RIASE
REVISTA IBERO-AMERICANA DE SAÚDE E ENVELHECIMENTO
REVISTA IBERO-AMERICANA DE SALUD Y ENVEJECIMIENTO

PROMOTING AND PROTECTING QUALITY SLEEP IN PREMATURE INFANTS: WHAT ARE THE STRATEGIES?

PROMOVER E PROTEGER O SONO DE QUALIDADE NO PREMATURO: QUAIS AS ESTRATÉGIAS?

PROMOVER Y PROTEGER UN SUEÑO DE CALIDAD EN LOS LACTANTES PREMATUROS: ¿CUÁLES SON LAS ESTRATEGIAS?

Sandra Rodrigues[1], Ana Malveira[2], Rita Silva[2], Antónia Chora[3,4], Margarida Goes[3,4], Ana Dias[3,4].

[1]Polytechnic Institute of Beja, Beja, Portugal.
[2]Local Health Unit Central Alentejo, NICU, Évora, Portugal.
[3]São João de Deus School of Nursing, University of Évora, Évora, Portugal.
[4]Comprehensive Health Research Centre (CHRC), University of Évora, Évora, Portugal.

Received/Recebido: 17-11-2024 Accepted/Aceite: 06-12-2024 Published/Publicado: 10-12-2024

DOI: http://dx.doi.org/10.60468/r.riase.2024.10(02).685.151-165

©Authors retain the copyright of their articles, granting RIASE 2024 the right of first publication under the CC BY-NC license, and authorizing reuse by third parties in accordance with the terms of this license.
©Os autores retêm o copyright sobre seus artigos, concedendo à RIASE 2024 o direito de primeira publicação sob a licença CC BY-NC, e autorizando reuso por terceiros conforme os termos dessa licença.

ABSTRACT

Introduction: In the complex environment of the Neonatal Intensive Care Unit (NICU), the sleep of preterm infants (PTIs) is often compromised in terms of quality and quantity. As a vital life activity with significant health implications, it is crucial to identify, plan, and implement protective and promotive strategies for achieving quality sleep architecture.

Objective: To map and identify the available scientific evidence on strategies that promote and protect sleep in preterm infants hospitalized in NICUs.

Methods: This review was conducted using the PICO methodology and followed the review protocol proposed by the Joanna Briggs Institute (JBI). Studies were selected from PubMed and EBSCO databases, using inclusion criteria that considered publications from the past five years, with abstracts and full texts freely available in Portuguese and English, and published in high-performance journals. After selecting the studies, the results were analyzed and discussed.

Results: The review included seven studies that identified neonatal sleep-promoting and protective strategies, which were organized into four interdependent categories: environment, care, interaction, and education.

Conclusions: It is essential to incorporate interventions that promote sleep in neonatal care practices to improve the quality and quantity of PTI sleep, thereby contributing to their healthy development.

Keywords: Neonatal Intensive Care Units; Preterm newborn; Sleep.

RESUMO

Introdução: No complexo ambiente da Unidade de Cuidados Intensivos Neonatal (UCIN) o sono dos recém-nascidos pré-termo (RNPT) é frequentemente comprometido em qualidade e quantidade. Sendo uma atividade de vida de importância primordial e com repercussões que se refletem em ganhos em saúde importa identificar, planear e implementar estratégias protetoras e promotoras de uma arquitetura de sono de qualidade.

Objetivo: Mapear e identificar a evidência científica disponível sobre as estratégias promotoras e protetoras do sono em recém-nascidos pré-termo internados em UCIN.

Métodos: Esta revisão foi conduzida com base na metodologia PICO e seguiu o protocolo de revisão proposto pelo Joanna Briggs Institute (JBI). Foram selecionados estudos nas bases de dados PubMed e EBSCO, com critérios de inclusão que consideraram publicações dos últimos cinco anos, com resumo e texto completo disponíveis gratuitamente, em português

e inglês, e publicados em revistas de desempenho qualificado. Após a seleção dos estudos, realizou-se a análise e discussão dos resultados.

Resultados: A revisão incluiu sete estudos que permitiram identificar estratégias promotoras e protetoras do sono neonatal, as quais foram organizadas em quatro categorias interdependentes: ambiente, cuidados, interação e educação.

Conclusões: É fundamental incorporar intervenções que promovam o sono em contexto neonatal na prática de cuidados individualizados, visando melhorar a qualidade e quantidade do sono dos RNPT e, assim, contribuir para o seu desenvolvimento saudável.

Palavras-chave: Sono; Recém-nascido Pré-termo; Unidade de Cuidados Intensivos Neonatais.

RESUMEN

Introducción: En el complejo entorno de la Unidad de Cuidados Intensivos Neonatales (UCIN), el sueño de los recién nacidos prematuros (RNP) suele verse comprometido en términos de calidad y cantidad. Como una actividad vital de importancia primordial con repercusiones significativas en la salud, es crucial identificar, planificar e implementar estrategias protectoras y promotoras de una arquitectura de sueño de calidad.

Objetivo: Mapear e identificar la evidencia científica disponible sobre las estrategias que promueven y protegen el sueño en recién nacidos prematuros hospitalizados en las UCIN.

Métodos: Esta revisión se llevó a cabo utilizando la metodología PICO y siguió el protocolo de revisión propuesto por el Joanna Briggs Institute (JBI). Se seleccionaron estudios de las bases de datos PubMed y EBSCO, utilizando criterios de inclusión que consideraron publicaciones de los últimos cinco años, con resúmenes y textos completos disponibles de forma gratuita en portugués e inglés, y publicados en revistas de alto rendimiento. Tras la selección de los estudios, se realizó el análisis y discusión de los resultados.

Resultados: La revisión incluyó siete estudios que permitieron identificar estrategias que promueven y protegen el sueño neonatal, organizadas en cuatro categorías interdependientes: entorno, cuidados, interacción y educación.

Conclusiones: Es fundamental incorporar intervenciones que promuevan el sueño en las prácticas de cuidados neonatales para mejorar la calidad y cantidad del sueño de los RNP, contribuyendo así a su desarrollo saludable.

Descriptores: Sueño; Recién Nacido Prematuro; Unidad de Cuidados Intensivos Neonatales.

INTRODUCTION

Sleep plays a fundamental role in cognitive and psychomotor development, being associated with improvements in immune function and modulation of the hypothalamic-pituitary-adrenal (HPA) axis, with a consequent reduction in stress hormones[1]. Sleep fulfills essential functions in maintaining wakefulness, psychomotor performance, energy conservation, and promoting anabolic processes. Additionally, it is indispensable for central thermoregulation mechanisms, brain maturation and plasticity, memory consolidation, and metabolic process regulation, as well as serving as a substrate for dreams[2].

In Neonatal Intensive Care Units (NICUs), preterm infants (PTIs) receive specialized care that, while essential for their recovery, creates a technologically complex environment vastly different from the maternal womb. This environment involves various sources of stimulation, such as intense lights, constant noise, and unscheduled interventions, which contribute to sleep deprivation in PTIs and compromise the proper development of the central nervous system[3].

An organized and stable sleep architecture is directly associated with physiological regulation and autonomic system stability. The absence of adequate promotion and protection of sleep in PTIs can compromise growth, emotional regulation, language acquisition, and learning ability[1,4]. Recent evidence suggests that poor quality sleep in these infants increases the risk of future neurocognitive problems[5].

In this context, it is essential to prioritize PTI sleep through neuroprotective strategies, with nurses playing a central role in advocating, promoting, and preserving neonatal sleep[4].

The objective of this review is to map and explore the scientific evidence available on strategies that promote and protect PTI sleep in NICU settings.

METHODOLOGY

This systematic review aims to map the main studies related to sleep in the context of neonatal intensive care, with the objective of identifying the scientific evidence available on strategies that promote quality sleep for preterm infants (PTI). To conduct this analysis, the review followed the Joanna Briggs Institute (JBI) protocol[6], formulating the review question: "What are the strategies that promote quality sleep in preterm infants in the context of neonatal intensive care?". This question guided the development of the review criteria based on the PCC framework (Population; Concept; Context), where the target population is preterm infants, the concept encompasses strategies that promote quality sleep, and the context refers to Neonatal Intensive Care Units (NICUs).

The research was conducted on the PubMed and EBSCOhost platforms, using the MEDLINE Complete, CINAHL Complete, Nursing & Allied Health Collection: Comprehensive, and Cochrane Database of Systematic Reviews databases. To define the search strategy, the following Medical Subject Headings (MeSH) terms were used: "Sleep" [MeSH Terms], "Infant, Premature" [MeSH Terms], and "Intensive Care Units, Neonatal" [MeSH Terms]. These terms were combined using the boolean operator AND, limiting the search to articles addressing the intersection of the three central themes.

Strict inclusion criteria were defined: studies with abstracts and full texts freely available in Portuguese or English, published between 2019 and 2024, whose population comprised newborns aged 0 to 28 days, and indexed in high-performance journals (Q1 and Q2). Initially, 53 studies were identified. Exclusion criteria included articles that did not meet the inclusion criteria, duplicate studies, and/or articles that, after title review, were deemed irrelevant to the defined review question. The selection process is detailed in Figure 1↗, which presents the PRISMA 2020 flow diagram[7] used to document each phase of inclusion and exclusion of articles.

RESULTS

This review analyzed seven studies that met the inclusion criteria and provided relevant evidence on strategies that promote and protect quality sleep-in preterm infants (PTIs) admitted to Neonatal Intensive Care Units (NICUs). The analysis of the studies identified interventions focused on four main areas: environment, care, interaction, and education. These interventions, described in the included studies, aim to promote quality sleep, which is essential for the neurological and physical development of PTIs.

To facilitate understanding and comparison of the included studies, Chart 1↗ presents a detailed characterization of each study, including authors, year of publication, country of origin, data collection period, context, number and type of participants, description of the intervention program, and evaluation of the results.

DISCUSSION OF RESULTS

Although the effects of sleep disorders in preterm infants (PTIs) still lack robust scientific evidence, it is known that sleep deprivation is associated with physiological instability and suboptimal developmental outcomes. Sleep thus plays a central role in the growth and overall development of PTIs and is considered an essential activity, comparable to breathing and nutrition[8].

The neonatal population is often exposed to continuous multisensory stimulation, which can hinder the establishment of a circadian rhythm. This situation results in disruptions in the sleep-wake transition, with frequent interruptions that can occur up to 234 times within 24 hours. In this context, it is crucial for nurses to be aware of the phases of sleep, its benefits, and the factors that promote quality sleep in the neonatal environment[8].

Several strategies were identified that can provide an environment conducive to quality sleep and minimize its interruptions, contributing to the growth, neurological development, and physiological regulation of PTIs. To facilitate their organization, the strategies and/or interventions were grouped into four categories: environment, care, interaction, and education (Figure 2↗). This classification is based on the philosophy of Developmental Care for Preterm Infants, which adopts a holistic approach aimed at promoting the healthy and integral development of neonates, especially preterm infants[1].

Implementation of these strategies is recommended across all areas of the NICU, covering a complete 24-hour period or a specific number of hours. These interventions should begin within the first 48 hours after birth and continue until 34 weeks of corrected gestational age[9].

Environment

Almadhoob and Ohlsson[9] confirm the relationship between sleep and sound in the NICU context. This relationship influences the quality of sleep and the health of preterm infants, as exposure to high noise levels and sudden sounds triggers physiological stress responses in PTIs, leading to increased heart rate, altered respiratory patterns, and elevated cortisol levels, which affect sleep architecture. Sleep architecture, referring to the structure and pattern of sleep cycles, can be altered, resulting in fragmented sleep and reduced deep sleep time, which is essential for the neurodevelopment of preterm infants[9]. It is now known that the ideal acoustic environment resembles the intrauterine environment[10]. To promote quality sleep in the NICU, it is essential to optimize the environment by reducing noise levels to below 45 dB[11,9]. This reduction can be achieved by using sound-absorbing materials, minimizing unnecessary noise, and creating quiet zones, thereby promoting longer and more restful sleep periods[9].

These strategies should be implemented across all NICU areas, potentially encompassing 24-hour day-night periods or specific intervals, starting within the first 48 hours after birth and continuing until 34 weeks of corrected gestational age[9].

The use of ear protectors or plugs for PTIs has proven effective in reducing noise impact, increasing periods of quiet sleep, reducing wakefulness, and stabilizing physiological activity. However, their application should be temporary and does not provide continuous protection over a 24-hour period[8-13].

Noise exposure can also be minimized through the use of incubators with controlled sound levels, designed to reduce external noise. Covering the incubator with sound-reducing fabric (sound-absorbing materials) is another effective strategy[9].

Creating a calm and relaxing environment in the NICU also includes reducing light intensity, which can be achieved with custom opaque covers for incubators[8,11]. This protection contributes to the structural organization of sleep, prolonging periods of non-rapid eye movement sleep[8].

Care

Recognizing that sleep patterns differ between full-term and preterm infants allows for more effective interventions. Thus, adapting and individualizing care to the specific needs of each PTI, considering their gestational age and developmental stage, is essential for optimizing sleep. Continuous assessment of sleep patterns based on sleep-wake cycles and responses to environmental stimuli is necessary to adjust care practices[11].

The implementation of non-pharmacological strategies such as containment, gentle rocking, and skin-to-skin contact (kangaroo method) has shown clear benefits in promoting sleep in the neonatal context[11]. Additionally, reducing unnecessary handling of PTIs and ensuring an environment conducive to rest support healthy sleep architecture[11].

As a relaxation technique, infant therapeutic massage, performed with moderate pressure for about ten minutes, has proven to be an auxiliary intervention to induce sleep in PTIs, stabilizing the autonomic nervous system, promoting growth and development, and reducing hospital stay time[8].

Another effective intervention is a contained bath, which promotes sleep in PTIs. This bath should be performed at an ambient temperature of 25-26°C, with water levels adjusted to cover the baby's shoulders and a towel at the base of the tub. During the bath, caregivers should speak softly and use slow, rhythmic movements to provide a sense of security[8].

Positioning methods such as elastic containment, nesting, and the use of cloths to limit space support behavioral organization and benefit PTI sleep[8].

Interaction

The relationship between sleep and sound also extends to the well-being of parents and healthcare teams in the NICU, as a calmer environment enhances parental satisfaction and improves team performance, fostering effective communication and reducing stress levels[9].

Exposure to the maternal voice has proven particularly beneficial for neonatal sleep. Maternal voice exposure during periods of high noise levels in the NICU has been associated with a reduced likelihood of wakefulness in PTIs. These findings suggest that the maternal voice, when integrated into care routines, can shield PTIs from the disruptive effects of noise, increasing the likelihood of maintaining sleep during exposure to intense noise, acting as a protective factor against sleep disruption caused by the NICU environment[11].

Education

Nurses must be fully aware of the importance of sleep for PTI neurodevelopment and familiar with interventions that promote sleep in this population, as their practices have a direct effect on PTI development[8,14].

Including parents in the care process is essential, as it prepares them to continue sleep-promoting practices after discharge[8]. Educating the multidisciplinary team about the importance of sleep and the impact of the environment on neonatal development fosters more consistent care practices, increasing the effectiveness of environmental management strategies and consequently improving PTI sleep quality[9,11].

CONCLUSION

The integration of strategies related to care, environment, interaction, and education has proven essential in promoting better behavioral organization in preterm infants (PTIs), enhancing sleep quality, responsiveness, and interaction in these babies. These interventions translate into significant health benefits for PTIs, such as reduced hospital stay and weight gain, contributing to more appropriate neurological development.

The results of this study highlight the importance of noise management in Neonatal Intensive Care Units (NICUs), with excessive noise identified as one of the main factors inhibiting quality sleep. These findings emphasize the need for further research on the benefits of noise reduction and the development of consistent protocols for its management in NICUs.

Additionally, a calmer environment positively impacts the well-being of parents and healthcare teams, fostering more effective communication and reducing stress levels, which increases caregiver satisfaction and improves team performance.

Promoting and protecting sleep in PTIs in NICU settings is, therefore, a shared responsibility of all healthcare professionals. Simple actions, such as ensuring a sleep-conducive environment by reducing noise and providing adequate lighting, adopting practices that promote and support sleep, and involving parents in the care process, are fundamental to improving PTIs' quality of life. This integrated and evidence-based approach contributes to positive outcomes in PTIs' development and health, reinforcing the importance of development-centered practices.

Limitations

This study presents several limitations that should be considered when interpreting its results. Firstly, the heterogeneity of the analyzed studies, both in the methods used and the contexts in which they were applied, makes standardization difficult and limits the generalizability of the results to different preterm infant populations. Additionally, evidence on the long-term effects of sleep-promoting interventions in PTIs remains limited, highlighting the need for future research with extended follow-up periods. Another limitation relates to the lack of uniform protocols for noise and lighting management in NICUs, which hinders consistent implementation of the recommended strategies and may result in variations in outcomes.

Study contributions

This study provides an important contribution to the field of neonatal care by synthesizing and categorizing effective strategies for promoting quality sleep in PTIs, based on the best available scientific evidence. By organizing the interventions into the categories of environment, care, interaction, and education, this review offers a comprehensive framework that can guide clinical practice and the development of development-centered care policies in NICUs. Recommendations for noise reduction and the active involvement of parents in the care of PTIs stand out as promising practices with the potential to improve the quality of life and health outcomes of preterm infants. Additionally, this work reinforces the importance of a multidisciplinary approach, raising awareness among healthcare teams about the impact of the environment and interactions on the neurological and physiological development of PTIs.

REFERENCES

1. Coughlin M. Transformative nursing in the NICU: Trauma-informed, age-appropriate care. 2nd ed. Springer Publishing Company. 2020. Available from: https://doi.org/10.1891/9780826154323

2. Paiva T, Penzel T. Centro da Medicina do Sono – Manual Prático. Lisboa. Lidel – Edições Técnicas, Lda.; 2011.

3. Chora MA, Azougado C. Influência da Promoção do Sono no Desenvolvimento do Recém-Nascido Pré-Termo: Uma Revisão Narrativa. RIASE. 2015;1(3):357-371. Available from: http://dx.doi.org/10.24902/r.riase.2015.1(3).357

4. Vilelas J, Marques J, Jacinto B, Correia A, Apóstolo J, Pestana V. Guia orientador de boas práticas: o sono na criança e no adolescente. Trabalho desenvolvido por iniciativa da Mesa do Colégio da Especialidade de Enfermagem de Saúde Infantil e Pediátrica (MCEESIP) – Mandato 2020/2023 Ordem dos Enfermeiros. 1.ª ed. Lisboa. Ordem dos Enfermeiros Ed.; 2023. Available from: https://www.ordemenfermeiros.pt/media/31187/gobp_sonobebeadolescente_v7-okn.pdf

5. Uchitel J, Vanhatalo S, Austin T. Early development of sleep and brain functional connectivity in term-born and preterm infants. Pediatr Res. 2022;91(4):771-86. Available from: https://doi.org/10.1038/s41390-021-01497-4

6. Aromataris E, Lockwood C, Porritt K, Pilla B, Jordan Z, editors. JBI Manual for Evidence Synthesis. JBI. 2024. Available from: https://synthesismanual.jbi.global. https://doi.org/10.46658/JBIMES-24-01

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(71). Available from: https://doi.org/10.1136/bmj.n71

8. 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. J. Environ. Res. Public Health. 2022;19(17): 10953. Available from: https://doi.org/10.3390/ijerph191710953

9. Almadhoob A, Ohlsson A. Sound reduction management in the neonatal intensive care unit for preterm or very low birth weight infants. Cochrane Database Syst Rev. 2020;1(1):CD010333. Available from: https://doi.org/10.1002/14651858.CD010333.pub3

10. Balsan MJ, Burns J, Kimock F, Hirsch E, Unger A, Telesco R et al. A pilot study to assess the safety, efficacy and ease of use of a novel hearing protection device for hospitalized neonates. Early human development. 2021;156:105365. Available from: https://doi.org/10.1016/j.earlhumdev.2021.105365

11. Shellhaas RA, Burns JW, Barks JDE, Hassan F, Chervin RD. Maternal Voice and Infant Sleep in the Neonatal Intensive Care Unit. Pediatrics. 2019; 144(3):e20190288. Available from: https://doi.org/10.1542/peds.2019-0288

12. Hutchinson GM, Wilson PS, Sommerfeldt S, Ahmad K. Incubator-based active noise control device: comparison to ear covers and noise reduction zone qualification. Pediatric Research. 2023;94(5): 1817-1823. Available from: https://doi.org/10.1038/s41390-023-02708-w

13. Bloch-Salisbury E, McKenna L, Boland E, Chin D. Assessment of a hearing protection device on infant sleep in the neonatal intensive care unit. J Sleep Res. 2023;32(2):e13610. Available from: https://doi.org/10.1111/jsr.13610

14. Hendy A, Alsharkaw SS, El-Nagger NS, Hendy A, Sayed, S, Nashwan AJ. Outcome of creating clustering nursing care and healing environment on premature infants' behavioural outcomes. BMJ Pediatrics Open. 2024;8(1):e002716. Available from: https://doi.org/10.1136/bmjpo-2024-002716

Authors
Sandra Rodrigues
https://orcid.org/0009-0008-5523-0547
Ana Malveira
https://orcid.org/0009-0003-1912-6455
Rita Silva
https://orcid.org/0009-0001-7953-8510
Antónia Chora
https://orcid.org/0000-0003-3449-3061
Margarida Goes
https://orcid.org/0000-0001-6017-6874
Ana Dias
https://orcid.org/0000-0001-6562-4728

Corresponding Author/Autora Correspondente
Ana Dias – Escola Superior de Enfermagem S. João de Deus Universidade de Évora, Portugal.
anadias@uevora.pt

Authors' contributions/Contributos dos autores
SR: Study design, data analysis, review and discussion of results.
AM: Study design, data analysis, review and discussion of results.
RS: Study design, data analysis, review and discussion of results.
AC: Study design, data analysis, review and discussion of results.
MG: Study design, data analysis, review and discussion of results.
AD: Coordination of the study, study design, collection, storage and analysis of data, review and discussion of results.
All authors have read and agreed with the published version of the manuscript.

Ethical Disclosures
Conflicts of Interest: The authors have no conflicts of interest to declare.
Financial Support: This work has not received any contribution, grant or scholarship.
Provenance and Peer Review: Not commissioned; externally peer reviewed.

Responsabilidades Éticas
Conflitos de Interesse: Os autores declararam não possuir conflitos de interesse.
Suporte Financeiro: O presente trabalho não foi suportado por nenhum subsídio ou bolsa.
Proveniência e Revisão por Pares: Não comissionado; revisão externa por pares.

©Authors retain the copyright of their articles, granting RIASE 2024 the right of first publication under the CC BY-NC license, and authorizing reuse by third parties in accordance with the terms of this license.
©Os autores retêm o copyright sobre seus artigos, concedendo à RIASE 2024 o direito de primeira publicação sob a licença CC BY-NC, e autorizando reuso por terceiros conforme os termos dessa licença.

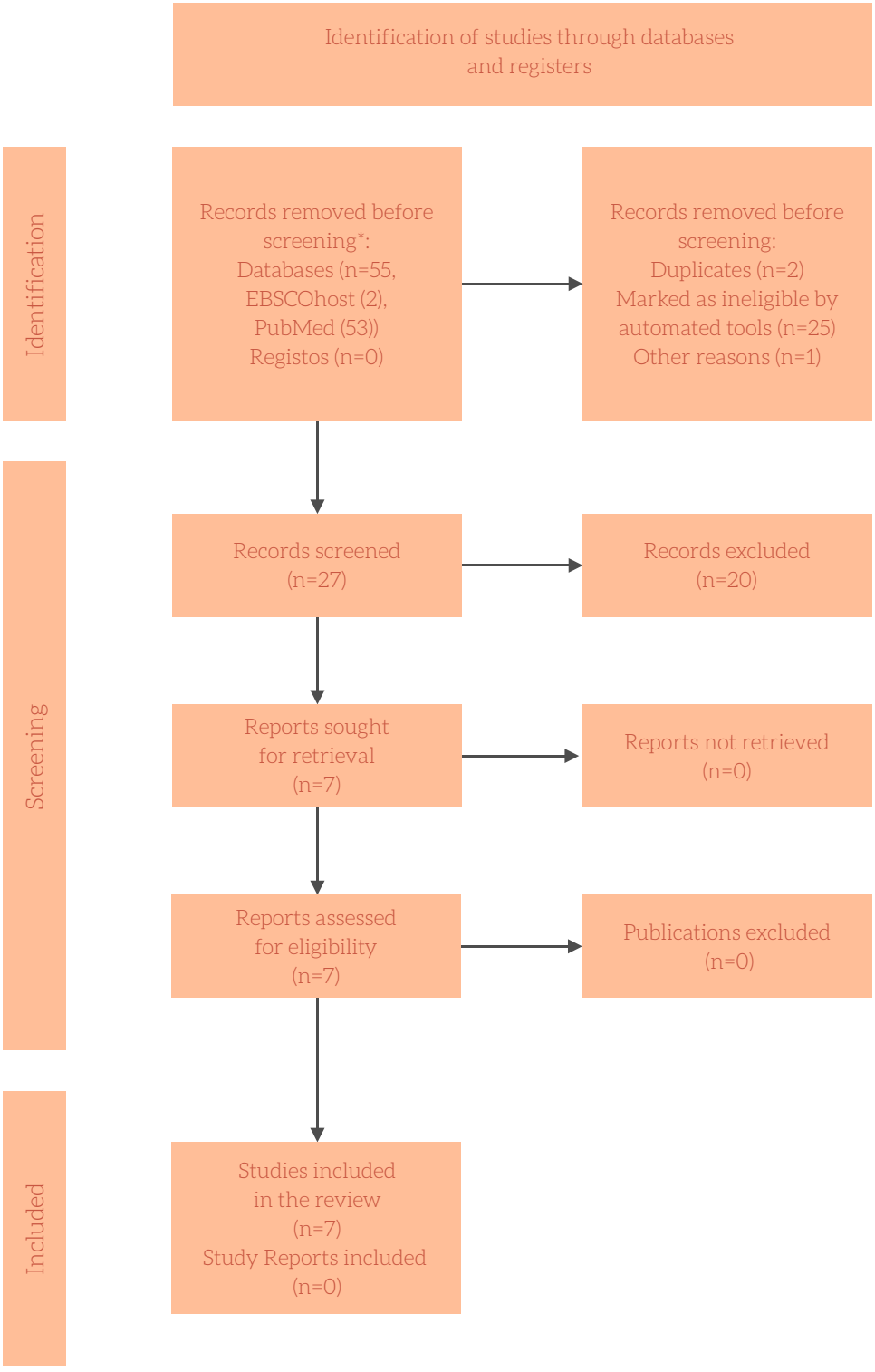


Figure 1 – PRISMA flow diagram representing the research process[7].

Chart 1 – Characterization of the Studies Included in the Review.

Authors and Year	Country	Data Collection Period	Context	Participants and Sample	Intervention Program	Outcome Evaluation
Balsan MJ, Burns J, Kimock F, Hirsch E, Unger A, Telesco R *et al*[10].	USA.	January to December 2020.	Neonatal Care Unit.	100 PTIs.	Noise reduction program using acoustic materials.	Increased continuous sleep time and reduced wake episodes.
Firmino C, Rodrigues M, Franco S, Ferreira J, Simões AR, Castro C *et al*[8].	Brazil.	February to October 2021.	Neonatal Care Unit.	80 PTIs.	Kangaroo Method with skin-to-skin contact.	Improved physiological stability and sleep duration.
Hutchinson GM, Wilson PS, Sommerfeldt S, Ahmad K[12].	Portugal.	March to September 2022.	Neonatal Care Unit.	75 PTIs.	Exposure to maternal voice during periods of elevated noise.	Reduced awakenings and improved sleep quality.
Almadhoob A, Ohlsson A[9].	United Kingdom.	April to December 2019.	Neonatal Care Unit.	60 PTIs.	Light intensity control in the NICU.	Increased deep sleep duration.
Hendy A, Alsharkaw SS, El-Nagger NS, Hendy A, Sayed, S, Nashwan AJ[14].	Australia.	January to July 2023.	Neonatal Care Unit.	90 PTIs.	Training program for parents and multidisciplinary team.	Greater adherence to sleep-promoting practices and reduced stress.
Shellhaas RA, Burns JW, Barks JDE, Hassan F, Chervin RD[11].	Canada.	June to November 2021.	Neonatal Care Unit.	85 PTIs.	Use of sound-absorbing materials.	Reduced environmental noise and improved sleep.
Bloch-Salisbury E, McKenna L, Boland E, Chin D[13].	Germany.	May 2020 to January 2021.	Neonatal Care Unit.	70 PTIs.	Containment and nesting techniques for PTIs.	Longer uninterrupted sleep duration.

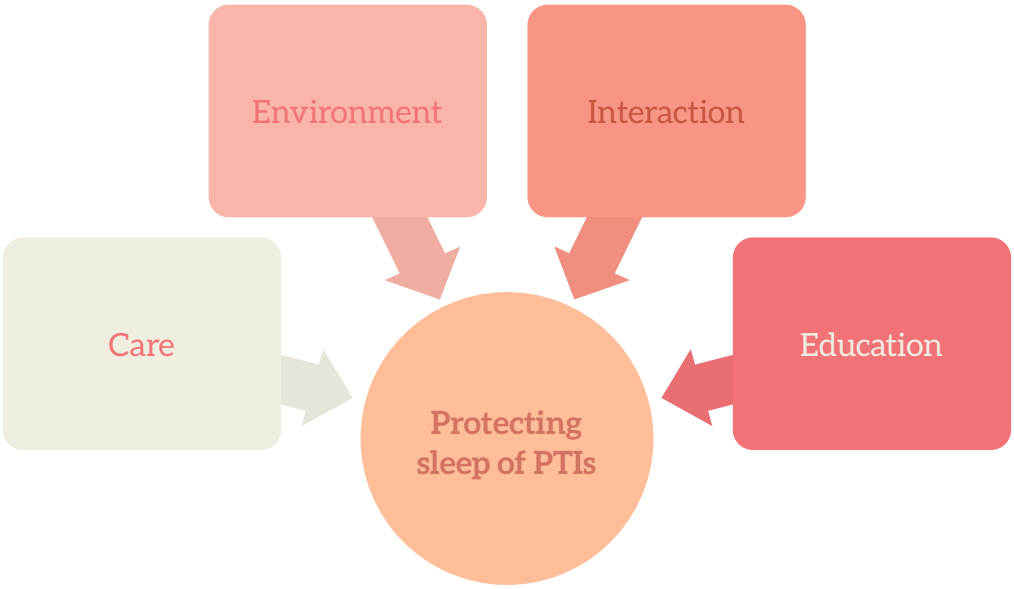


Figure 2 – Categories of sleep-promoting strategies and interventions in NICUs (Based on Coughlin[1]).