# Physiotherapeutic perception of the epidemiological profile of newborns admitted to a Neonatal Intensive Care Unit

# Percepção do fisioterapeuta sobre perfil epidemiológico de recém-nascidos e atuação fisioterapêutica em Unidade de Terapia Intensiva Neonatal

Ruana Glicya Lima Silva[1]
Alice Anny Diniz Rocha[2]
Jaíza Marques Medeiros e Silva[3]
Gustavo Coringa de Lemos[4]

[1]Universidade Estadual do Rio Grande do Norte (Mossoró). Rio Grande do Norte, Brazil.
[2]Faculdade de Medicina do Porto (Porto). Porto, Portugal.
[3]Corresponding contact. Universidade Federal da Paraíba (João Pessoa). Paraíba, Brazil. jaizamarquesms@gmail.com
[4]Faculdade de Enfermagem Nova Esperança de Mossoró (Mossoró). Rio Grande do Norte, Brazil.

**ABSTRACT | BACKGROUND:** The Neonatal Intensive Care Unit (NICU) provides care for critically ill or at-risk newborns who require continuous medical assistance. However, there is limited data on physiotherapists' perception of the epidemiological profile of this population to guide specific actions. Thus, this study aimed to identify, from the perspective of physiotherapists, the epidemiological profile of newborns admitted to NICUs in Mossoró/RN. **METHODS:** This cross-sectional, descriptive, and mixed-methods study was conducted between October and November 2022 among physiotherapists working in NICUs using an electronic questionnaire. Data were analyzed using Jamovi 2.4.14.0 statistical software and presented as means, standard deviations, and frequencies. **RESULTS:** Eleven professionals participated in the study, reporting respiratory disorders as the most frequent occurrences (100%) and cesarean section as the predominant type of delivery (100%). The main cause of admission was respiratory distress syndrome (63.3%), and the most commonly used technique was pulmonary re-expansion therapy (63.6%). The city's mortality rate ranges from low to moderate, with cardiac disorders being the leading cause of death (27.3%). **CONCLUSIONS:** Understanding the epidemiological profile allows for better planning, adjustments in interventions, and the strengthening of strategies to improve patient survival rates.

**KEYWORDS:** Neonatal Intensive Care Units. Premature Infant. Epidemiology. Health Profile. Physiotherapy.

**RESUMO | FUNDAMENTOS:** A Unidade de Terapia Intensiva Neonatal (UTIn) atende recém-nascidos graves ou de risco que precisam de assistência contínua. No entanto, há poucos dados sobre a percepção do fisioterapeuta quanto ao perfil epidemiológico desse público-alvo para orientar ações específicas. Desta forma, este estudo teve como objetivo identificar, pela percepção dos fisioterapeutas, o perfil epidemiológico de recém-nascidos admitidos nas UTIn do município de Mossoró/RN. **MÉTODOS:** Trata-se de uma pesquisa transversal, descritiva e quantiqualitativa, desenvolvida entre outubro e novembro de 2022, com fisioterapeutas atuantes em UTIn, por meio da aplicação de questionário eletrônico, com perguntas sobre o perfil epidemiológico e atuação fisioterapêutica nessas unidades. Os dados foram analisados no software estatístico Jamovi 2.4.14.0 e apresentados em média, desvio padrão e frequências. **RESULTADOS:** Onze profissionais participaram do estudo, apontando os distúrbios respiratórios como as ocorrências mais frequentes (100%) e a cesárea como tipo predominante (100%). A principal causa de admissão foi a síndrome do desconforto respiratório (63,3%), e a técnica mais utilizada é a terapia de reexpansão pulmonar (63,6%). A taxa de mortalidade no município varia entre baixa e média, sendo os distúrbios cardíacos a principal causa de óbito (27,3%). **CONCLUSÕES:** Portanto, o conhecimento do perfil epidemiológico possibilita o planejamento, readequação de ações e auxilia no direcionamento e fortalecimento de ações, contribuindo para a melhora na sobrevida do paciente.

**PALAVRAS-CHAVE:** Unidade de Terapia Intensiva Neonatal. Recém-Nascido Prematuro. Epidemiologia. Perfil de Saúde. Fisioterapia.

# 1. Introduction

The neonatal period is defined as the period between birth and 28 days of life, a time of great fragility in a child's life, with potential biological, socioeconomic, environmental, and cultural risks[1-3]. Given that this is a period of many changes, it is essential that the NB receive care and vigilant attention at all times, especially in cases of premature birth or the presence of clinical conditions that require specialized care[2,3].

Studies show that Brazil ranks 10th among countries with the highest rate of births before 37 weeks of gestation, and these variables are also statistically associated with neonatal mortality[4,5]. Therefore, prematurity is considered one of the leading causes of newborn admissions to NICUs[2,6-8]. According to the Brazilian Ministry of Health, 340,000 babies are born prematurely every year in Brazil, which corresponds to 931 per day or 6 premature babies every 10 minutes[9].

The Neonatal Intensive Care Unit (NICU) is designed to care for at-risk or critically ill newborns who require continuous medical care, especially premature babies. These units have specialized infrastructure, advanced technology, and a qualified multidisciplinary team. Serving patients from zero to 28 days of life, NICUs have contributed significantly to increasing neonatal survival rates and reducing morbidity rates[2,10].

In this sense, epidemiology is an essential tool for health research, as it provides several indicators for analysis, including the epidemiological profile, which reflects health conditions and the health-disease process[11,12]. Knowledge of this profile among patients admitted to Neonatal Intensive Care Units (NICUs) is essential to qualify the multidisciplinary team, improve the quality of care, and reduce possible complications[2,11].

In this context, physical therapists play a crucial role in the NICU, working in respiratory rehabilitation, preventing motor complications, and providing ventilatory support, which directly impacts the survival and recovery of newborns. Their perception of the epidemiological profile is essential for identifying clinical patterns, optimizing therapeutic approaches, and contributing to the development of effective strategies in neonatal management.

A study conducted with 144 newborns admitted to three referral hospitals reported that planning strategic actions and decisions aimed at improving the quality of care reduced morbidity and mortality rates among babies admitted to intensive care[2]. In this context, studies show that respiratory physical therapy in NICUs can reduce hospitalization time and the need for invasive ventilatory support, positively impacting clinical outcomes[13,14]. However, it is worth noting that, despite its growing importance, the literature on the perception and specific role of physiotherapists in these environments remains scarce in Brazil.

Thus, understanding the epidemiological profile of newborns admitted to NICUs in hospitals in the Northeast region can provide valuable information for the development of public policies that enhance access to and quality of neonatal care. Furthermore, it enables the development of more effective preventive and therapeutic interventions at both the regional and national levels. Given this, this study aims to answer the following question: What are the primary characteristics of the epidemiological profile of newborns admitted to NICUs, as perceived by physical therapists working in the municipality of Mossoró, Rio Grande do Norte? The primary objective is to identify this profile, highlighting the primary causes of hospitalization, complications, clinical outcomes, and the physical therapy techniques most commonly employed in these units.

# 2. Methods

The study is a cross-sectional, descriptive, quantitative study conducted between October and November 2022 with physical therapists working in NICUs in the municipality of Mossoró (RN), using an electronic questionnaire. Physical therapists of both sexes who used social networks (WhatsApp, Telegram, and Facebook) and were working in the field were included. The exclusion criteria were professionals who, for some reason, did not complete the questionnaire or those without internet access, making it impossible for them to participate in the study.

The sample for this study was non-probabilistic for convenience. Participants were recruited through social networks and virtual media, and those who showed interest were contacted individually to ensure their privacy. They were then presented with the research proposal, including its objectives, methodologies, benefits, and risks, along with the Free and Informed Consent Form (FICF). After reading the proposal, participants had the option to indicate whether they agreed or disagreed with the terms, limiting access to the form to individuals who agreed to participate. In addition, participants were asked to provide their email address so that they could receive a copy of the entire questionnaire they had completed.

## 2.1 Data collection instrument

The data collection instrument consisted of a structured form developed by the researchers themselves, which was made available through Google Forms for a one-month period. This form was organized into categories of questions that ranged from the reason for admission of newborns to the NICU to the leading cause of death in the same environment.

## 2.2 Variables

The variables analyzed in the study include: main reason for admission; most recurrent pathology; most frequent clinical occurrences (such as metabolic, hydroelectrolytic, hematological, hemorrhagic, respiratory, neurological, circulatory, gastrointestinal, renal/urological disorders, congenital anomalies, hyperbilirubinemia, birth trauma, infections, and others); most prevalent type of delivery; most commonly used physiotherapy techniques; professionals' perception of the mortality rate (high, medium, or low); average estimate of newborns who die; and leading cause of death.

Most questions were designed as open-ended responses. However, the item on clinical occurrences required dichotomous responses (yes/no), while the question about perception of the mortality rate required a single selection.

## 2.3 Data analysis

The statistical software Jamovi 2.4.14.0 was used for data analysis, which was expressed in terms of mean, standard deviation, absolute frequency, and percentage.

## 2.4 Ethical aspects

This research was conducted under the auspices of the Research Ethics Committee (CEP) of the Escola de Enfermagem Nova Esperança - FACENE/RN (Nova Esperança School of Nursing), under opinion No. 5,680,658. The guidelines of Resolution 466/12 of the National Health Council were also respected, which is in accordance with the Code of Ethics and Deontology of Physiotherapy, as outlined in Resolution No. 424, dated July 8, 2013.

# 3. Results

Data were collected from 11 physical therapists. According to the participating professionals, the main reason for admission was respiratory distress syndrome (RDS) (63.6%), which was also the pathology with the highest recurrence rate (27.2%). In addition, the most prevalent occurrence was respiratory disorders (100%), with cesarean section being the most common type of delivery in newborn admissions (100%). These characteristics are shown in table 1.

**Table 1.** Distribution of epidemiological characteristics according to the perception of physical therapists working in NICUs. Mossoró, Brazil

| Epidemiological characteristics | n(%) |
|---|---|
| **The main reason for admission of newborns to the NICU** | |
| Respiratory distress syndrome | 7(63.6) |
| Prematurity | 3(27.3) |
| Pneumonia | 1(9.1) |
| **Pathologies with the highest recurrence rates in the NICU** | |
| Respiratory distress syndrome | 3(27.2) |
| Pulmonary hypertension | 2(18.2) |
| Hyaline membrane syndrome | 2(18.2) |
| Others | 4(36.4) |
| **Predominant occurrences** | |
| Respiratory disorders | 11(100) |
| Infections | 5(45.5) |
| Hyperbilirubinemia | 3(27.2) |
| Others | 8(72.7) |
| **Type of delivery** | |
| Cesarean section | 11(100) |

Source: the authors (2022).

Table 2 presents the distribution of physiotherapy techniques, as well as the mortality rate and frequency of death, indicating that lung re-expansion therapy was the most commonly used technique by physiotherapists (63.6%). The mortality rate was considered average (54.5%), and there was an evolution from 0.75 to newborn death.

| Epidemiological characteristics | n(%) |
|---|---|
| **Physiotherapy techniques used** | |
| Lung re-expansion therapy | 6(63.6) |
| Aspiration | 5(54.5) |
| Bronchial hygiene therapy | 5(54.5) |
| Mobilization/functional positioning | 3(27.2) |
| Invasive Mechanical Ventilation and Noninvasive Ventilation | 2(18.2) |
| **Mortality rate** | |
| High | 5(45.5) |
| Average | 6(54.5) |
| Low | 0(0.0) |
| **The number of newborns who die per day in the NICU** | **Mean (SD)** |
| | 0.75 ± 0.49 |
| **Cause of death** | **n(%)** |
| Cardiac disorders | 3(27.2) |
| Sepsis | 3(27.2) |
| Circulatory disorders | 2(18.2) |
| Other | 3(27.2) |

Source: the authors (2022).

Figure 1 illustrates the results in the form of vertical bar charts, pie charts, radial progress charts, progress rings, and progress bars, presenting the data interactively and understandably for the broadest audience of readers and researchers.

**Figure 1.** Infographic on the characteristics of the sample
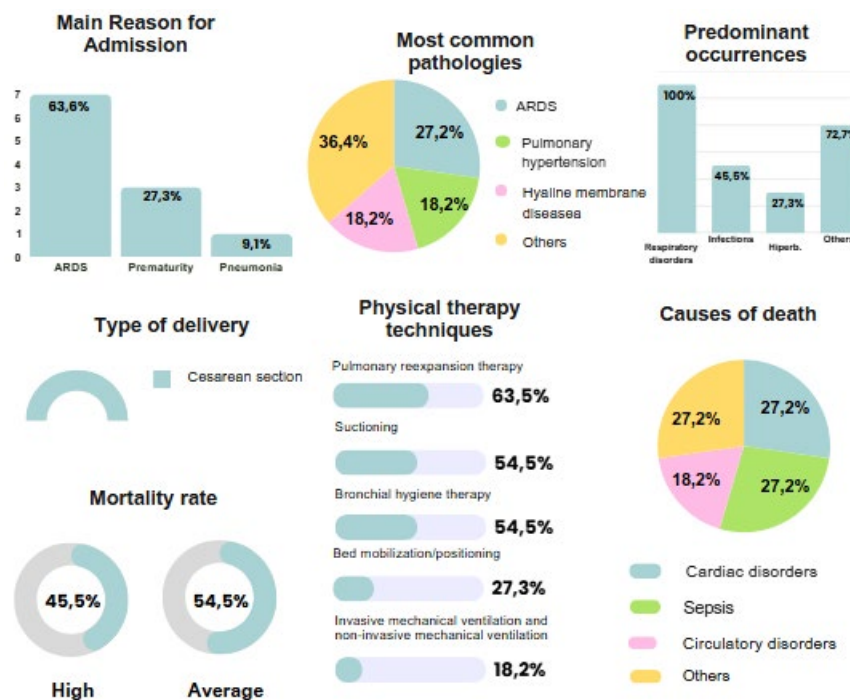


Source: the authors (2022).

# 4. Discussion

This study aimed to identify the epidemiological profile of newborn admissions to a NICU in a municipality in northeastern Brazil according to the perception of physical therapists working in the sector. Thus, the present study identified that the leading cause of admission to the NICU is RDS, which is also the most recurrent pathology. Respiratory disorders were the most prevalent among the occurrences. As for physiotherapy techniques, lung re-expansion therapy was the most frequently mentioned. Cardiac and circulatory disorders and sepsis were identified as the leading causes of death, indicating a mortality rate considered average in the NICU.

This finding regarding RDS as the leading cause of admission to the NICU is consistent with other studies that also point to this condition as one of the most frequent among hospitalized newborns[2,15]. RDS is a common respiratory complication, especially in premature neonates, due to pulmonary immaturity and deficient surfactant production[16]. In a study of 37 very low birth weight newborns, a prevalence of RDS was observed in 62.2% of cases, reinforcing the strong association between prematurity and the development of this pathology[17]. These data highlight the importance of early physiotherapy, both in the prevention and management of respiratory complications, primarily through techniques such as lung re-expansion, which was highlighted by the professionals participating in this study as the most used in the NICU context.

In this context, prematurity was considered the second most frequently cited cause of admission by physical therapists in the present study. Considering that prematurity is not considered a disease. Rather than a classification of newborns according to gestational age at birth, it is possible to identify in the literature that this condition is among the predominant risk factors for newborns admitted to NICUs, in addition to being cited as one of the leading causes of neonatal mortality[18].

In addition, prematurity was cited as one of the leading causes of death in NICUs, corroborating a study that showed that the leading causes of neonatal and infant death are related to prematurity and extremely low birth weight[19]. Researchers, when analyzing factors related to prolonged hospitalization and death of premature newborns, also correlated extreme prematurity, low birth weight, Apgar scores below seven, and clinical complications as the leading causes of death in newborns admitted to NICUs[20].

The most prevalent disorders within NICUs, in the perception of physical therapists, are respiratory disorders, followed by infections. These data corroborate a study of 176 medical records of newborns admitted to a NICU, in which it was observed that 40% of children at birth required the use of a face mask to improve respiratory dysfunction, and in 30% to 60% of cases, there was a prevalence of infections that could progress to sepsis[21]. In addition, a study of 158 extremely low birth weight newborns showed that the most prevalent morbidities were cardiac, respiratory, neurological, and infectious, with these pathologies having a high frequency of deaths[22].

Sepsis and respiratory problems are also mentioned as causes of death in the literature by some authors, which the immaturity and low immunity of the organism can explain[21,23]. It was observed in a study carried out in Northeast Brazil that the most frequent causes of death are sepsis, respiratory problems, congenital malformations, and hypoxia, causes that may also be related to the issue of prematurity[24].

Regarding the type of delivery of newborns, the professionals participating in this study unanimously mentioned cesarean section. Thus, it is possible to highlight that factors associated with birth, as well as the care provided in this scenario, may be related to the development of disorders and pathologies in the later period. The higher prevalence of cesarean section when compared to vaginal delivery has also been observed in other studies[4,17]. However, an ecological time series study conducted by iming to analyze the

trend of prematurity in Brazil between 2012 and 2019 according to sociodemographic characteristics, prenatal care, and type of delivery observed that until 2016, the highest proportion of premature births occurred among vaginal deliveries and subsequently became higher among cesarean deliveries[25].

Regarding the physiotherapy techniques used by the professionals participating in this study, lung re-expansion therapies, bronchial hygiene therapy, and aspiration were the most cited. This data corroborates another study that aimed to characterize physiotherapy care in NICUs, in which it was observed that these three techniques are the most present within the scope of practice[26]. Although invasive mechanical ventilation (IMV) and non-invasive ventilation (NIV) were rarely mentioned in the current study, this was not evident in a study of 168 extremely low birth weight (≤ 1,000 g) preterm infants, in which 72.7% used NIV[16].

A systematic review showed that airway suctioning, vibrocompression, and postural drainage are effective in improving respiratory distress and increasing $SpO_2$ in hospitalized newborns[27]. In contrast, a study conducted with 60 newborns, which aimed to describe the benefits of the inclusion of a physical therapist in the profile of newborns in the NICU, observed that procedures such as bronchial hygiene, lung expansion technique, and thoracoabdominal rebalancing technique did not show significant changes in cardiorespiratory parameters and pain[28].

Regarding the mortality rate of newborns admitted to neonatal ICUs, most physical therapists reported considering it to be at a medium level, followed by those who classified it as low. This finding corroborates studies that point to a reduction in the average rate of early and late neonatal mortality in Brazil, with an emphasis on early mortality — referring to deaths occurring before seven full days of life — which showed the most significant decline[29,30]. However, a survey conducted in Espírito Santo between 2008 and 2017 indicated that the most significant reduction occurred in late neonatal mortality, while the early neonatal mortality rate did not show the same downward trend[22].

In the present study, the daily average number of deaths in the NICU was reported as low. Despite this, observational cohort research points to high mortality among very low birth weight newborns, with a prevalence of 60.5% of deaths recorded in 200 medical records analyzed at a referral hospital in Rio Grande do Sul[31]. However, over the years, neonatal survival has increased significantly due to technological advances and intensive maternal and child care[32]. In Alagoas, for example, between 2008 and 2017, 5,647 neonatal deaths were recorded, with the highest rate in 2008 (12.6%), followed by a progressive decline in subsequent years[30].

The last question asked of the participants in this study was about the leading cause of death among hospitalized newborns, with heart disorders and sepsis being the main reasons. A study of 181 premature infants found that the leading causes of death cited were sepsis, acute respiratory distress syndrome, multiple organ failure, acute renal failure, and pulmonary hemorrhage[33].

One limitation of this study was the low adherence of physical therapists, resulting in a sample of 11 participants, as many professionals reported a lack of time to participate. Additionally, it should be noted that the data obtained refer to the subjective perceptions of the professionals and were not extracted from medical or hospital records, which may affect the accuracy of the information, especially regarding the causes of mortality. Another limitation is the lack of a detailed description of the physical therapy techniques used, as they were often mentioned generically, without specific details regarding methods, frequency, or clinical indications. Similarly, there was a restriction in the specification of the reported pathologies, which in some cases were grouped into broad categories, such as "respiratory disorders" or "cardiac disorders".

Some methodological limitations should also be acknowledged, such as the inclusion criteria being restricted to the participants' work in NICUs, without considering aspects related to qualifications or length of professional experience. Additionally, sociodemographic data on the participating physical

therapists, including age and gender, were not collected. This absence makes it impossible to characterize the sample in more detail and limits the analysis of possible relationships between these factors and the results obtained.

However, despite the limitations, the findings provide relevant information about these professionals' perceptions of neonatal mortality and advances in perinatal care. In addition, the data collected can serve as a basis for future research, broadening understanding of the topic and encouraging new investigations with larger samples and complementary methodologies.

## 5. Conclusion

This study highlighted the perception of physical therapists regarding the epidemiological profile of newborns admitted to NICUs in the municipality of Mossoró (RN). The results presented demonstrate that the main reason for admission to NICUs is respiratory distress syndrome, which is also the most recurrent. Regarding the most prevalent occurrences, professionals pointed to respiratory disorders as the most common, and cesarean section as the most pervasive type of delivery. The technique most used by them is lung re-expansion therapy, followed by aspiration and bronchial hygiene therapy. According to the professionals, the mortality rate in the municipality is between low and medium, and the leading cause of death cited was cardiac disorders.

In this context, the study aims to provide scientific evidence that can lead to greater knowledge of hospitalized newborns, helping professionals, especially physical therapists, to identify factors that are predominant in ICUs and, based on this, improve their practices. Furthermore, this type of study enables planning, readjustment of actions, and assists in directing and strengthening care actions, contributing to improved patient outcomes and survival.

## Authors' contributions

The authors declared that they made substantial contributions to the work in terms of the conception or design of the research; the acquisition, analysis, or interpretation of data for the work; and the writing or critical revision of relevant intellectual content. All authors approved the final version to be published and agreed to take public responsibility for all aspects of the study.

## References

1. Zulian AC, Lisboa DDJ, Batista JS, Lisboa RR. Perfil dos pacientes internados na Unidade de Terapia Intensiva Neonatal. JCS HU-UFPI [Internet]. 2018;1(3):38-48. Available from: https://scholar.google.com/citations?view_op=view_citation&hl=pt-BR&user=Y1sGYVwAAAAJ&citation_for_view=Y1sGYVwAAAAJ:qjMakFHDy7sC

2. Silveira TB, Tavella RA, Fernandez JB, Ribeiro APFA, Garcia EM, Silva Junior FMR. . Epidemiological profile of newborns admitted to Neonatal Intensive Care Units in university hospitals in the extreme south of Brazil. Vittalle. 2020;32(2):46-54. https://doi.org/10.14295/vittalle.v32i2.9815

3. Dol J, Hughes B, Bonet M, Dorey R, Dorling J, Grant A, et al. Timing of neonatal mortality and severe morbidity during the postnatal period: a systematic review. JBI Evid Synth. 2023;21(1):98–199. https://doi.org/10.11124/JBIES-21-00479

4. Pitilin EB, Rosa GFD, Hanauer MC, Kappes S, Silva DTR, Oliveira PP. Perinatal factors associated with prematurity in neonatal intensive care unit. Texto contexto – enferm. 2021;30:e20200031. https://doi.org/10.1590/1980-265X-TCE-2020-0031

5. World Health Organization. Preterm birth [Internet]. Geneva: World Health Organization; [updated 2023 May 10; cited 2021 May 9] Available from: https://www.who.int/news-room/fact-sheets/detail/preterm-birth

6. Melo TCLC, Alves PCA, Santos JLR, Félix TA, Ferreira FV. Profile of newborns hospitalized in a Neonatal Intensive Care Unit. CLCS. 2023;16(8):8548 61. https://doi.org/10.55905/revconv.16n.8-020

7. Gumboski J, Silva DI, Henrique LUC, Schultz LF. Clinical and demographic profile of newborns admitted to a neonatal unit. J Contemp Nurs. 2022;11:e4655. https://doi.org/10.17267/2317-3378rec.2022.e4655

8. Nascimento TM, Omena IS, França AMB, Soares ACO, Oliveira MM. Caracterização das causas de internações de recém-nascidos em uma unidade de terapia intensiva neonatal. Ciênc Biol Saúde Unit [Internet]. 2020;6(1):63 74. Available from: https://periodicos.set.edu.br/cdgsaude/article/view/6568

9. Ministério da Saúde. Dia mundial da prematuridade: "Separação zero: aja agora! Mantenha pais e bebês prematuros juntos" [internet]. Brasília: Ministério da Saúde; 2021. [cited 2022 Mar 7]. Available from: https://bvsms.saude.gov.br/17-11-dia-mundial-da-prematuridade-separacao-zero-aja-agora-mantenha-pais-e-bebes-prematuros

10. Freitas MCN, Sousa AOB, Cabral SAAO, Alencar MCB, Guedes MSSE, Oliveira GF. Characterization Newborn Hospitalized in Intensive Care Units. Id on Line Rev Mult Psic. 2018;12(40):228-42. https://doi.org/10.14295/idonline.v12i40.1110

11. Siqueira ACF. Perfil epidemiológico da unidade neonatal: Revisão integrativa [trabalho de conclusão de curso] [Internet]. Niterói: Universidade Federal Fluminense; 2016. [cited 2022 Aug. 22]. Available from: https://app.uff.br/riuff/handle/1/2568

12. Pereira MG. Epidemiologia: Teoria e Prática. Rio de Janeiro: Editora Guanabara Koogan, 2024.

13. Santos RPB, Lourenço A, Santos LF, Neves AIA, Alencar CP, Pinheiro YT. Effects of respiratory physiotherapy on babies of risk under special care. Arch Health Invest. 2019;8(3):150-6. https://doi.org/10.21270/archi.v8i3.3179

14. Santos ABMS, Almeida LL, Andrade MC, Silva VS. Physiotherapy in neonatology: sensory and cognitive development in cases of neonatal respiratory distress syndrome (RDS). REASE [Internet]. 2024;10(8):2292-303. Available from: https://periodicorease.pro.br/rease/article/view/15256

15. Silva SMR, Motta GCP, Nunes CR, Schardosim JM, Cunha MLC. Late-onset neonatal sepsis in preterm infants with birth weight under 1.500 g. Rev Gaúcha Enferm [Internet]. 2015;36(4):84-9. Available from: https://lume.ufrgs.br/handle/10183/132179

16. Biazus GF, Kupke CC. Clinical profile of newborns undergoing physical therapy in a neonatal intensive care unit. Fisioter Mov. 2016;29(3):553-60. https://doi.org/10.1590/1980-5918.029.003.AO13

17. Marcuartú AC, Malveira SS. Profile of Premature Newborns with Very Low Birth Weight Admitted to a Neonatal Intensive Care Unit. R bras ci Saúde. 2017;21(1):5-10. https://doi.org/10.22478/ufpb.2317-6032.2017v21n1.28551

18. Matos AGA. Perfil epidemiológico de pacientes de uma Unidade de Terapia Intensiva Neonatal em um hospital de referência [Trabalho de Conclusão de Curso] [Internet]. Curitiba: Faculdade Evangélica Mackenzie do Paraná; 2020. Available from: http://dspace.mackenzie.br/handle/10899/27987

19. Teixeira JAM, Araújo WRM, Maranhão AGK, Cortez-Escalante JJ, Rezende LFM, Matijasevich A. Mortality on the first day of life: trends, causes of death and avoidability in eight Brazilian Federative Units, between 2010 and 2015. Epidemiol Serv Saúde. 2019;28(1):e2018132. https://doi.org/10.5123/S1679-49742019000100006

20. Silva RMM, Zilly A, Ferreira H, Panciere L, Pina JC, Mello DF. Factors related to duration of hospitalization and death in premature newborns. Rev Esc Enferm. 2021;55:e03704. https://doi.org/10.1590/S1980-220X2019034103704

21. Sacramento DDS, Ferreira CKHAP, Souza MOLS, Boulhosa FJS. Profile of Low Birth Newborns in an Intensive Care Unit. Rev Med Minas Gerais [Internet]. 2019;29:e2006. Available from: https://www.rmmg.org/artigo/detalhes/2486

22. Baptista GC, Poton WL. Evolution of neonatal mortality by preventable causes over the past ten years in Espírito Santo State. Rev Bras Saúde Mater Infant. 2021;21(1):45-54. https://doi.org/10.1590/1806-93042021000100003

23. Silveira CK, Brasil LMC, Cerqueira JVC, Crispim PTB, Carvalho ASD. Epidemiological Profile of a Neonatal Intensive Care Unit in a Region of the Brazilian Amazon. Residência Pediátrica. 2023;13(2):1-9. https://doi.org/10.25060/residpediatr-2023.v13n2-768

24. Pereira MUL, Lamy-Filho F; Anunciação PS, Lamy ZC, Gonçalves LLM, Madeira HGR. Neonatal death in the city of São Luís: causes and factors associated with early neonatal death. Rev Pesq Saúde. 2017;18(1):18-23. Available from: https://periodicoseletronicos.ufma.br/index.php/revistahuufma/article/view/7874

25. Martinelli KG, Dias BAS, Leal ML, Belotti L, Garcia EM, Santos Neto ET. Preterm births in Brazil between 2012 and 2019: data from the Information System on Live Births. R Bras Est Pop [Internet]. 2021;38:1 15. https://doi.org/10.20947/S0102-3098a0173

26. Arakaki VSNM, Gimenez IL, Correa RM, Santos RS, Sant'anna CC, Ferreira HC. Demographic mapping and characterization of physical therapy care profile offered in Neonatal Intensive Care Units in the City of Rio de Janeiro, Brazil. Fisioter pesqui. 2017;24(2):143-8. https://doi.org/10.1590/1809-2950/16470124022017

27. Oliveira TC, Moda GSM, Ribeiro AKPL, Nunes SED, Araujo RA, Gaia VSC.Bronchic hygiene techniques in newborns and infants in the intensive care unit: systematic review of clinical trials. J Physiother Res. 2018;8(3):420-9. https://doi.org/10.17267/2238-2704rpf.v8i3.1958

28. Martins R, Silva MEM, Honório GJS, Paulin E, Schivinski CIS. Respiratory physiotherapy techniques: the effect on cardio-respiratory parameters and pain in stable newborns in neonatal intensive care. Rev Bras Saúde Mater Infant [Internet]. 2013;13(4):317-27. Available from: https://www.scielo.br/j/rbsmi/a/sPxr9PdZ56jmwhf4LYQMmFp/?format=pdf&lang=pt

29. Bernardino FCS, Gonçalves TM, Pereira TID, Xavier JS, Freitas BHBM, Gaíva MAM. Trends in neonatal mortality in Brazil from 2007 to 2017. Ciênc Saúde Coletiva. 2022;27(2):567-78. https://doi.org/10.1590/1413-81232022272.41192020

30. Medeiros VAB, Bezerra INS, Mota LM, Monteiro FS. Profire of neonatal mortality in Alagoas in the period 2008 to 2017. Revista Ciência Plural. 2019;5(2):16-31. https://doi.org/10.21680/2446-7286.2019v5n2ID16212

31. Malveira SS, Moraes AN, Chermont AG, Costa DLF, Silva TF. Recém-nascidos de muito baixo peso em um hospital de referência. Revista Paraense de Medicina. 2006;20(1):41-46. Available from: http://scielo.iec.gov.br/scielo.php?script=sci_arttext&pid=S0101-59072006000100007

32. Sousa DS, Sousa Júnior AS, Santos ADR, Melo EV, Lima SO, Almeida-Santos MA, et al. Morbidity in extreme low birth weight newborns hospitalized in a high risk public maternity. Rev Bras Saúde Matern Infant. 2017;17(1):149-57. https://doi.org/10.1590/1806-93042017000100008

33. Lima RG, Vieira VC, Medeiros DS. Determinants of preterm infants' deaths at the Neonatal Intensive Care Units in the Northeast Countryside in Brazil. Rev Bras Saúde Mater Infant. 2020;20(2):545-54. https://doi.org/10.1590/1806-93042020000200012