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O SONO DO RECÉM-NASCIDO PRÉ-TERMO E DE TERMO NAS UNIDADES DE CUIDADOS INTENSIVOS NEONATAIS – MODELO TOUCHPOINT

SLEEP OF PRETERM AND FULL-TERM NEWBORNS IN NEONATAL INTENSIVE CARE UNITS – TOUCHPOINTS MODEL

EL SUEÑO DEL RECIÉN NACIDO PRETÉRMINO Y A TÉRMINO EN LAS UNIDADES DE CUIDADOS INTENSIVOS NEONATALES – MODELO TOUCHPOINT

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RESUMO

Introdução: Os recém-nascidos (RN) não apresentam um padrão circadiano. O Modelo Touchpoint salienta que o ajustamento dos ciclos de sono e de vigília do RN constituem a primeira tentativa dos pais de adaptarem o RN ao mundo externo. A capacidade dos RN atingirem um estado de transição sugestivo de adormecimento está relacionada com o desenvolvimento neuronal expressas em respostas comportamentais comprometidas pela estimulação sensorial excessiva, indutora de privação do sono.
Objetivo: Avaliar o sono dos RN mediante a sua estabilidade autónoma e fisiológica, regulação motora e organização dos estádios de sono.
Métodos: Estudo observacional, correlacional e prospetivo, de abordagem quantitativa. A amostra incluiu 62 RN internados numa Unidade de Cuidados Intensivos Neonatais (UCIN). Foi utilizada uma grelha de observação que avaliou o sono quanto ao estado comportamental, posicionamento, necessidade de ventilação, alimentação, manipulação e exposição a ruído e luminosidade.
Resultados: Constatou-se que o ruído influencia o tempo de sono, tendo em conta a idade gestacional (IG); não se verificou correlação entre a resposta comportamental, perante fatores stressores e a IG; o posicionamento, a ventilação e a alimentação não influenciam o tempo de sono.
Conclusão: É perentório existirem avaliações individuais das capacidades do RN pré-termo e de termo para lidarem com a estimulação excessiva a que ficam sujeitos nas UCIN, com efeito direto na proteção do seu sono.

Palavras-chave: recém-nascido; prematuro; sono; Unidade de Cuidados Intensivos Neonatais

ABSTRACT

Introduction: Newborns (NBs) do not have a circadian pattern. The Touchpoint Model emphasizes that the adjustment of the NB's sleep and wake cycles constitutes the parents' first attempt to adapt the NB to the external world. The ability of NBs to reach a transitional state suggestive of sleep is related to neuronal development expressed in behavioral responses compromised by excessive sensory stimulation. sleep deprivation inducer.
Objective: To assess the sleep of newborns based on their autonomous and physiological stability, motor regulation and organization of sleep stages.
Methods: Observational, correlational and prospective study with a quantitative approach. The sample included 62 newborns admitted to a Neonatal Intensive Care Unit (NICU). An observation grid was used to assess sleep in terms of behavioral status, positioning, need for ventilation, feeding, handling and exposure to noise and light.
Results: It was found that noise influences sleep time, taking into account gestational age (GA); no correlation was found between behavioral response to stress factors and GA; positioning, ventilation and feeding do not influence sleep time.
Conclusion: It is imperative that there are individual assessments of the abilities of preterm and full-term newborns to deal with the excessive stimulation to which they are subjected in the NICU, with a direct effect on protecting their sleep.

Keywords: newborn; premature; sleep; Neonatal Intensive Care Unit

RESUMEN

Introducción: Los recién nacidos (RN) no presentan un patrón circadiano. El Modelo Touchpoint destaca que el ajuste de los ciclos de sueño y vigilia del RN constituye el primer intento de los padres de adaptar al RN al mundo exterior. La capacidad de los RN para alcanzar un estado de transición sugestivo de adormecimiento está relacionada con el desarrollo neuronal, expresado en respuestas conductuales comprometidas por la estimulación sensorial excesiva, que induce privación del sueño.
Objetivo: Evaluar el sueño de los RN en función de su estabilidad autónoma y fisiológica, regulación motora y organización de las fases del sueño.
Métodos: Estudio observacional, correlacional y prospectivo, con enfoque cuantitativo. La muestra incluyó 62 RN ingresados en una Unidad de Cuidados Intensivos Neonatales (UCIN). Se utilizó una rejilla de observación que evaluó el sueño en relación con el estado conductual, posicionamiento, necesidad de ventilación, alimentación, manipulación y exposición al ruido y la luminosidad.
Resultados: Se constató que el ruido influye en el tiempo de sueño, teniendo en cuenta la edad gestacional (EG); no se observó correlación entre la respuesta conductual frente a factores estresantes y la EG; el posicionamiento, la ventilación y la alimentación no influyen en el tiempo de sueño.
Conclusión: Es imperativo realizar evaluaciones individuales de las capacidades de los RN pretérmino y a término para afrontar la estimulación excesiva a la que están sometidos en las UCIN, con un efecto directo en la protección de su sueño.

Palabras clave: recién nacido; prematuro; sueño; Unidad de Cuidados Intensivos Neonatales

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INTRODUCTION

Parenting is one of the main roles in an adult's life that begins during pregnancy, a phase during which parents build images, develop expectations, idealize the newborn (NB) and plan the future. Pregnancy is the first touchpoint in life and is seen as a time of vulnerability (Brazelton & Sparrow, 2006). When the newborn is admitted to the Neonatal Intensive Care Unit (NICU), remains in an environment surrounded by unfamiliar sounds, constant lights and is invaded by invasive procedures. Therefore, and taking into account the thresholds of premature infants to stimulation, they are more vulnerable and may not be able to protect themselves from the NICU environment, which may result in hypo- or hyper-reactive and hypo- or hyper-responsive newborns. Thus, in the first months of life, newborns may have difficulties in regulating their sleep hours (Portuguese Society of Neonatology, 2018; Uchitel et al., 2021), leading parents/caregivers to feel some confusion in how to plan them and knowing when they should, or should not, stimulate the child. Furthermore, sleep disorders increase the risk of sudden death in premature newborns (PTNBs) four times when compared to other newborns (Huang et al., 2021). Thus, the theme that underpins this study focuses on protecting newborns' sleep in NICUs, taking into account the touchpoints that are part of their growth and development. This study took as its starting question: How can the sleep pattern of preterm and full-term newborns in NICUs be ensured, subject to stressors, taking into account the *contact points* in their growth and development? To answer this question, an observational, longitudinal, correlational and prospective study was carried out, with a quantitative approach, which aims to analyze the stress factors existing in the NICU capable of modifying the newborn's sleep pattern. Thus, the aim is to evaluate the sleep of newborns through a biobehavioral analysis taking into account the neurodevelopment stages of preterm and full-term newborns. As specific objectives, we defined the following: To describe the level of impact of stressors existing in NICUs on newborns, taking into account their gestational and corrected ages; Analyzing behavioral organization enhances the non-fragmentation of newborns' sleep; Describe the impact of excessive handling of newborns in NICUs; Identify how auditory stimulus varies throughout the day and night; To verify the association between the length of stay of the newborn, between the first and the 7th day of hospitalization, with the effect of stress factors.

1. LITERATURE REVIEW

In Portugal and worldwide, prematurity is considered a relevant issue in the assessment of perinatal health indicators. Although it is held responsible for being one of the main causes of neonatal mortality, the survival of preterm newborns is increasingly guaranteed (Fukinaga et al., 2019). The birth and hospitalization of a newborn in a NICU are very different environments to which the newborn is subjected (Sentner et al., 2022) and in stark contrast to the intrauterine environment (Bonan et al., 2014). Therefore, the provision of care must focus on protecting the neurodevelopment of the newborn, since he/she is involved in an environment with a high overload of sensory stimuli (Zhang & He, 2023), which influences the development of his/her central nervous system (CNS) (Firmino et al., 2022). Regarding sleep, the NICU environment enhances changes in its quality and quantity (Levy et al., 2017). When a preterm newborn is born, the progressive development of brain structures is altered, since the extrauterine environment does not provide the newborn with the ideal conditions for its adequate development. When talking about neurodevelopment, we cannot dissociate it from the topic of sleep. Although there are constant technological advances in NICUs that allow adequate intervention in the quality of life of newborns, sleep deprivation is frequent in these units (Lee et al., 2021), which comes from all the interventions to which they are subjected (Vadakkan & Prabakaran, 2022) that generate stimuli that affect the adequate development of the central nervous system (Order of Nurses, 2023) and the maturation of the sleep pattern. Directly related to prematurity, sleep deprivation is not only reflected in admission to NICUs, but also in conditions such as intrauterine growth restriction (associated with low brain growth and characterized by varying degrees of hypoxia and malnutrition), infection/inflammation, and changes at the placental level (given that the placenta plays a fundamental role in modulating fetal behavior, providing steroids that, after being metabolized at the brain level, induce sleep (Bennett et al., 2018). All these conditions have a direct impact on the organization of sleep states in newborns. Considering a calm environment in these units is a key element, which should include strategies aimed at responding to concerns regarding the negative impact of the NICU environment on preterm newborns, as well as minimizing the impact on the immature human brain of negative experiences experienced in the unit (Ferraz et al., 2022). continuous stresses *that,* in the long term, become harmful, triggering prolonged stimulation of the neuronal axis hypothalamic-pituitary and CNS (Coughlin, 2014). According to *Betty Neuman*, each newborn has, at a given moment, a capacity to adapt in response to the environment, but this same capacity, combined with the specificities of prematurity, must be worked on, built, respecting the line of defense (their state of well-being) and the flexible line of defense (attempt to cushion the effects of something *stressful*). The latter remains in permanent adaptation, expansion or contraction in relation to normal, resulting in temporary stability, as in states of sleep deprivation and adequate rest, and changes in the circadian rhythm. Although quiet sleep and active sleep are present in newborns, for unknown reasons, they do not establish a circadian rhythm for sleep. As a result, they are predisposed to inefficient and easily interrupted sleep cycles (Firmino et al., 2022). As the newborn approaches full-term GA, around 36 weeks, their sleep becomes more organized in cyclical patterns, alternating periods of calm sleep with periods of active sleep (Warren, 2015), awakening to the waking state to feed, which is called periodicity. Later,

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and weeks after term, a night-day pattern is achieved, i.e. there is evidence of differences between daytime and nighttime sleep patterns (Warren et al., 2023). Thus, in the neonatal period, three stages of sleep are identified, as explained in Table 1: REM (*Rapid eye movement sleep*), also called active sleep in Portuguese, in which rapid random eye movements occur, N-REM sleep (*Non- rapid eye movement)* in Portuguese defined as sleep without rapid eye movement, or calm sleep, and the transitional or indeterminate state (Firmino et al., 2022) .

Table 1 – Warren's Sleep States (2015)

Sleep States	Features
REM - active	- Paradoxical sleep with electroencephalogram (EEG) similar to the alert state. EEG with continuous activity; - Rapid eye movements; - Faster and more irregular breathing; - Low tone; - Predominant sleep state until close to term age; - Important for neuronal plasticity, memory and sensory development; - Deprivation has long-term effects on health and brain development.
Non-REM -calm	- Known as deep sleep; - Slow wave – discontinuous electrical pattern with bursts of activity; - There are no movements apart from internally generated jolts and small movements of the mouth; slower and more regular breathing; - Gradually replaces indeterminate sleep; - Particularly important for tissue growth and repair, and memory consolidation; - The organization of calm sleep is a marker of neurological maturity.
Transitional or Indeterminate	- Diffuse and immature state; there are no true sleep waves on the EEG; - Present until 34-36 weeks. - The eyes may be open or glazed, or closed; - Important part of the sleep cycle. If the transition from being awake to asleep is interrupted, the sleep cycle is disturbed.

The ability to fall asleep autonomously is a temporally dependent acquisition like other developmental milestones, and does not merely translate into physiological, respiratory, or thermoregulatory maturation (Rafael, 2019). Therapeutic positioning, considered non-traumatic care, is one of the Nursing interventions that should be instituted earliest (Skelton et al., 2022). After birth, the PTNB is exposed to an aggressive environment, presenting a deficit in muscle tone and strength (Gomes et al., 2022), called hypotonia (Skelton et al., 2022), often assuming a position of extension of the neck, back and extremities, with the head lateralized to one side and the extremities in abduction and external rotation. This positioning results from the effect of gravity as well as the predominance of extensor tone, which can affect the acquisition of fundamental capabilities for motor development and hinder the ability to self-regulate (Da Cruz, 2018). Protecting sleep through proper positioning also minimizes energy expenditure, enabling effective weight gain and promoting self-regulation, in addition to being considered a non-pharmacological pain relief strategy (Skelton et al., 2022). Oral interventions and feeding techniques must be appropriate to the newborn's maturational level, with a view to not generating traumatic experiences with a direct negative impact on their neurodevelopment. Likewise, it is known that oral stimulation through non-nutritive sucking and the use of sucrose reduces the occurrence of behavioral states of agitation and crying, enhancing the state of calm alertness (Liao et al., 2018), which most favors interaction (Brantes, 2018) and, consequently, readiness for feeding. Neurosensory development can be affected by several factors, including sleep deprivation and exposure to intense and bright artificial lights (Portuguese Society of Neonatology, 2018). The growing development of hospital technology that we are witnessing brings with it an increase in the number of sources of hospital noise, given the growing number of surveillance equipment, particularly in intensive care units. The environment of these units is therefore particularly harmful and appears to contribute to neurocognitive changes in PTNBs, which may subsequently lead to attention deficit and changes in communication skills (Portuguese Society of Neonatology, 2018).

2. MATERIAL AND METHODS

The study carried out was observational, correlational and prospective, with a quantitative approach.

The population (N) consisted of all newborns admitted to a unit of a private hospital in the Lisbon area between October 2023 and February 2024, totaling 160 newborns in this period. The sample (n) can be defined as non-probabilistic intentional, composed of 62 RN. These met the eligibility criteria for the study, which were having a GA equal to or greater than 34 weeks and having a hospital stay of more than 24 hours. Of these 62 newborns, n = 34 were preterm (GA between 34 and 36 weeks) and n = 28 were full-term (GA between 37 and 41 weeks). It is important to note that newborns under sedation were not included, because the decrease in spontaneous motor activity may influence the assessments, with observation only beginning after sedation is suspended. The newborns that participated in the study were essentially male (n = 34; 54.80%) with an IG (in days) ranging from 238 to 295 days, with an average of 259.97 days and a standard deviation of 15.12 days. We also found that most of the types of

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births performed were cesarean sections (n = 49.79%). Approximately one third of newborns were hospitalized due to prematurity (n = 26;31.90%), followed by Respiratory Distress Syndrome (RDS) with 19.40%; convulsions, feeding difficulties and hypoxemia were the other reasons for hospitalization (n = 15; 24.20%).
An observation grid was used, constructed by the main researcher using the results of a *scoping survey. review* on the thematic area. The grid allowed the collection of neonatal data, the shift in which the observation was carried out, the location where the newborn was and the time of observation; sleep state, motor behavior, vital parameters of the newborn at the beginning and end of observation; sleep time at the observed time and the existence or absence of self-regulation mechanisms. Through the grid, data such as type, form of administration, and time of feeding and sleep time between feedings were also collected. The brightness, noise and transition between sleep states prior to handling the newborn were also evaluated. To test the grid, it was analyzed by an expert on sleep and one on research and applied by five nurses to two newborns. It was found that it was not necessary to adjust the instrument. Natural participant observation took place two weeks after the start of the study, with the intention of not biasing the first assessments carried out, allowing a longer time period to assess its applicability. These newborns were studied only during the first seven days of hospitalization to avoid data dampening. One observation per shift, for three hours, was carried out on each NB admitted. Thus, the grid was filled in by all the nurses in the service (n = 18), occurring in three phases: the start time (initial observation), the end time (final observation) and the three hours that followed.
The study was approved by the Hospital Ethics Committee and other bodies between March and May 2023. The inclusion of newborns in the study took into account prior authorization from their parents/caregivers. To this end, they had to sign an Informed Consent Form. The research was based on six ethical principles, reflected in the informed consent forms, namely: beneficence, assessment of maleficence, fidelity, justice, truthfulness and confidentiality.

3. RESULTS

The prospective study included the observation of NBs throughout their hospitalization. The NBs were observed at six intervals over a 24-hour period. We found that the highest frequency of observations occurred between 9 am and 12 pm (16 observations, representing 25.80% of the total). Taking into account the sleep state, time and rest, we can see that in the observations of the newborns: Active Alert: Decrease from 11 newborns (17.70%) in the initial observation to 8 (12.90%) in the final; Calm Alert: Increased from 3 (4.80%) to 5 (8.10%); Crying: Increase from 7 (11.30%) to 9 (14.50%), indicating an increase in the frequency of crying in newborns between observations; Transition State: Significant reduction from 10 (16.10%) to 4 (6.50%); Active Sleep (REM): Increase from 12 (19.40%) to 14 (22.60%); Calm Sleep (non-REM): Increase from 19 (30.60%) to 22 (35.50%); The distribution of sleep and rest time showed that most newborns had sleep periods of less than three hours (33; 53.3%) and more than three hours (29; 46.7%).
When analyzing the stressors for the sleep of newborns admitted to the NICU, *we* can highlight that the positioning in which the newborn is placed: Kangaroo: decrease from 12 newborns (19.40%) to 10 (16.10%); Dorsal: remains constant at 15 (24.20%), indicating that this position remained a stable choice for positioning; Right Back: decrease from 23 (37.10%) to 18 (29.00%); Left Back: increase from nine (14.50%) to 16 (25.80%); Ventral: unchanged in three (4.80%). Regarding sleep time, it was observed that most newborns (η= 41; 66.10%) slept more than three hours, regardless of the position in which they were placed, which can be considered a healthy sleep pattern for this phase of neurodevelopment. On the other hand, 21 newborns (33.90%) slept less than three hours, suggesting that they had shorter sleep periods and/or were more easily awakened. The data reflect transitions in food preferences or needs in the sample studied, elucidating that: Adaptation to the breast: decreased from five newborns (8.10%) to two (3.20%), indicating a reduction in the number of newborns fed exclusively with the breast; Supplementation (Breast + Perfusion/Teat): the combination of adaptation to the breast with supplementation by perfusion or teat remained constant in five (8.10%) and five (6.40%), respectively, with no change in the two observation moments; Food Break: decrease from six (9.70%) to five (8.10%), reflecting a slight reduction in the need for food breaks; Perfusion: considerable increase from 26 (41.90%) to 33 (53.20%), indicating a greater dependence on this form of feeding at the end of the observation; Slope Probe: slight decrease from 10 (16.10%) to nine (14.50%), which suggests a small change in the use of this technique; Teat/tube at a slope: increase from 10 (16.10%) to 18 (29.00%), an increase in the use of the teat for feeding in addition to the tube at a slope.
In order to protect the newborn's sleep in these units, the provision of care took into account not only the ideal moment for establishing contact with the newborn, but also: Sleep and Rest Pattern before Manipulation : the vast majority of newborns (n = 51; 82.30%) presented an effective sleep and rest pattern before the current manipulation; Programming and adjustment of Manipulation to Sleep Pattern: most manipulations (n = 44; 7 1.00%) were scheduled and adjusted according to the newborn's sleep pattern; Calm transition between sleep stages during manipulation: almost all newborns (n = 60; 96.80%) experienced a smooth transition between sleep stages during manipulation, a testament to delicate practices adopted to ensure that the newborn's sleep was as little disturbed as possible; Adjustment of lighting prior to manipulation: in the majority (n = 52; 83.90%) the lighting was adjusted for greater comfort of the newborn; and the Identification of a calm environment with reduced stimuli: the majority (n = 61; 98.40%) had the environment around them identified as calm and with reduced stimuli.

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After ensuring these conditions, it was also important to know the sleep stages in which the newborn was at the beginning and end of the observation: Active Alert: slight decrease from 14 (22.60%) to 13 (21.00%); Calm Alert: significant increase from four (6.50%) to 17 (27.40%); Crying: only eight (12.9%) were mentioned in the initial observation, which may indicate an improvement in general well-being or in the effectiveness of care interventions; Transition State: considerable increase from 10 (16.10%) to 19 (30.60%); Active Sleep (REM): reduction from 10 (16.10%) to four (6.50%); Calm sleep (non-REM): decrease from 16 (25.80%) to nine (14.50%).
Considering that the provision of care, as an independent variable of the study carried out, is expressed through a constant interaction with other variables considered in the study, all of which are considered stressors for the sleep of newborns admitted to the NICU, it was also important to know the newborn's response to all of them, in behavioral terms: The average response to light (1.45) indicates a low level of stress, with little variation among newborns, as indicated by the standard deviation of 0.53. The response varied from almost no reaction (0.65), that is, between not applicable due to no exposure to light during the observed time, and nobody startles, to a moderate reaction (2.78), in which there was a localized and gradual startle or eyelid movement; The response to auditory stimulus has the lowest average (0.94) among the various variables, suggesting that the newborns were not exposed to noise during the observed time, close to an absence of response due to being very asleep. However, the range goes from no reaction (minimum of 0.00) to a moderate reaction (2.67), the latter indicating that there was a response with a general startle or constant eyelid movement; The response to manipulation identifies the maximum expression among the variables (3.57), indicating that this type of stimulus can provoke quite high stress reactions, identified by a generalized hypertonia, difficult to contain, or agitation/irritability that is difficult to console with the presence of tremors. However, the average value is 1.56, which indicates a low average impact, based on a synchronous movement of the limbs, keeping the newborn comfortable, or a slight agitation, but consoleable; The response to change of positioning is a significant *stressor*, having the second highest average (1.66) and a maximum value (3.27) that also indicates considerable stress responses in certain cases. These values are translated at a behavioral level by a generalized hypotonia, but with acceptance of the positioning, or a discomfort that was calmed with comfort measures, maintaining the newborn in the position in which it was placed; The response to feeding was the *stressor* with the highest average (2.08), but for the parametric evaluation of this variable it shows us that the existence of a respect for the newborn's sleep was consistent through feeding by gastric tube with a periodic autonomous awakening, or a condition of feeding training with a previous autonomous awakening and the existence of coordinated reflexes. However, the standard deviation (0.41) indicates that the majority of responses are more grouped around the average compared to other stressors.
Scientific evidence identifies noise as a stressor for newborns' sleep (Brazilian Society of Neonatology, 2018) . In neonatal care, this must be assessed beforehand and during the provision of care, making it important to assess how sleep is affected by its existence. Thus, the results obtained revealed that: The average noise level before manipulation was 43.32 dB (decibel), with a standard deviation of 4.49 dB. Values ranged from 36.00 dB to 55.00 dB. These levels suggest a relatively calm environment prior to manipulation, but with some variation, indicated by the standard deviation; The average noise level during handling increased slightly to 45.32 dB, with a standard deviation of 6.27 dB. Values ranged from 37.00 dB to 62.00 dB. The increased mean and standard deviation, as well as the higher maximum, indicate a noisier environment with greater variation during manipulations, which is expected due to the additional activity in the environment; The total average number of hours of sleep at the observed time was 173.15 hours (h), with a standard deviation of 17.82 hours, and the values ranged from 110.00 h to 210.00 h.
Regarding the hypothesis tested, we can state that newborns show improvements between the first and 7th day of hospitalization regarding the effect of *stress factors*, such as: Noise during handling: the average decreased from 46.53 to 43.79 with $p = .011$, indicating a statistically significant decrease, suggesting increased care with noise control during handling over time; Sleep time between feedings: there is a significant increase in mean sleep time from 2.65 to 4.09, with $p < .001$. This is a highly significant result, indicating an improvement in sleep time over the first week; Initial Feeding Administration Method: decrease from 5.00 to 3.71 with $p < .001$, indicating significant changes in the practices/effectiveness of initial feeding; Final Feeding Administration Form: decrease from 4.88 to 4.15 with $p = .014$, also showing significant changes in feeding at the end of the period; Manipulation adjusted to the newborn's sleep time: significant increase from 1.62 to 1.88 with $p = .010$, suggesting a tendency towards respect for the newborn's sleep cycle with better programming of care provision taking this into account, and not a rigid schedule; Environmental manipulation: we found a large difference with the mean reducing from 1.97 to 1.00 and $p < .001$, indicating a drastic and significant change in environmental manipulation, probably reflecting an improvement in environmental management to minimize stressors.

4. DISCUSSION

We know that sleep plays a key role in the management of stimuli and energy. The multidisciplinary team must plan the provision of care, as their routine is the main modulator of the newborn's circadian rhythms. Each contact with the newborn is an entry into the newborn's microenvironment, breaking the acoustic, thermal and light isolation (Rafael, 2019). Therefore, although the most selected time was from 9 am to 12 pm, it is important to rethink the care planning strategy, adapting it to the individuality of each newborn, minimizing sleep interruptions only for the benefit of those who handle the newborn. It is worth noting that the start and end time of the observation corresponded to contact with the newborn, which translates into an undue interruption of their sleep to provide care, not respecting their sleep cycle by waiting for the ideal moment for contact. The literature is clear on this

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point, telling us that a full-term newborn spends more time in the active phase of sleep (REM sleep) than a preterm newborn (Rafael, 2019). All non-emergency interventions should be postponed until the newborn wakes up autonomously (Order of Nurses, 2023), but in cases where care cannot be postponed, the multidisciplinary team should be aware of the need to approach the newborn with the aim of modulating their behavioral state. The study found a predominance of sleep and rest periods of less than three hours, which may reflect the polyphasic sleep patterns typical of this stage of life, but which should also be the focus of our attention regarding the factors that may induce a sleep time shorter than the time considered standard for feeding newborns (3/3h) in NICU's. Nevertheless, the comparative analysis indicates a general improvement in the behavioral state of the newborns: there was a decrease in agitated/irritable newborns and an increase in calm and peaceful newborns. The study data suggest a variable preference in the positioning of the newborns, with a tendency to balance the use of lateral positions in the final observation. The constancy in the dorsal position and the low adherence to the ventral position (η= 34) are in line with the recommendations for safety during sleep, but contrast with the literature, which tells us that there is a preference for the ventral decubitus position, when tolerated, since this is related to more restful sleep states. As a result of research in the literature, it is found that the ventral decubitus position is the position of choice for very low birth weight newborns (Shepherd *et al*, 2019), since it promotes the development of their pulmonary, cardiovascular and gastrointestinal functions, promoting sleep organization. The sleep time indicated in the study points to the importance of adequate positioning in facilitating adequate periods of rest, essential for protecting the neurodevelopment of the newborn. The calm sleep state (non-REM) is shown to be the most beneficial for neurodevelopment, lasting longer in the prone position (Shepherd *et al,* 2019) or lateral position (Skelton et al., 2022) . On the other hand, the active sleep state (REM) lasts longer in the supine position, which is the greatest driver of awakenings (Skelton et al., 2022). In the study carried out, the supine position was selected in 24.20% of the observations, a very considerable percentage that may have influenced the total sleep times. Following the line of thought evidenced in the literature, this percentage may be related to the 33.90% of newborns who slept less than three hours, 12.90% of whom slept less than two hours, as well as the 19.40% and 22.60% who reflected active sleep-in newborns, the third and second highest percentages in sleep states at the observed times. Feeding involves a complex interrelationship between neurosensory, neuromotor (Brantes , 2018) and behavioral aspects, reflected through the transition between sleep states that have an impact on the immediate, or absent, availability for feeding. In the study carried out, the types of feeding reflect a diversity in the practice of care in the NICU, with a balance between the use of breast milk (exclusive or with the need for supplementation) and exclusive formula. The significant presence of mixed feeding suggests a pragmatic approach to meet the nutritional needs of newborns, combining the benefits of breast milk with the convenience or need for formula to meet individual caloric needs. The study made it possible to evaluate the care provided in interaction with sleep stressors in order to understand how the Nursing Team demonstrated sensitivity to these factors. The following were assessed: the effectiveness of the sleep and rest pattern, the programming and adjustment of care provision in relation to the newborn's sleep pattern, the transition between sleep stages, the adjustment of lighting and the identification of the environment in terms of sound stimuli. The data obtained indicate a strong awareness and implementation of practices aimed at preserving the newborn's sleep patterns during the necessary clinical manipulations. The commitment to maintaining a calm and minimally stimulating environment suggests a holistic approach to care, considering the sensory and emotional effects of interactions on the newborn. Taking into account a neuroprotective approach, scientific evidence corroborates the need to observe the newborn in order to identify the ideal moment for interaction with him/her. Approaching the newborn with a calm voice, modulating their behavior, was identified in a study carried out with 65 preterm newborns as supporting the improvement of the sleep cycle, increasing its time and decreasing the frequency of awakenings (Lan et al., 2018). Regarding the provision of care, the identification of the sleep state in which the newborn was at the time selected for observation was requested. The reduction in active sleep (REM) and calm sleep (non-REM) in the final observation may indicate a change in sleep cycles or in the duration of rest over time. In the face of sound stimuli (noise), an increase was observed during handling, which can affect the quality of sleep or the alertness of newborns, as well as a gradual transition between sleep states until reaching the ideal state for interaction. Noise management is crucial in neonatal care environments to minimize stressful and exhausting responses to noise and protect neurodevelopment, and this management should take into account not only what was triggered during handling, but also what occurred prior to it (Zhang & He, 2023; Sentner et al., 2022) . The results obtained indicate that there was no very marked discrepancy in noise before and during handling, which may lead to the existence of effective practices in environmental control, but which, on the other hand, may provide the need to reflect on practices that can reduce the noise level to values closer to the recommended ones.

CONCLUSION

In this study, a predominance of sleep and rest periods of less than three hours was observed in newborns. Changes in positioning did not significantly influence the duration of sleep of newborns. Regarding feeding and form of administration, these were not directly associated with the time for the newborn to reach the transition state. Environmental factors such as light and noise were considered a concern, although these did not have an impact on the newborn's sleep. Nevertheless, there was a significant

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increase in noise associated with the care provided to preterm newborns, confirming the hypothesis, but partially, as it was also not proven, in the sample studied, a difference in sleep time in newborns subjected to noise at different ages. The difficulties inherent in a longitudinal study, namely in ensuring the accessibility of the sample over a period of time and the impossibility of performing polysomnographic analysis of newborns, were the main limitations.

Touchpoints Model identifies regression, before typical or atypical development. These predictable periods can be disruptive to the family as the child's behavior and developmental skills change. *Touchpoints* are a way to help families anticipate regressions and then collaboratively guide them to discover their own strengths as they experience and manage *stressful* situations, such as a neonatal intensive care unit stay.

The newborn's behavior is the basis for interpreting what is meaningful, showing us the path to follow; it is the information from which we will generate hypotheses and make choices. When practicing *Touchpoints*, we make observations and predictions based on our understanding of this language. The biobehavioral analysis carried out in this study thus allowed us to use the newborn's behavior as our language, establishing a shared understanding of what the newborn does and what we predict it will do. In this process, parents were invited to correct, expand or complement these observations and predictions.

Future suggestions include continuous noise monitoring through the use of a sound level meter and the implementation of "Hours of Silence". It is also suggested that a "Minimum Interventions Protocol" be created, which sets out actions to be adopted by the Multidisciplinary Team. Also as a future suggestion, we highlight the need to carry out other studies that allow for the evaluation of the environment in health institutions and its impact on newborn sleep, with a more comprehensive focus in terms of gestational ages and units at different levels.

AUTHORS' CONTRIBUTION

Conceptualization, A.V.P. and J.V.; data curation, A.V.P.; formal analysis, A.V.P. and J.V.; investigation, A.V.P. and J.V.; methodology, A.V.P. and J.V.; validation A.V.P. and J.V.; visualization, A.V.P. and J.V.; writing - original draft, A.V.P.; writing – review & editing, A.V.P. and J.V.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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