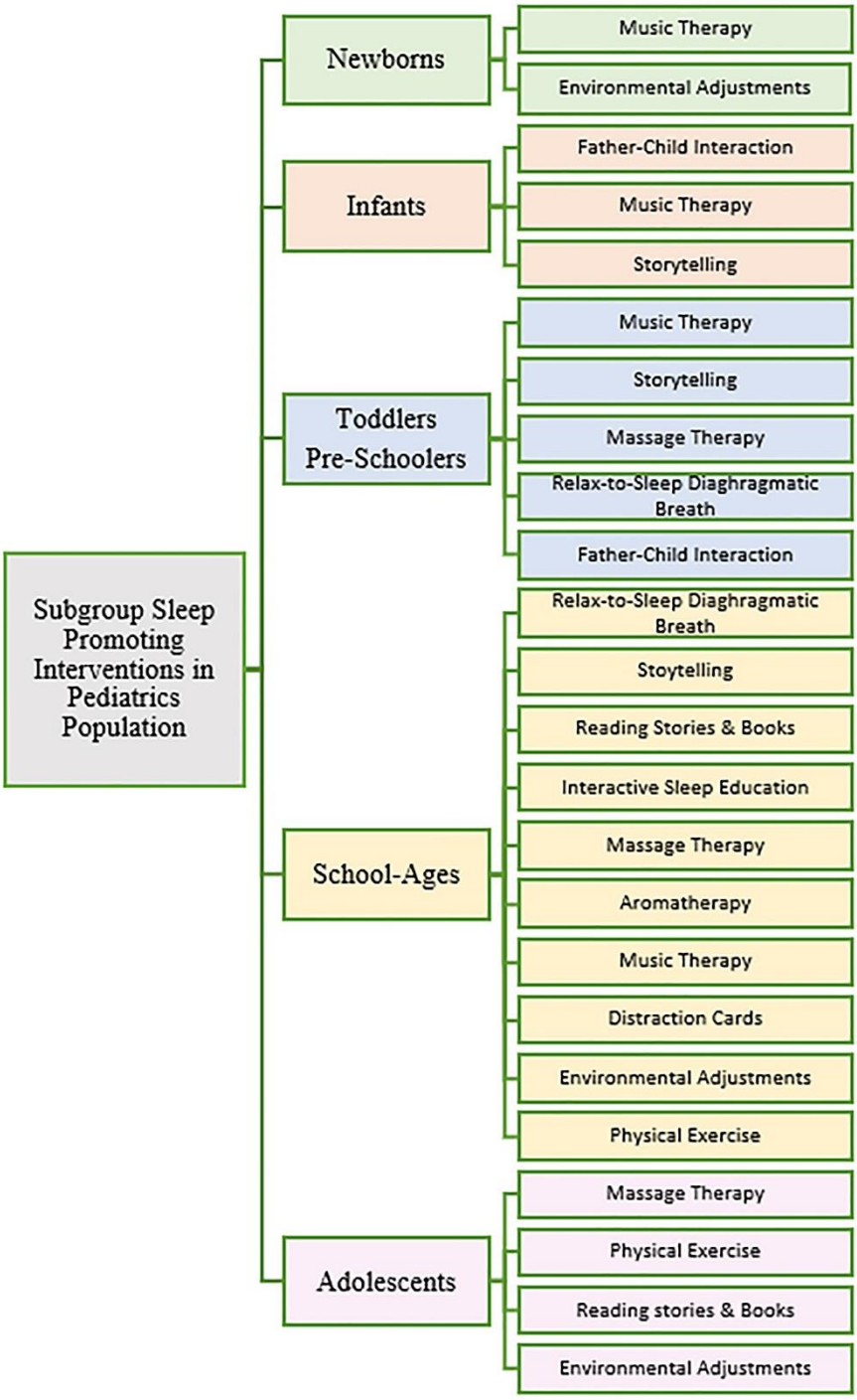

Figure 3. Subgroup sleep promoting interventions in pediatrics population.

4.1 | Limitations

No studies were found on pharmacological methods to enhance sleep in hospitalized children or promote sleep using alternative interventions similar to those used in older adults. This lack of research may be due to concerns regarding the safety and effectiveness of pharmacological interventions in pediatric populations. Furthermore, the use of pharmacological interventions may not be feasible in hospital settings due to the risk of adverse reactions and drug interactions. Some studies did not report adverse effects related to the sleep-promoting interventions used. Another limitation of the studies was the lack of control for confounding variables, such as comorbidities and medication use, which may have affected sleep quality.

4.2 | Clinical implications for nursing managers and policymakers

In hospitalized children, inadequate sleep can result in a range of negative outcomes. Nursing managers and policymakers should consider methods to enhance sleep in hospitalized children or promote sleep using alternative interventions similar to those used in older adults.

4.3 | Recommendations for future research

Future studies should aim to evaluate the effectiveness and feasibility of pharmacological interventions, as well as non-pharmacological interventions. Also, future studies should consider the impact of interventions similar to those used in older on both sleep outcomes and other health outcomes.

5 | Conclusions

The results of this systematic review highlight the need for further research on interventions to promote sleep in hospitalized children.

Supplementary files

Supplementary Table 1.

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Authors' contributions

Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work: SV, MN, ASF; Drafting the work or revising it critically for important intellectual content: SV, MN, ASF; Final approval of the version to be published: SV, MN, ASF; Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: SV, MN, ASF.

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Ethics approval and consent to participate

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Competing interests

We do not have potential conflicts of interest with respect to the research, authorship, and publication of this article.

Availability of data and materials

The datasets used during the current study are available from the corresponding author on request.

Using artificial intelligent chatbots

None.

References

1. Kudchadkar SR, Aljohani OA, Punjabi NM. Sleep of critically ill children in the pediatric intensive care unit: a systematic review. *Sleep Med Rev*. 2014;18(2):103-110.
2. Kudchadkar SR, Berger J, Patel R, Barnes S, Twose C, Walker T, et al. Non-pharmacological interventions for sleep promotion in hospitalized children. *Cochrane Database Syst Rev*. 2022;6(6):CD012908.
3. Cutler AJ. The Role of Insomnia in Depression and Anxiety: Its Impact on Functioning, Treatment, and Outcomes. *J Clin Psychiatry*. 2016;77(8):e1010.
4. Daniel LC, van Litsenburg RRL, Rogers VE, Zhou ES, Ellis SJ, Wakefield CE, et al. A call to action for expanded sleep research in pediatric oncology: A position paper on behalf of the International Psycho-Oncology Society Pediatrics Special Interest Group. *Psychooncology*. 2020;29(3):465-474.
5. Hybschmann J, Topperzer MK, Gjærde LK, Born P, Mathiasen R, Sehested AM, et al. Sleep in hospitalized children and adolescents: A scoping review. *Sleep Med Rev*. 2021;59:101496.
6. Cho E, Shin J, Seok JW, Lee H, Lee KH, Jang J, et al. The effectiveness of non-pharmacological interventions using information and communication technologies for behavioral and psychological symptoms of dementia: A systematic review and meta-analysis. *Int J Nurs Stud*. 2023;138:104392.
7. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71.
8. Higgins J, Savović J, Page M, Elbers R, Sterne J. Assessing risk of bias in a randomized trial. In: Higgins J, Thomas J, Chandler J, Cumpston M, Li T, Page M, et al., editors. Cochrane Handbook for Systematic Reviews of Interventions. 6.3 ed: Cochrane; 2022.
9. Khaksar S, Kalhor F. Restriction of the family-centered care miracle by COVID-19: the role of the father in sleep disturbance of hospitalized pediatrics. *Sleep Sci*. 2022;15(4):407-415.
10. Papaconstantinou EA, Hodnett E, Stremler R. A Behavioral-Educational Intervention to Promote Pediatric Sleep During Hospitalization: A Pilot Randomized Controlled Trial. *Behav Sleep Med*. 2018;16(4):356-370.
11. Rogers VE, Zhu S, Ancoli-Israel S, Liu L, Mandrell BN, Hinds PS. A pilot randomized controlled trial to improve sleep and fatigue in children with central nervous system tumors hospitalized for high-dose chemotherapy. *Pediatr Blood Cancer*. 2019;66(8):e27814.
12. van Bindsbergen KLA, van der Hoek H, van Gorp M, Ligthart MEU, Hindriks KV, Neerincx MA, et al. Interactive Education on Sleep Hygiene with a Social Robot at a Pediatric Oncology Outpatient Clinic: Feasibility, Experiences, and Preliminary Effectiveness. *Cancers (Basel)*. 2022;14(15):3792.

13. Dewald-Kaufmann J, de Bruin E, Michael G. Cognitive Behavioral Therapy for Insomnia (CBT-i) in School-Aged Children and Adolescents. *Sleep Med Clin*. 2019;14(2):155-165.
14. Sciberras E, Efron D, Patel P, Mulraney M, Lee KJ, Mihalopoulos C, et al. Does the treatment of anxiety in children with Attention-Deficit/Hyperactivity Disorder (ADHD) using cognitive behavioral therapy improve child and family outcomes? Protocol for a randomized controlled trial. *BMC Psychiatry*. 2019;19(1):359.
15. Hayati H, Afiyanti Y. "AeRop exercise" can improve the sleep quality of Indonesian pediatric cancer patients. *Enferm Clin*. 2019;29(Suppl 2):342-345.
16. Hedlund ER, Villard L, Lundell B, Sjöberg G. Physical exercise may improve sleep quality in children and adolescents with Fontan circulation. *Cardiol Young*. 2019;29(7):922-929.
17. Tse AC, Lee PH, Zhang J, Chan RC, Ho AW, Lai EW. Effects of exercise on sleep, melatonin level, and behavioral functioning in children with autism. *Autism*. 2022;26(7):1712-1722.
18. Anggerainy SW, Wanda D, Nurhaeni N. Music Therapy and Story Telling: Nursing Interventions to Improve Sleep in Hospitalized Children. *Compr Child Adolesc Nurs*. 2019;42(sup1):82-89.
19. Valizadeh L, Romouzi A, Aghajari P, Jafarabadi MA. The effects of storytelling on anxiety and sleep in hospitalized children with fracture: A randomized clinical trial. *Nurs Midwifery Stud*. 2022;11(2):123-129.
20. Ebrahimi HK, Esmaeilian S, Jafarnejad S, Sohrabi S, Papi S. A Comparative Study the Effect of Painting and Storytelling on Children's Sleep with Autism. *Ann Romanian Soc Cell Biol*. 2021;25(3):398-408.
21. Hoseinpour M, Sahebalzamani M. The Effect of Storytelling Training to Parents on Sleep Disorders of Children Affected by Autism Referred to Tehran Autism Center in 2017. *Razi J Med Sci*. 2022;29(3):8-18.
22. Karbandi S, Soltanifar A, Salari M, Asgharinekah SM, Izie E. Effect of music therapy and distraction cards on anxiety among hospitalized children with chronic diseases. *Evid Based Care J*. 2020;9(4):15-22.
23. Loewy J, Stewart K, Dassler AM, Telsey A, Homel P. The effects of music therapy on vital signs, feeding, and sleep in premature infants. *Pediatrics*. 2013;131(5):902-918.
24. Loewy J, Hallan C, Friedman E, Martinez C. Sleep/sedation in children undergoing EEG testing: a comparison of chloral hydrate and music therapy. *J Perianesth Nurs*. 2005;20(5):323-332.
25. Naulia RP, Allenidekania A, Hayati H. The effect of music therapy on sleep quality among children with chronic illness. *In J Nurs Health Serv*. 2019;2(1):15-20.
26. Bazregari M, Mirlashari J, Ranjbar H, Pouraboli B. Effect of Clustered Nursing Care on Sleep Behaviors of the Preterm Neonates Admitted to the Neonatal Intensive Care Unit. *Iran J Neonatol*. 2019;10(3):14-20.
27. Varvara B, Effrossine T, Despoina K, Konstantinos D, Matziou V. Effects of neonatal intensive care unit nursing conditions in neonatal NREM sleep. *J Neonatal Nurs*. 2016;22(3):115-123.
28. Cook DJ, Arora VM, Chamberlain M, Anderson S, Peirce L, Erondu A, et al. Improving Hospitalized Children's Sleep by Reducing Excessive Overnight Blood Pressure Monitoring. *Pediatrics*. 2020;146(3):e20192217.
29. Firmino C, Rodrigues M, Franco S, Ferreira J, Simões AR, Castro C, et al. Nursing Interventions That Promote Sleep in Preterm Newborns in the Neonatal Intensive Care Units: An Integrative Review. *Int J Environ Res Public Health*. 2022;19(17):10953.
30. Arregi A, Lertxundi A, Vegas O, García-Baquero G, Ibarluzea J, Anabitarte A, et al. Environmental Noise Exposure and Sleep Habits among Children in a Cohort from Northern Spain. *Int J Environ Res Public Health*. 2022;19(23):16321.
31. Jacobs S, Mowbray C, Cates LM, Baylor A, Gable C, Skora E, et al. Pilot Study of Massage to Improve Sleep and Fatigue in Hospitalized Adolescents With Cancer. *Pediatr Blood Cancer*. 2016;63(5):880-886.
32. 32. Kamal FE-Z, Abd-Alasis A, Sayed HA-R, Yousef YE-S, Zaki NA-E. Effect of Therapeutic Massage on Fatigue among Children with Leukemia following Chemotherapy. *Assiut Sci Nurs J*. 2018;6(13):83-91.
33. Ayu Yuliani S, Zaitun Z, Peni C, Nandan L. Influence Swedish Massage On The Quality Of Thalassemia Beta Mayor Children. *Eur J Mol Clin Med*. 2020;7(11):1792-1802.
34. Arbianingsih A, Amal AA, Hidayah N, Azhari N, Tahir T. Massage with lavender aromatherapy reduced sleep disturbances on infant. *Enferm Clin*. 2020;30(Suppl 3):62-65.
35. Pados BF, McGlothen-Bell K. Benefits of Infant Massage for Infants and Parents in the NICU. *Nurs Womens Health*. 2019;23(3):265-271.
36. Salarfard M, Zarei B, Younesi Z, Nikkhah Bidkhti A, Taheri Bojd F. The Effect of Orange Essential Oil Aromatherapy on Sleep Quality in Hospitalized Children. *Prev Care Nurs Midwifery J*. 2023;13(1):83-90.

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