

# Developmental care for preterm newborns: A scoping review

*Cuidado desenvolvimental para recém-nascidos pré-termos: revisão de escopo*  
*Atención del desarrollo de recién nacidos prematuros: revisión de alcance*

## ABSTRACT

**Objective:** to map the evolution of developmental care provided to preterm newborns in Neonatal Intensive Care Units to synthesize current scientific evidence. **Method:** a bibliographic search for a scoping review was conducted in November 2022 on the MEDLINE, *Biblioteca Virtual em Saúde*, CINAHL, Embase and Web of Science databases. The studies included were those discussing developmental care in neonatal units in the past five years, without language restrictions. **Results:** the scoping review included seven articles whose main topics were skin-to-skin contact, noise and light control, family participation, and team awareness and training. **Conclusion:** developmental care practices contribute to the neuropsychomotor development of preterm infants and to improve care, in addition to reducing morbidity, mortality and hospitalization times. **Descriptors:** Child Development; Neuroprotection; Infant, Premature; Intensive Care, Neonatal; Nursing Care.


## RESUMO

**Objetivo:** mapear como o cuidado desenvolvimental prestado aos recém-nascidos pré-termos tem sido desenvolvido nas unidades de terapia intensiva neonatal com a finalidade de sintetizar as evidências científicas atuais. **Métodos:** revisão de escopo com busca realizada em novembro de 2022 nas bases MEDLINE, Biblioteca Virtual em Saúde, CINAHL, Embase e *Web of Science*. Foram incluídos estudos que retratavam o cuidado desenvolvimental nas unidades neonatais, nos últimos cinco anos, sem restrição de idioma. **Resultados:** incluíram-se sete artigos e os principais temas foram: contato pele a pele, controle do ruído e luminosidade, participação da família e sensibilização e treinamento da equipe. **Conclusão:** esses cuidados contribuem para o desenvolvimento neuropsicomotor do prematuro, melhoram a assistência e reduzem a morbimortalidade e o tempo de internação. **Descritores:** Desenvolvimento infantil; Neuroproteção; Prematuro; Terapia intensiva neonatal; Cuidados de enfermagem.


## RESUMEN

**Objetivo:** mapear cómo se ha llevado a cabo la atención en el proceso de desarrollo de los recién nacidos prematuros en las unidades de cuidados intensivos neonatales para sintetizar la evidencia científica actual. **Métodos:** revisión de alcance realizada en noviembre de 2022 mediante búsquedas en las bases de datos MEDLINE, Biblioteca Virtual en Salud, CINAHL, Embase y *Web of Science*. Se incluyeron estudios que trataron la atención del desarrollo en unidades neonatales, en los últimos cinco años, sin restricción de idioma. **Resultados:** se incluyeron siete artículos y los temas principales fueron contacto piel con piel, control de luz y ruido, participación familiar y sensibilización y entrenamiento del equipo. **Conclusión:** estos cuidados contribuyen al desarrollo neuropsicomotor de los prematuros, mejoran la asistencia y reducen la morbimortalidad y la estancia hospitalaria. **Descriptor:** Desarrollo Infantil; Neuroprotección; Prematuro; Cuidado Intensivo Neonatal; Atención de Enfermería.


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## INTRODUCTION

The term “prematurity” is used to determine newborn (NB) infants that were born before 37 weeks of gestational age. It is known that 10.9% of the NBs in Brazil in 2018 were premature and required support in Neonatal Intensive Care Units (NICUs) to help them conclude their development outside the uterus<sup>(1)</sup>.

Although considered the most indicated place for preterm newborns (PTNBs) to survive, NICUs contain factors that can subject these NBs to harms, such as excessive light and noise, constant handling (including painful procedures), and sleep and rest interruption. Due to the inability and immaturity of the PTNB organs and systems, these events can exert negative impacts on the Central Nervous System and constitute a morbidity factor<sup>(2)</sup>.

Faced with concerns over the negative effects of the NICU, in 1980, Hendelise Als created the Neonatal Individualized Developmental Care and Assessment Program (NIDCAP), a care philosophy that aims at protecting the full neurodevelopment of PTNBs, with individualized approaches and targeted care measures from the behavioral observation of premature NBs<sup>(3)</sup>. It also proposes changes in the NICU environment, such as reduction of noise and luminosity, minimal handling, sleep promotion, adequate positioning, breastfeeding, collaborative participation of the family and skin-to-skin contact<sup>(4,5)</sup>.

One of the NIDCAP objectives is to train health professionals, who are the main people responsible for long- and short-term care, in order to broaden a more cautious perspective in relation to the development and evaluation of PTNBs and high-risk newborns. Thus, the purpose of this program is to provide educational support so that the professionals can provide good quality and individualized care, aiming at the neurological development of NBs and support for the family members<sup>(3)</sup>.

In addition to that, the NIDCAP method compares PTNBs that received this type of care to those that received NICU routine care,

based on the following aspects: regulation of the motor and self-regulation systems by means of the Assessment of Preterm Infants' Behavior and the improvement in neurological development by means of the Prechtl Neurologic Examination of the Full-term Newborn Infant<sup>(6)</sup>. In Brazil, these care procedures are recommended by the Humanized Care for Low Birth Weight Newborn norm: Kangaroo Method (KM), of the Ministry of Health<sup>(7)</sup>.

Insufficient knowledge and awareness raising are considered obstacles to care implementation, considered of low cost. Behavioral changes in the health team can significantly reduce PTNB health problems inherent to the stressful NICU environment. Therefore, studies that describe these grouped care measures and point out the importance of each one are relevant. This paper aimed at mapping how the developmental care provided to PTNBs has been developed in NICUs, intending to synthesize the current scientific evidence.

## METHODS

A scoping review carried out according to the recommendations set forth in the 2020 Review Manual from the Joanna Briggs Institute (JBI)<sup>(8)</sup>, supported on the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). This review was registered in the Open Science Framework platform for scientific papers: [osf.io/b2qks](https://osf.io/b2qks).

The *Population, Concept and Context* (PCC) strategy was used to formulate the research question. The following was defined: *Population* (P): PTNBs; *Concept* (C): Developmental or neuroprotective care; and *Context* (C): NICUs. Given the above, the following research question was formulated to guide the searches: How has the developmental care provided to PTNBs been carried out in NICUs?

Five databases were accessed by means of the Federated Academic Community in the CAPES Journals portal, including MEDLINE, by means of the PubMed search engine; LILACS,

via *Biblioteca Virtual em Saúde* (BVS); CINAHL; Embase; and Web of Science. The searches were carried out independently in November 2022 by two reviewers.

The controlled descriptors from the Health Sciences Descriptors (*Descritores em Ciências da Saúde*, DeCS) and Medical Subject Headings (MeSH) used were “neuroprotection”;

“infant, premature” and “intensive care, neonatal”. To build the sensitized search strategy, presented in Chart 1, the AND Boolean operator was used for the simultaneous occurrence of subject matters, and OR for the occurrence of one or another subject matter. Small changes were made based on the specific criteria of each database.

**Chart 1 – Search Strategy.**

	STRATEGY ADOPTED
#1	((“Neuroprotection”[Mesh] OR (Neural Protection) OR (Protection, Neural) OR (Neuron Protection) OR (Protection, Neuron) OR (Neuronal Protection) OR (Protection, Neuronal) OR (Developmental Care)) AND (“Infant, Premature”[Mesh] OR (Infants, Premature) OR (Premature Infant) OR (Preterm Infants) OR (Infant, Preterm) OR (Infants, Preterm) OR (Preterm Infant) OR (Premature Infants) OR (Neonatal Prematurity) OR (Prematurity, Neonatal))) AND (“Intensive Care, Neonatal”[Mesh] OR (Care, Neonatal Intensive) OR (Neonatal Intensive Care) OR (Infant, Newborn, Intensive Care))

The studies included were those that reported some developmental care measure, in the last five years, with no language restrictions; and those with no direct relationship with the research topic/question, editorials and experts’ opinions were excluded.

Files in the *Research Information Systems* (RIS) format generated in the databases were imported into the Rayyan tool, through which two independent reviewers managed the references and removed duplicates. The titles and abstracts were screened according to the inclusion criteria and, after selecting the eligible materials for full-reading, the full texts were retrieved and assessed in detail by the same criteria. Any and all conflicts were settled down by a third reviewer. The exclusion criteria were the following, in this order: duplicate articles; inadequate study design for the question; and not answering the research question.

Detailed and JBI-standardized information was extracted in an Excel spreadsheet, containing the following: authorship, year of publication and country; study objectives; population and sample size; methodology used; details of the interventions performed; outcomes and main

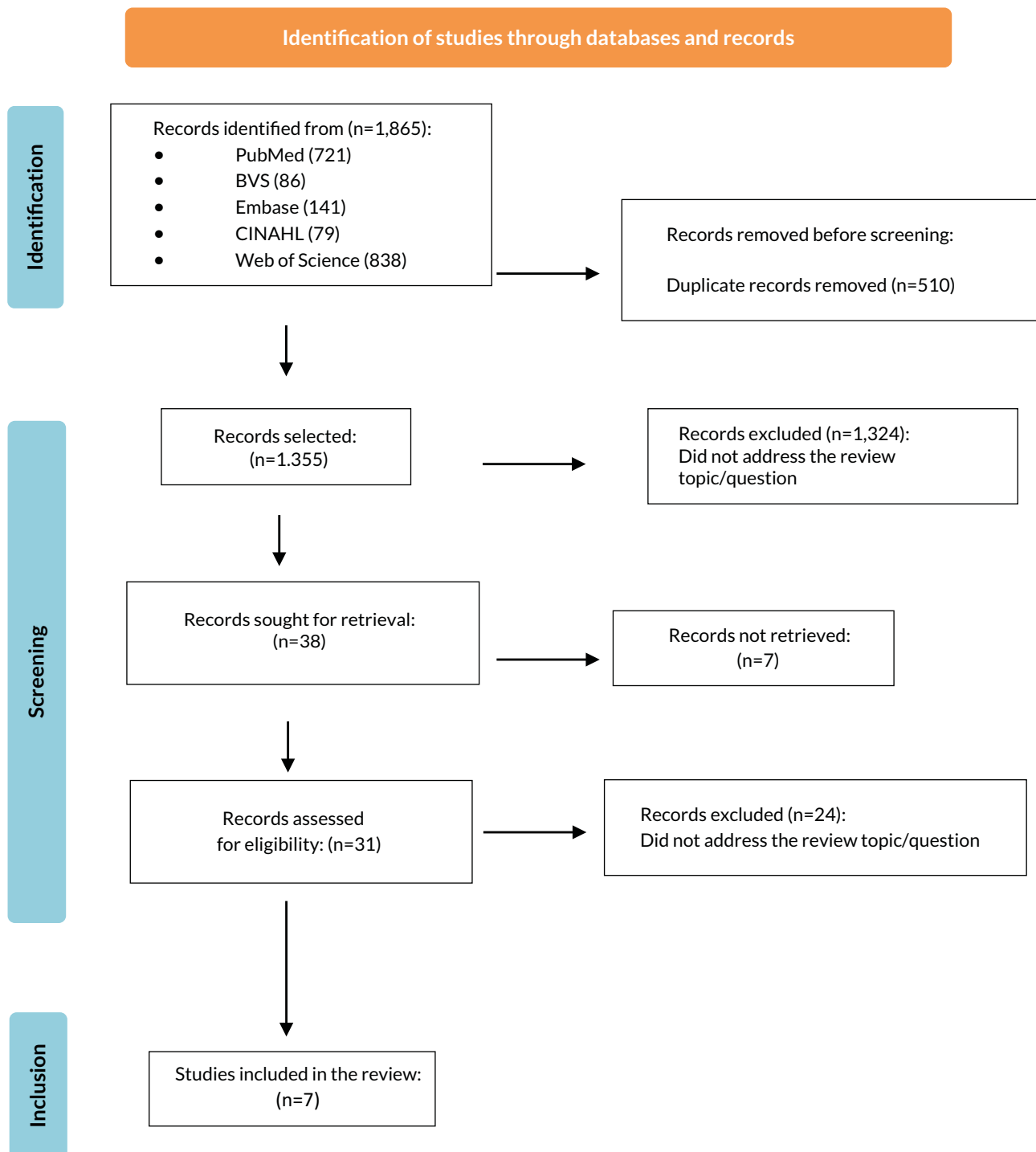
findings related to the research question. A narrative data synthesis was performed, which was presented in table format.

To assess the methodological quality and risk of bias of the studies included, the JBI Appraisal Tools were used and the level of evidence was identified based on the study design. Thus, level I was assigned to systematic reviews and meta-analysis of randomized clinical trials; II, to randomized clinical trials; III, to non-randomized clinical trials; IV, to case-control or cohort studies; V, to systematic reviews of qualitative or descriptive studies; VI, to qualitative or descriptive studies; and VII, to authority opinions and/or experts’ committee reports. This hierarchy classifies levels I and II as strong, III to V as moderate, and VI and VII as weak.

## RESULTS

A total of 1,865 articles were found on the theme, of which seven were included in the final sample. The process followed to select the articles is shown in Figure 1, according to the PRISMA-ScR flowchart.

**Figure 1** - Flowchart corresponding to selection of the studies identified in the PRISMA-ScR recommendations.



The main findings are summarily described in Chart 2.

Chart 2 - Presentation of the articles included in the review

Authors	Year and country	Objective	Population (sample) or databases	JB1	Methodology and level of evidence	Interventions	Outcomes and main findings related to the review questions
Baghlani et al. <sup>(9)</sup>	2019 Iran	To explore the knowledge and perception of nurses that work in this city in relation to this care model.	120 nurses	87%	Cross-sectional study Level VI	A questionnaire with 20 questions on nurses' knowledge and perception regarding the NIDCAP, with a score interval from 0 to 100.	The nurses' knowledge and perception scores for the NIDCAP were 71.83 (1.64) and 76.80 (0.79), respectively. The highest score belonged to neonatal nutrition, whereas the lowest was related to evolution and universal care measures. It is recommended to continuously evaluate the team and organization so that they prepare a discipline-based and well-coordinated approach to provide better care.
Griffiths et al. <sup>(10)</sup>	2019 Australia	To compare the practical recommendation to the systematic reviews that explore the NDSC publications.	MEDLINE, CINAHL, PROQUEST, OVID, Cochrane Database of Systematic Reviews, JBI Systematic Reviews	80%	Literature review Level VI	Classification of the level of evidence corresponding to systematic reviews following the JBI recommendation degrees. Narrative data synthesis.	Recommendations were pointed out regarding neurodevelopment, parents/infants separation, sensory environment, sleep, feeding, skin-to-skin contact, pain and stress, and care provided by the team. All recommendations for neurodevelopment, parents/infants separation, skin-to-skin contact and care provided by the team were classified as A degree, suggestive of high-quality evidence. The B degree identified in the other recommendations points out the need for more research studies for them to be highly recommended, although it does not rule out their importance or performance.
Mirlashari et al. <sup>(11)</sup>	2019 Iran	To understand and describe the experience of nurses and physicians in the implementation of the NIDCAP in Iran.	15 participants: 11 nurses and four physicians.	90%	Qualitative study Level VI	A semi-structured interview with four open questions.	The participants recognize the importance of the NIDCAP; however, they point out that shortage of nurses, lack of facilities and lack of resources are the main barriers to implementing developmental care in developing countries.
Sathish et al. <sup>(12)</sup>	2019 India	To examine the efficacy of the Development Support Care Program to improve NICU nurses' knowledge and skills to provide a healing environment, family partnerships, positioning and handling (minimizing stress and pain, protecting the skin, protecting sleep, and optimizing nutrition for premature infants).	54 nurses	93%	Quasi-experimental Level IV	Before-and-after, non-randomized intervention. Training in seven sessions, separated into six learning modules.	The findings point to an improvement in the knowledge scores about the concept of support health care for the development of premature infants after the training. A significant increase in the mean knowledge score was observed among the Intervention Group participants (pre-test: 16.6 ± 3.1; post-test: 29.9 ± 4.1, p=0.01), but not in the Control Group (pre-test: 16.4 ± 2.2; post-test: 18.6 ± 3.6, p=0.98).

(Continues)

Authors	Year and country	Objective	Population (sample) or databases	JBIs	Methodology and level of evidence	Interventions	Outcomes and main findings related to the review questions
Nejad et al. <sup>(13)</sup>	2018 Iran	To assess the situation of neonatal care in Iranian NICUs based on the development approach to design and provide clinical guidelines for the care to be provided.	23 NICUs	88%	Cross-sectional study Level VI	Checklist of the developmental care program with 30 items in six domains: "Supporting the infant", "Developmental care activities", "Supporting the infant's postural organization", "Providing control of neonatal pain", "Developmental care approaches in documentation", and "Team approaches to developmental care".	The mean score obtained in all six domains was 31.29 out of 100, and the mean score in each domain was 50 or less than 50 out of 100. The results indicated a low mean score for developmental care, which implies the quality of the care provided to premature infants.
Lockridge <sup>(14)</sup>	2018 Washington	To assess and improve the neuroprotective care practice ("brain-sensitive care") in neonatal intensive and intermediate care units.	A NICU and a neonatal intermediate care unit	50%	Experience report Level VI	Implementation of the guidelines on better neuroprotective practices that include care measures for sleep, positioning, handling, skin, pain, nutrition, environment and parents' participation.	The implementation committee evaluated the actions developed and the care measures recommended by the literature. Subsequently, they defined the guidelines to be implemented. Among the care procedures, sleep maintenance was the most challenging. They reported that waking up NBs up to carry out procedures can impair their sleep and wakefulness state and that it is necessary to change that conception and encourage handling when NBs are awake, maintaining the care measures grouped.
Milette et al. <sup>(15)</sup>	2017 Canada	To improve the quality of the care provided to premature and severely-ill infants hospitalized in a NICU or nursery, by adopting and implementing institutional neuroprotective care guidelines to support development.	Medline, CINAHL, Cochrane, Psychology and Behavioral Sciences Collection, PsycINFO and Google Scholar.	80%	Literature review Level VI	Classification of the level of evidence. Narrative data synthesis.	This review presented recommendations and strategies for the institutional implementation of neuroprotective care in NICUs that include sleep protection, pain and stress reduction, implementation of activities of daily living appropriate to the age, implementation of care measures centered on the family, and promotion of a caring environment. It suggested organizational changes for the actions to be effective, in five steps: planning, educating, prioritizing, assessing, and ensuring sustainability.

JBIs – Joanna Briggs Institute; NDSC – Neuroprotective Developmentally Supportive Care; NIDCAP – Neonatal Individualized Developmental Care and Assessment Program; NB – Newborn; NICU – Neonatal Intensive Care Unit.

## DISCUSSION

The seven articles included<sup>(9-15)</sup> in this review allude to the care procedures recommended by the NIDCAP, a program that aims at flexible and individual care according to each NB's needs for healthy neurodevelopment<sup>(3-4)</sup>. These care measures are effective and have the potential to reduce morbidity and to be significantly useful in the neurological and psychomotor development of PTNBs<sup>(3,5)</sup>.

The PTNBs that received this care are subjected to shorter times of mechanical ventilation and gastric tube feeding, with more weight gain, reduced hospitalization times and costs, and lower incidence of brain damage. In addition to that, an improvement in the functional behavior of the motor and autonomous systems can be observed, as well as in self-regulation competence. Efforts have been made to reduce avoidable stimuli that are harmful to PTNBs in NICUs; however, there still is resistance to implementing and maintaining these care procedures<sup>(3,5)</sup>. The changes depend on individual behavior, institutional support and development of robust national/international guidelines<sup>(9)</sup>.

Among the care measurements identified in this review, evaluating pain and stress was a practice recommended in the articles included<sup>(9-15)</sup>. It is noted that PTNBs admitted to NICUs are subjected to multiple handling instances while undergoing care and procedures that cause painful stimuli, increasing their stress level and impairing their development<sup>(16)</sup>. Non-pharmacological measures – such as non-nutritive sucking, sweetened substances, adequate positioning, therapeutic touch, stimulus reduction, breastfeeding and skin-to-skin contact – must be implemented by the Nursing team as a pain relief means to promote comfort and welcoming to NBs before a painful or uncomfortable procedure<sup>(17)</sup>. Although they identify pain and apply relief methods, nurses state that they do not use standardized instruments to relieve pain, which is considered a limiting factor in the treatment and an adequate record of this sign<sup>(18)</sup>.

Controlling luminosity and noises helps minimize PTNB stress<sup>(9-15)</sup>. Thus, measures such as turning the lights off at scheduled times, lowering lights' intensity with blankets over the incubator, keeping silent, immediately silencing alarms and forbidding cellphones and other devices that are not in vibratory mode, among others, are necessary to promote a quiet and cozy environment<sup>(10,13,16,19)</sup>.

Skin-to-skin contact was mentioned as a necessary care measure<sup>(9-15)</sup> that not only helps relieve pain, but also promotes a sensation of tranquility and security for both mothers and NBs, provides thermal regulation, helps adjust the metabolism and create a bond with the parents and family members, and facilitates breastfeeding and reducing stress and energy consumption<sup>(20,21)</sup>. A study that assessed Iranian NICUs, included in this review, indicated a mean score for the Kangaroo position of 45.21, below the recommended, reinforcing the need for strategies that encourage this practice in the units as soon as possible<sup>(13)</sup>. The barriers to implementing the Kangaroo position in neonatal units include lack of physical space, shortage of professionals, insufficient team training, and low levels of knowledge, adherence and professional motivation<sup>(22)</sup>.

Early, and oftentimes prolonged, separation generates negative effects in the development of PTNBs and in the affective bond with the family, where one of the developmental care axes is centered, considered neuroprotective<sup>(5-15)</sup>. A physical and interpersonal environment that welcomes and encourages parents to remain more time in the unit and fosters early participation in the care procedures favors bonding, skin-to-skin contact, offering maternal milk and breastfeeding initiation<sup>(15)</sup>. A Canadian study describes responsibilities that can be assigned to the parents of premature infants in NICUs based on Family Integrated Care (FICare), which clarifies the parents' role in a critical environment to promote training, learning, shared decision-making and positive care experiences. Therefore, allowing parents to

participate increases self-confidence, parental autonomy and trust in the team<sup>(23)</sup>.

Sleep was cited as a challenging care aspect<sup>(14)</sup>, and protecting it is provided for in the recommendations because it assists in thermoregulation, energy preservation, neuromotor development and brain plasticity<sup>(24)</sup>. Grouping the care measures among the multiprofessional team members and respecting the sleep intervals are essential practices for neurodevelopment. A scoping review carried out in Portugal surveyed 17 interventions on the maintenance of premature infants' sleep, divided into the Environment and Sensory domains, and it recommends nurses to promote these care procedures as a way of ensuring comfort and stability in PTNBs<sup>(25)</sup>.

However, it is understood that the guidelines do not ensure implementation, with a need to show how to do it<sup>(9-11)</sup>. One of the ways to ensure performance of these guidelines is to qualify and sensitize the team by means of simulations, bedside training and continuing education, aiming at efficient therapeutic strategies to encourage NICU professionals to include developmental care in their assistance and be concerned about family-centered care<sup>(26,27)</sup>.

The design of the papers varied between descriptive studies, literature reviews and quasi-experimental studies. No randomized study was identified in the search. The type of research is related to the recommendation degree and level of evidence, which are associated with quality and reliability of the information generated. For this purpose, tools have been employed to evaluate each type of study, in order to ensure that the necessary stages were followed<sup>(28)</sup>.

Based on the data, it is perceived that developmental care is approached in a fragmented way both in the assistance provided and in the literature, with a limited number of studies that consolidate all the recommendations. Thus, it is understood that providing a set of strategies based on current scientific evidence allows improving the Nursing team practice in this

context and promoting comprehensive care to PTNBs, validating the importance of all actions.

## FINAL CONSIDERATIONS

This study allowed mapping how the developmental care provided to PTNBs has been carried out in NICUs with the objective of synthesizing current scientific evidence.

It is indispensable to incorporate these care measures in the NICU environment in a humanized way, with presence of a qualified team, in addition to including the family during the entire care and hospitalization process. With that, we suggest studies that assert the relevance of implementing the developmental care model, aiming to improve health care, reduce the infant morbidity and mortality rates, and reduce hospitalization times and neural and musculoskeletal damages. In this sense, nurses should devise an organizational culture in which the entire team perceives developmental care as an essential task in the unit.

Among the limiting factors of this review is the scarcity of studies that applied developmental care as a whole, including the fact that such care is not considered an official descriptor but only a synonym of the term "neuroprotection", which can contribute to data fragmentation. Given the importance of this care for PTNBs, we suggest conducting research studies that describe how to apply the method in NICUs and how to assess its progress.

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