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CUIDAR DO SONO DO RECÉM-NASCIDO PRÉ-TERMO NA UNIDADE DE CUIDADOS INTENSIVOS NEONATAIS
CARE OF PRETERM NEWBORN'S SLEEP IN THE NEONATAL INTENSIVE CARE UNIT
CUIDAR EL SUEÑO DEL RECIÉN NACIDO PRETÉRMINO EN LA UNIDAD DE CUIDADOS INTENSIVOS NEONATALES

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RESUMO

Introdução: O sono tem um papel importante no desenvolvimento cerebral e plasticidade sinática com implicações no neurodesenvolvimento. A avaliação dos estados de comportamento do recém-nascido (sono e vigília) é o primeiro passo para proteger o sono no prematuro, otimizando o processo do neurodesenvolvimento.
Objetivo: O objetivo do presente estudo de investigação é o de analisar a implementação de um conjunto de medidas relativas ao sono do recém-nascido prematuro na unidade de cuidados especiais neonatais (UCEN) e a sua influência no tempo de internamento.
Métodos: Estudo descritivo de natureza exploratório desenvolvido numa UCEN portuguesa. Descrevemos as diferentes estratégias de cuidados estandardizados implementadas, dando resposta às exigências da Joint Comission International nos cuidados ao doente e também às preocupações dos profissionais de saúde neste tema.
Resultados: No período de tempo analisado e com a aplicação dos cuidados e estratégias na melhoria da qualidade do sono, não encontrámos diferenças significativas no perfil de doentes internados e este procedimento não levou a um aumento do tempo de internamento.
Conclusão: Os profissionais têm um papel vital na implementação de estratégias que promovam o sono do prematuro na UCEN e nas intervenções com efeito positivo na qualidade de sono do recém-nascido. É necessário incluir e capacitar os pais no esforço para promover o desenvolvimento do sono na UCEN para que mantenham estas intervenções após a alta hospitalar.

Palavras-chave: sono; prematuro; recém-nascido; cuidados estandardizados

ABSTRACT

Introduction: Sleep plays an important role in brain development and synaptic plasticity and has implications for neurodevelopment. Assessment of NB's behavioral states (sleeping and awake) is the first step to protecting sleep in premature babies and optimizing the neurodevelopment process.
Objective: The aim of this research study is to analyze the implementation of a set of measures relating to the sleep of premature newborns in the neonatal special care unit (NSCU) and its influence on the length of stay.
Methods: This is an exploratory descriptive study carried out in a Portuguese NSCU. We describe the different standardized care strategies implemented, in response to the demands of Joint Commission International in patient care and also to the concerns of health professionals in this area.
Results: Applying care and strategies to improve sleep quality in the studied timeframe, we did not find significant differences in the profile of hospitalized patients, and this procedure did not lead to an increase in the length of hospital stay.
Conclusion: Professionals have a vital role in implementing strategies that promote sleep in premature babies in the NICU and in interventions that have a positive effect on the quality of sleep of these newborns.
It is necessary to include and train parents in the effort to promote sleep development in the NSCU so that they maintain these interventions after hospital discharge.

Keywords: sleep; preterm; newborn; standard of care

RESUMEN

Introducción: El sueño juega un papel importante en el desarrollo del cerebro y la plasticidad sináptica y tiene implicaciones para el desarrollo neurológico. La evaluación de los estados conductuales del recién nacido (sueño y vigilia) es el primer paso para proteger el sueño en los bebés prematuros, optimizando el proceso de neurodesarrollo.
Objetivo: El objetivo de este estudio de investigación es analizar la aplicación de un conjunto de medidas relacionadas con el sueño de los recién nacidos prematuros en la unidad de cuidados especiales neonatales (UCEN) y su influencia en la duración de la estancia.
Métodos: Se trata de un estudio descriptivo exploratorio realizado en una UCEN portuguesa. Describimos las diferentes estrategias de cuidados estandarizados implementadas, en respuesta a las exigencias de la Joint Commission International en la atención a los pacientes y también a las preocupaciones de los profesionales de la salud en esta área.
Resultados: En el período de tiempo analizado y con la aplicación de cuidados y estrategias para mejorar la calidad del sueño, no encontramos diferencias significativas en el perfil de los pacientes hospitalizados y este procedimiento no supuso un aumento en la duración de la estancia hospitalaria.
Conclusión: Los profesionales tienen un papel vital en la implementación de estrategias que promuevan el sueño de los bebés prematuros en la UCEN y en intervenciones que tengan un efecto positivo en la calidad del sueño de los recién nacidos.
Es necesario incluir y capacitar a los padres en el esfuerzo de promover el desarrollo del sueño en la UCEN para que mantengan estas intervenciones después del alta hospitalaria.

Palabras Clave: sueno; prematuro; recién nacido; cuidados estandarizados

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INTRODUCTION

In Portugal, newborns (NB) with less than 37 weeks of gestational age (GA), that is, preterm babies, make up around 10% of all NBs. Around 1% of these newborns are born with less than 32 weeks and/or less than 1500 g of birth weight or very low birth weight (VLBW), with around a thousand VLBW newborns being born in Portugal annually (Peixoto, Guimarães, Machado, et al., 2002). The growth of these VLBW infants occurs mainly outside the mother's womb, in neonatal intensive care units (NICU), with a high risk of sequelae from both a nutritional point of view (Moreira, Matos, Rebelo Pacheco, Cunha, 2020) and neurodevelopment (Matos, Costa, Rebelo Pacheco, Moreira, Cunha, Barroso, 2019). This is a critical period of growth and differentiation of the central nervous system (CNS). Neuronal migration and synaptogenesis begin, and the process of apoptosis occurs, all contributing to an enormous brain plasticity during this period. Innate fetal activity results from central pattern generators that are organized into sets of neurons with increasingly numerous connections between them called networks (Hadders-Algra, 2000a; Hadders-Algra 2000b; Johnston, 2009). Whether or not certain neuronal circuits are strengthened also depends on afferent information, which the environment plays a huge role in acquiring. Therefore, it is very important to maintain the NICU environment as close as possible to the in-utero environment (Newville, Ortega, & Maxwell, 2018).

The fetal biological rhythm appears to be sensitive to day-night cycles through the secretion of maternal hormones and maternal physiological parameters. Fetal innate activity highlights a pattern of sleep organization that can be detected from 25 weeks of GA through heart rate (HR), respiratory rate, and sleep/wake periods (Bertelle, Sevestrem, Laou-Hap, Nagahapitiye & Sizun, 2007). This can be assessed by active movements and HR and is classified into four stages from around 32 weeks: 1F: Quiet sleep – slow and regular HR, rare body movements, in a saccade, without eye movements; 2F: active sleep – regular HR, eye movements, large body movements mainly extension; 3F: waking up calmly – fast and regular HR, eye movements, no body movements; 4F: active awakening – rapid and irregular HR with prolonged periods of tachycardia, eye movements and continuous body movements (Bennet, Walker, Horne, 2018). The distribution of waking and sleeping time varies with post-menstrual age.

Newborns, especially premature ones, do not yet have the ability to stay awake nor to demand food, and thus spend most of their time sleeping (Georgoulas, Jones, Laudiano-Dray, Meek, Fabrizi, and Whitehead. 2021; Cailleau, Weber, Cabon, Flamant, Roué, Favrais, et al., 2020). In newborns, sleep distribution can be assessed by direct observation (Allen, 2012; Altimier & Philips, 2013) and, in a more systematic way, by continuous video-EEG recording (Ryan, Mathieson, Livingstone, O'Sullivan, Dempsey, Boylan, 2023). This last technique requires specific training, experience, and a lot of monitoring time and is not easily applicable in clinical practice (Ryan et al., 2023).

Although premature babies' sleep varies with maturation, sleep after birth can be classified as quiet sleep (equivalent to REM sleep), active sleep (equivalent to NREM sleep), and indeterminate sleep, a state in which the characteristics of active sleep or quiet sleep are not present. The predominant sleep state in premature infants is approximately 80% active sleep, approximately 20% quiet sleep, 10% undifferentiated or transitional sleep, and only 10% awake. This variation changes, reducing active sleep to around 70%, quiet sleep to around 20%, and 20% of the time being awake, a pattern already very close to full-term newborns (Georgoulas, Jones, Laudiano-Dray, Meek, Fabrizi, and Whitehead. 2021; Cailleau, Weber, Cabon, Flamant, Roué, Favrais, et al., 2020).

The importance of sleep manifests itself in the maturation of the CNS in the formation of synapses and, through neuronal plasticity, in their strengthening or weakening, leading to their elimination (apoptosis). Synaptic homeostasis depends on sleep-wake regulation; that is, the hyperstimulation of certain synapses that occurs during wakefulness is reduced during sleep, improving the ability to store new information and contributing to neuronal plasticity (Sun, Zhou, Cichon, Yang, 2020; Kuhn, Wolf, Maier, et al. 2016).

Restful sleep, integrated with developmental care, contributes to better weight gain and reduces hospital stay. For this reason, care strategies that facilitate the NB's peaceful sleep must be established as soon as possible and included in the neuroprotective measures that best suit each case (Altimier & Philips, 2013; Coughlin, 2017). In this article, we seek to analyze the implementation of these measures and the impact they had on the length of stay in our Neonatal Special Care Unit (NSCU).

1. METHODS

1.1 Sample

Our hospital is located in the Greater Lisbon area and has a maternity ward with around 2500 births per year, of which around 10% are preterm. NSCU provides intensive and intermediate neonatal care for newborns over 28 weeks of GA. Therefore, we selected premature newborns (GA less than 37 weeks) who had been admitted to the NSCU in 2020.

1.2 Data collection instruments and procedures

The hospital and NSCU have been evaluated since 2010 in an audit process through the Joint International Commission (JCI). This audit process aims, among others, to implement standardized measures that aim to improve the provision of care to patients (JCI International Manual ed. 2021). Among these measures is the development care program, which has been developed at NSCU. In 2020, we began implementing a development care program at NSCU that includes, among others, the use of skin-to-skin contact, noise, and light reduction. We take special care in trying to maintain peaceful sleep, combining moments of handling and observation. For this, nap time was established, a period during which the light and the sound of alarms is reduced, and the newborns are not handled except in situations of need. Several procedures were developed to promote healthy sleep at NSCU: "Promoting newborn sleep habits"; "Optimizing the environment in Neonatology"; "Implementation of Nap Time as Care to Promote Adequate Sleep" and "Teaching Parents about Adequate Sleep" (COP – JCI Standard 2021).

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The main objectives are patient care (COP) and standardizing the provision of care, training the multidisciplinary team and parents in these strategies (COP – JCI 2021 Standard). The procedure adopted consists of the following main points: Optimize the environment; manage rest; monitor NB activity; comfort the NB; take measures to initiate the child's sleep; position the NB; monitor NB sleep.
Discharge is a time of great anxiety for parents, so it is necessary to train parents to carry out adequate teaching in relation to sleep.
In 2021, sessions were started for parents that remained in 2022 on the same topics. However, the implementation of the recommended measures was not linear due to the pandemic situation experienced during the years under analysis (DGS, 2021; Jonet et al., 2021). Teaching parents involves the following concepts: Teaching about sleep, teaching about the environment, Teaching about positioning, Training on parental skills: sleep, and validating the ability to improve parenting. In this article, we seek to analyze the implementation of these measures and the impact they had on the length of stay at NSCU.

1.3 Implementation of "nap time" as a way of promoting adequate sleep

- **Optimize the environment**: reduce light and noise. Promote nap time and night breaks in order to establish a circadian cycle favorable to the development of healthy sleep/wake cycle patterns.
- **Manage rest by applying practices that protect the integrity of sleep and support the circadian rhythm**: Grouped care with as few manipulations as possible; Regulation of light and noise similar to the circadian rhythm; Recognition, by the family and health professionals, of the NB's sleep states; Manipulate the child while respecting their state of consciousness. Manipulations should be carried out during the alert state where the best results are obtained.
- **Monitor the newborn's activity**: Identify signs of stress in the newborn: crying, clawed fingers, hyperextension of the head and yawning; Identify signs of physiological stability: relaxed posture of all extremities, arms and legs in flexion, hand-mouth reflex as a self-regulation mechanism and sleep promoters;
- **Comforting the newborn**: ensuring that the newborn experiences a lower level of activity through restraint, touch, optimizing body position, feeding, and non-nutritive sucking. Carry out measures to initiate sleep if the child shows signs of difficulty falling asleep: Non-nutritive sucking; Bathing; Massage; Positioning; Music therapy; Comfort object; Kangaroo.
- **Positioning the newborn**: ensure training in measures to promote safe sleep during hospitalization;
- **Monitoring the newborn's sleep**.
- Record the care provided, teaching, training and validation of skills to the family/caregiver and the pediatric user's response. With regard to "Nap Time," in addition to the principles mentioned above, the following procedures are also carried out: Optimize the environment - reduce the unit's natural and artificial light, as well as noise and other environmental stimuli, in the period between 1 pm and 3 pm ("Nap Time"). Post "Nap Time" signs in a place that is visible to everyone entering the unit. Promote the newborn's sleep habits by applying practices integrated into the culture of care, which aim to protect the integrity of sleep and support the circadian rhythm: Grouped care with as few manipulations as possible; Regulation of light and noise similar to the circadian rhythm; Recognition.

1.4 Statistical analysis

In the statistical analysis, means and standard deviation were used in continuous variables, and the percentage in categorical variables. We used non-parametric tests using IBM SPSS 25.0 Software, considering a statistical significance level of 5%.

2. RESULTS

The number of NB admitted to the NSCU below 37 weeks was 79 NBs in 2020, 80 NBs in 2021, and 104 NBs in 2022. The average GA was 33.1 weeks, 33.3 weeks GA and 33.2 weeks GA, respectively, with other characteristics mentioned in Table 1.

Table 1 - Demographic characteristics of the study population

Demographic characteristics		2020	2021	2022	P-value
Total admissions to the NSCU		176	190	232	
NB with GA <37 weeks (%)		79 (44,8%)	80 (42,1%)	104 (44,8%)	
Maternal age (years)	Average (sd; minimum-maximum)	31,9 (6,4; 13,8-44,3)	32,7 (5,7; 19,8-45,2)	31,8 (5,7; 20,5-45,7)	0,654*
Gestational age (weeks)	Average (sd; minimum-maximum)	33,1 (2,2; 28-36)	33,3 (2,1; 24-36)	33,2 (1,8; 28-36)	0,620*
Birth weight (g)	Average (sd; minimum-maximum)	1949,5 (525,9; 730-3720)	2033,6 (542,8; 712-4220,0)	2010,0 (545,5; 1000-3210)	0,613*
Gender F/M	(% Male)	31/48 (60,8%)	32/48 (60,0%)	45/59 (56,7%)	0,837#
Hospitalization time (days)	Average (sd; minimum-maximum)	20,35 (18,6; 0,4-92,7)	17,3 (14,2; 0,4-67,1)	18,8 (13,7; 0,9-64,6)	0,746*

NSCU: neonatal special care unit; GA: gestational age; *Kruskall-Wallis test; # Chi-square test

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In the analyzed timeframe, hospitalized patients had similar characteristics in relation to maternal age, distribution by GA, birth weight, and sex. With the application of strategies to improve care, including sleep quality, the average length of stay was slightly longer in 2020, but when compared to the years 2021 and 2022, this difference was not statistically significant (Table 1).
In 2020, 24 training sessions were held for professionals and groups of parents between January and October. In 2021, only individual training was carried out for parents due to the restrictions imposed by the pandemic, and in 2022, group training for parents was resumed from March onwards, with a total of 14 training sessions being carried out.
In the informal analysis of the implementation of measures aimed at promoting healthy sleep at NSCU and the sessions held with families, they showed greater satisfaction and greater ease in caring for newborns

3. DISCUSSION

The principles of promoting healthy sleep applied at NSCU are governed by the recommendations of the **European Foundation for the Care of Newborn Infants** (EFCNI) and the **Newborn Individualized Developmental Care and Assessment Program** (NIDCAP). The EFCNI has established European healthcare standards for NB. Care focused on the child's development in the family is an integral part of these standards. This care includes regulating exposure to light and noise, temperature control, touch (positioning and manipulation), nutrition, and peaceful and protected sleep (EFCNI 2019; Altimier & Philips, 2013). The application of these measures may contribute to a reduction in the length of stay (Altimier & Philips, 2013), although this was not verified in our sample.
NIDCAP, which is based on the assessment of the NB's response and adaptation of care to it, also seeks to understand the NB's needs through observation of their behavior at each moment of their evolution (Als & McAnulty 2011). It is currently fully applied in some neonatal units in Portugal. In other units like ours, some of the measures recommended by NIDCAP are applied, but not the program as a whole. To apply these assumptions, professionals must have knowledge of innate fetal activity, which is similar in premature newborns (Allen 2012).
It is also necessary to know the different stages of the NB's behavior, as well as the language of the NB's response to different interventions through the different systems: autonomic, motor, state, and self-regulation (Als & McAnulty 2011).
Knowledge of this standard and teaching parents are essential as facilitators of the transition process in the provision of care from the health professional to the family (Barlow, Herath, Bartram-Torrance, Bennett, Wei, 2018).
However, sleep states after birth may change from the first hours of life in the NICU. The constant need to carry out treatments, some of which are painful, intense light, loud noises, and the need for ventilation, whether invasive or non-invasive, influence the state of sleep (Ryan et al., 2023). With certain pathologies, the change is even more pronounced, such as hypoxic-ischemic encephalopathy, intrauterine growth restriction (IUGR), loss of placental circulation (corticosteroids and progesterone), postnatal hypoxia and hemodynamic instability and inflammation (Allen 2012 ; Bennet, 2018). Based on this knowledge, the measures adopted at NSCU to allow a peaceful sleep are the optimization of the environment, management of rest, monitoring NB activity, comforting the NB, taking measures to initiate the child's sleep, positioning the NB, and monitoring the NB's sleep.
During hospitalization, the transition to lying supine should be gradual after the postmenstrual age of 32 weeks, as it may affect sleep quality (Altimier & Philips, 2013). The situations that may raise more doubts are bronchopulmonary dysplasia, respiratory malformations such as Pierre Robin Syndrome, prematurity apneas, gastroesophageal reflux (GER), hyperbilirubinemia and withdrawal syndrome (Goodstein, Stewart, Keels, Moon, 2021).
In bronchopulmonary dysplasia, there may be an indication for a more gradual transition to the supine position. This transition is also necessary to define oxygen needs in babies who maintain this need at home (Goodstein, 2021). Teaching parents about sleep and sleeping position after discharge, applied at NSCU, are in accordance with the recommendations of the American Academy of Paediatrics (AAP), which state that the sleeping position of premature babies should be the supine position (Goodstein et al. al., 2021).
The main limitation of the study is that we did not apply to the families of patients admitted to the NSCU, a measurable form of satisfaction results from the application of the strategies used, but, as we mentioned, the informal evaluation showed an increase in the satisfaction of these families. On the other hand, due to the pandemic, the restrictions imposed made it difficult to apply the strategies, and training for parents was also more limited (DGS, 2021; Jonet et al., 2021).
We also consider it a limitation that the assessment of sleep quality and its staging were not carried out systematically. Perhaps the ideal way to obtain this data is continuous monitoring using video-EEG. However, this process is complex and laborious and requires experience (Ryan et al., 2023), which was not the objective of our study.
The effectiveness of developmental care is more evident when it is applied as an integrated bundle (Altimier & Philips, 2013). Therefore, the evaluation of the influence of these strategies on neurodevelopment, in the short and long term, should be part of future studies.

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CONCLUSION

Premature birth occurs at a critical period of CNS growth and differentiation, with enormous neuronal plasticity. The environment, through afferent information, contributes to the strengthening, or not, of certain neuronal circuits.
Synaptic homeostasis occurs during sleep. That is, the hyperstimulation of certain synapses that occurs during wakefulness is reduced during sleep, contributing to neuronal plasticity.
Child-family-centered developmental care recommends evaluating the different stages of the NB's activity with respect to sleep periods.
This care must involve the entire team and teaching the family, including preparation for discharge. In future studies, more objective forms of measuring these results should be used.

AUTHORS' CONTRIBUTION

Conceptualization, M.C., D.T. and A.R.C.; data curation, M.C.; formal analysis, M.C., D.T. and A.R.C.; investigation, M.C., D.T. and A.R.C.; methodology, M.C., D.T. and A.R.C.; project administration, M.C., D.T. and A.R.C.; software, M.C.; supervision, M.C., D.T. and A.R.C.; validation, M.C., D.T. and A.R.C.; visualization, M.C., D.T. and A.R.C.; writing-original draft, M.C., D.T. and A.R.C.; writing-review and editing, M.C., D.T. and A.R.C.;

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

REFERENCES

Allen, K. A. (2012). Promoting and protecting infant sleep. *Advances in Neonatal Care: Official Journal of the National Association of Neonatal Nurses, 12*(5), 288–291. https://doi.org/10.1097/ANC.0b013e3182653899

Als, H., & McAnulty, G. B. (2011). The Newborn Individualized Developmental Care and Assessment Program (NIDCAP) with Kangaroo Mother Care (KMC): Comprehensive Care for Preterm Infants. *Current Women's Health Reviews, 7*(3), 288–301. https://doi.org/10.2174/157340411796355216

Altimier, L., & Phillips, R.M. (2013). The Neonatal Integrative Developmental Care Model: Seven Neuroprotective Core Measures for Family-Centered Developmental Care. *Newborn and Infant Nursing Reviews, 13*, 9–22. https://doi.org/10.1053/j.nainr.2012.12.002.

Barlow, J., Herath, N. I., Bartram Torrance, C., Bennett, C., & Wei, Y. (2018). The Neonatal Behavioral Assessment Scale (NBAS) and Newborn Behavioral Observations (NBO) system for supporting caregivers and improving outcomes in caregivers and their infants. *The Cochrane Database of Systematic Reviews, 3*(3), CD011754. https://doi.org/10.1002/14651858.CD011754.pub2

Bennet, L., Walker, D. W., & Horne, R. S. C. (2018). Waking up too early—The consequences of preterm birth on sleep development. *The Journal of Physiology, 596*(23), 5687–5708. https://doi.org/10.1113/JP274950

Bertelle, V., Sevestre, A., Laou-Hap, K., Nagahapitiye, M. C., & Sizun, J. (2007). Sleep in the neonatal intensive care unit. *The Journal of Perinatal & Neonatal Nursing, 21*(2), 140–148. https://doi.org/10.1097/01.JPN.0000270631.96864.d3

Cailleau, L., Weber, R., Cabon, S., Flamant, C., Roué, J.-M., Favrais, G., Gascoin, G., Thollot, A., Esvan, M., Porée, F., & Pladys, P. (2020). Quiet Sleep Organization of Very Preterm Infants Is Correlated With Postnatal Maturation. *Frontiers in Pediatrics, 8*, 559658. https://doi.org/10.3389/fped.2020.559658

Coughlin, M. (2017). *Trauma-Informed Care in the NICU: Evidence-Based Practice Guidelines for Neonatal Clinicians*, *1st Edition.* Springer Publishing Company.

Cuidados ao Doente (COP) / Padrão JCI. (2021). *Implementação da Hora da Sesta como cuidado promotor do sono adequado. Ensinar os pais sobre o Sono adequado. Otimizar o ambiente na Neonatologia. Promover hábitos de sono do recém-nascido*. Hospital de Cascais Dr. José de Almeida

Direção Geral de Saúde (DGS) (2021). Orientação nº 026/2020 de 19/05/2020, atualizada a 27/10/2021 – REVOGADA. *COVID-19: Cuidados ao Recém-nascido na Maternidade*. https://covid19.min-saude.pt/normas-e-orientacoes/

Georgoulas, A., Jones, L., Laudiano-Dray, M. P., Meek, J., Fabrizi, L., & Whitehead, K. (2021). Sleep-wake regulation in preterm and term infants. *Sleep, 44*(1), zsaa148. https://doi.org/10.1093/sleep/zsaa148

DOI: https://doi.org/10.29352/mill0226.34689

Goodstein, M. H., Stewart, D. L., Keels, E. L., Moon, R. Y., & COMMITTEE ON FETUS AND NEWBORN, TASK FORCE ON SUDDEN INFANT DEATH SYNDROME. (2021). *Transition to a Safe Home Sleep Environment for the NICU Patient. Pediatrics, 148*(1), e2021052045. https://doi.org/10.1542/peds.2021-052045

Hadders-Algra, M. (2000a). The neuronal group selection theory: A framework to explain variation in normal motor development. *Developmental Medicine and Child Neurology, 42*(8), 566–572. https://doi.org/10.1017/s0012162200001067

Hadders-Algra, M. (2000b). The neuronal group selection theory: Promising principles for understanding and treating developmental motor disorders. *Developmental Medicine and Child Neurology, 42*(10), 707–715. https://doi.org/10.1017/s0012162200001316

Johnston, M. V. (2009). Plasticity in the developing brain: Implications for rehabilitation. *Developmental Disabilities Research Reviews, 15*(2), 94–101. https://doi.org/10.1002/ddrr.64

Joint Commission International (2021). *Manual de Acreditação Hospitalar, 7ª Edição*. Joint Commission International. https://pt.scribd.com/document/647417831/Manual-de-Padroes-JCI-7a-Edicao-PT-1-3

Jonet, J., Condessa, L., Limbert, M., Roquette, M., Tavares, A., & Cunha, M. (2021). Was Rooming-In a Safe Approach to Newborns from SARS-Cov-2 Positive Mothers? *Portuguese Journal of Pediatrics, 52*(4), Artigo 4. https://doi.org/10.25754/pjp.2021.23476

Kuhn, M., Wolf, E., Maier, J. G., Mainberger, F., Feige, B., Schmid, H., Bürklin, J., Maywald, S., Mall, V., Jung, N. H., Reis, J., Spiegelhalder, K., Klöppel, S., Sterr, A., Eckert, A., Riemann, D., Normann, C., & Nissen, C. (2016). Sleep recalibrates homeostatic and associative synaptic plasticity in the human cortex. *Nature Communications, 7*(1), 12455. https://doi.org/10.1038/ncomms12455

Matos, E., Costa, C., Pacheco, S. R., Moreira, T., Cunha, M., & Barroso, R. (2019). Variables which influence the neurodevelopment at 2 years of newborns born less than 32 weeks of gestational age or less than 1,500 g. *Journal of Pediatric and Neonatal Individualized Medicine (JPNIM), 8*(1), Artigo 1. https://doi.org/10.7363/080128

Moreira, T., Matos, E., Pacheco, S. R., & Cunha, M. (2020). The catch-up growth at 2 years of newborns born less than 32 weeks of gestational age. *Journal of Pediatric and Neonatal Individualized Medicine (JPNIM), 9*(1), Artigo 1. https://doi.org/10.7363/090103

Newville, J., Ortega, M., & Maxwell, J. (2018). *Babies Born Early Can Have Brain Injury*. Frontiers for Young Minds. https://kids.frontiersin.org/articles/10.3389/frym.2018.00020

Peixoto, J.C., Guimarães, H., Machado, M.C., Martins, V., Mimoso, G., Neto, M.T., Tomé, T., Virella, D., e Grupo do Registo Nacional do Recém-nascido de Muito Baixo Peso. (2002). *Nascer prematuro em Portugal. Estudo Multicêntrico Nacional 1996- 2000. Prémio Bial de Medicina Clínica 2002*. Fundação Bial. http://dx.doi.org/10.13140/2.1.3716.6086

Ryan, M. A. J., Mathieson, S. R., Livingstone, V., O'Sullivan, M. P., Dempsey, E. M., & Boylan, G. B. (2023). Sleep state organisation of moderate to late preterm infants in the neonatal unit. *Pediatric Research, 93*(3), 595–603. https://doi.org/10.1038/s41390-022-02319-x

Sun, L., Zhou, H., Cichon, J., & Yang, G. (2020). Experience and sleep-dependent synaptic plasticity: From structure to activity. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences, 375*(1799), 20190234. https://doi.org/10.1098/rstb.2019.0234