

Neonatal transport in the emergency mobile care service: integrative review

Transporte neonatal no serviço de atendimento móvel de emergência: revisão integrativa

Transporte neonatal en el servicio de atención móvil de emergencia: revisión integradora

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Abstract

Objective: to identify scientific evidence on neonatal transport in the emergency medical service **Methods:** integrative review carried out between December 2020 and March 2021 in five national and international databases, and descriptors: “neonatal transport”, “newborn” and “ambulance”. 198 researches were found, of which 12 constituted the final sample. The material was analyzed and organized using simple descriptive statistics. **Results:** The publications highlighted that the use of neonatal transport is complex and requires assistive technology and specific qualified care. **Conclusion:** It is necessary to develop strategies that broaden the perspectives of professionals in neonatal transport.

Keywords: Neonatal transport; Newborn; Ambulance; Emergency mobile care service; Review.

Resumo

Objetivo: identificar evidências científicas sobre transporte neonatal no serviço de emergência médica. **Métodos:** revisão integrativa realizada entre dezembro de 2020 e março de 2021 em cinco bases de dados nacionais e internacionais, e descritores: “transporte neonatal”, “recém-nascido” e “ambulância”. Foram encontradas 198 pesquisas, das quais 12 constituíram a amostra final. O material foi analisado e organizado por meio de estatística descritiva simples. **Resultados:** As publicações destacaram que o uso do transporte neonatal é complexo e requer tecnologia assistiva e assistência qualificada específica. **Conclusão:** É necessário desenvolver estratégias que ampliem as perspectivas dos profissionais do transporte neonatal.

Palavras-chave: Transporte neonatal; Recém-nascido; Ambulância; Serviço de atendimento móvel de emergência; Revisão.

Resumen

Objetivo: identificar evidencias científicas sobre el transporte neonatal en el servicio de urgencias médicas. **Métodos:** revisión integradora realizada entre diciembre de 2020 y marzo de 2021 en cinco bases de datos nacionales e internacionales, y descriptores: “transporte neonatal”, “recién nacido” y “ambulancia”. Se encontraron un total de 198 estudios, de los cuales 12 constituyeron la muestra final. El material fue analizado y organizado utilizando estadística descriptiva simple. **Resultados:** Las publicaciones destacaron que el uso del transporte neonatal es complejo y requiere tecnología asistiva y asistencia calificada específica. **Conclusión:** Es necesario desarrollar estrategias que amplíen las perspectivas de los profesionales del transporte neonatal.

Palabras clave: Transporte neonatal; Recién nacido; Ambulancia; Servicio de atención móvil de emergencia; Revisión.

1. Introduction

In Brazil, the Mobile Emergency Care Service (SAMU) is part of the mobile pre-hospital component of the National Emergency Care Policy. This policy aims to guarantee the service with respect to the universality, equity and completeness equity and completeness. In this way, SAMU attends to clinical, surgical, gynecological and obstetric, psychiatric, pediatric emergencies related to external causes and also to the inter-hospital transport of critically ill patients (Brasil, 2013).

As defined by the Brazilian Ministry of Health, neonatal hospital transport occurs when there is a need to transfer the newborn at risk from the neonatal unit to other hospital facilities (intra-hospital) or between different health institutions (inter-hospital) in order to perform diagnostic tests or treatments not available in the sector or service of origin (Nogueira, 2018).

In this context, the newborn transport must be seen not only as a routine procedure, performed by health professionals, but as an action of vital importance, inserted in the care of hospitalized newborns (Brasil, 2011).

The mobile emergency care is an area with comprehensive knowledge and specific performance (Brasil, 2011). From the professionals, it has demanded a formation that is compatible with the services that the population requires. These services encompass several professionals' classes with specific practices and knowledge, what forms interrelated teams in a collective way, resulting in acts developed by each and every one of them, having to be prepared to assist any type of injury in all age groups (Marba et al., 2017).

In Brazil, the urgency and emergency sectors are seen as deficient and problematic areas within the health system, in which the guidelines for decentralization, regionalization and hierarchization are poorly implemented (Dantas et al., 2015; Coren, 2011). In this context, the National Emergency Care Policy emerges and, as a consequence, the Mobile Emergency Care Service induces the organization of the care network and the structuring of national emergency services, in order to be an observatory of the health system (Brasil, 2003).

Considering that the Mobile Emergency Care Service is a regulatory complex for health care, which interferes in the organization of the care network and in the structuring of emergency services, it is necessary to assess the quality of its service provision, with the intention of proposing solutions and improving its quality (Dantas et al., 2015).

In mobile urgent and emergency units, this responsibility is even greater, given the patient's clinical instability. The necessary conditions to offer quality neonatal transport are well established in the literature, following international standards for safety in neonatal transport (Nogueira, 2018, Sampetro, 2016).

According to Busch (2015), risks, benefits, clinical conditions of the patient, equipment, staff and available materials must be evaluated, with the goal of reducing the occurrence of adverse events during the newborn's journey as much as possible. Therefore, ensuring the safety of the patient and of the health professional during the transfers is extremely important, and it intends to prevail the benefits that must be sought when transporting the newborn in the context of health care.

In this perspective, this study aims to identify scientific evidence about neonatal transport in the emergency medical care service.

2. Methodology

This is an integrative literature review on the subject, in order to elucidate the care provided by health professionals who work with neonatal transport. This review allowed us to assess what is currently being studied on the subject, as well as to point out gaps in this knowledge that need to be filled with further studies (Mendes, Silveira & Galvão, 2008).

To conduct this investigation, six steps were followed: elaboration of the research question, inclusion and exclusion criteria for the studies; search of studies in databases, extraction of data from the studies, evaluation of the selected studies,

analysis and synthesis of the results.¹⁰ We established the following guiding question for the research: *What evidence is available in the literature on neonatal transport care provided by the mobile emergency care service?*

The following were designated as inclusion criteria: publications in full, in Portuguese/Spanish/English, made available electronically free of charge, addressing the transport of the newborn by the mobile emergency service. A limit was establishment regarding the year of publication, in order to ensure recent data on the subject.

For this literature review, we carried out advanced searches on MEDLINE (Medical Literature Analysis and Retrieval System Online), LILACS (Latin American & Caribbean Health Sciences Literature), CINAHAL (Cumulative Index to Nursing and Allied Health Literature) SCOPUS (Cumulative Index you the Nursing and Allied Health Literature) and Web of Science (WOS).

As for temporality, we included studies from January 2015 to March 2021, using the descriptors "newborn transport" AND "newborn infants" AND "ambulance", their combinations and their respective translations into Portuguese and Spanish

3. Results

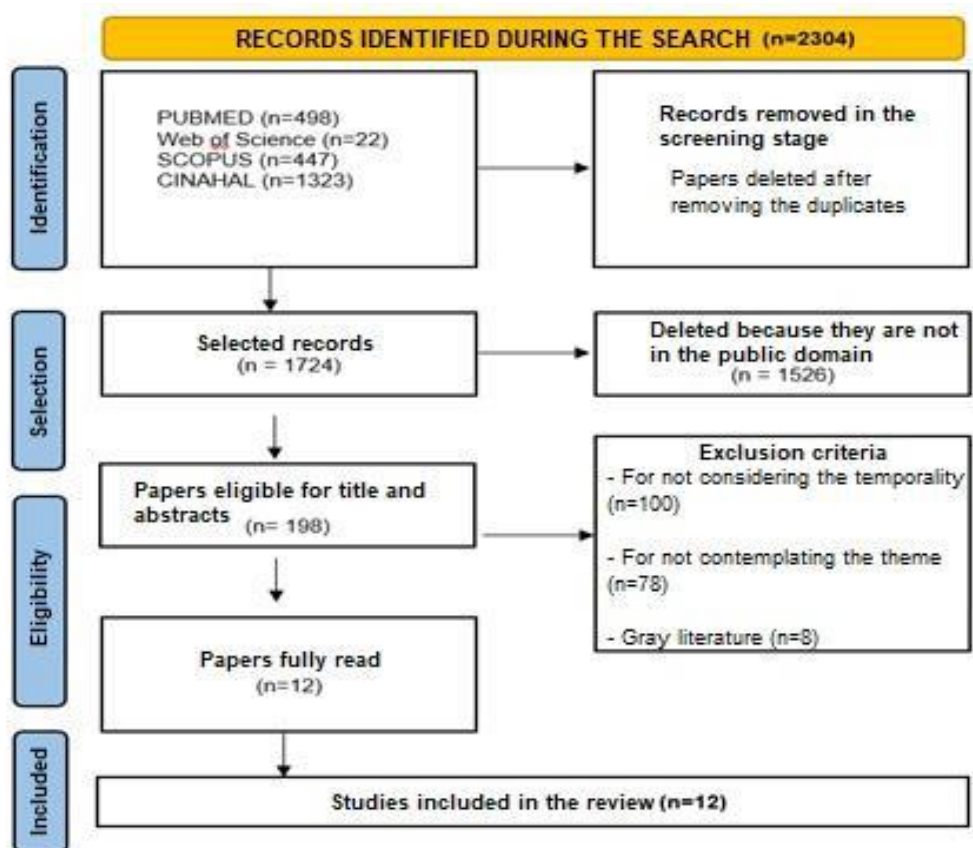
In the initial identification of the research, 2304 studies were demonstrated, out of which 1323 are indexed on Cinahal, 498 on Pubmed, 447 on Scopus, 22 on Web of Science, 14 on LILACS.

In the screening process, 580 duplicated articles were abstained and 1724 were selected for the eligibility phase. When tracking the studies, we excluded 1526 articles, as they were not in the public domain, therefore, they are not available in full.

After tracking, we carefully read the titles, summaries and conclusions, in order to identify the relevance of 198 articles. As to the inclusion criteria, we excluded 100 articles for not considering the temporality, between the years 2015 and 2021; 78 for not covering the subject, that is, studies on air transport, specific to covid-19 and to pediatric patients; eight researches considered gray literature, configured as dissertations and thesis, annals of events.

For full reading, we carried out two successive evaluations in 12 publications, which had significant attributes for this review, since they met study question and the pre-established criteria, according to the analysis flowchart. (Figure 1)

Figure 1. Flowchart of the study selection process adapted from *Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA)*. Maringa, Parana, 2021.



Source: Prepared by the authors.

The temporal distribution of articles had the last 5 years as period, with the oldest article having been published in 2015 and the most current, in 2021. The majority of the studies was carried through in Brazil (Balbino, Cardoso & Queiroz, 2019; Silva et al 2017; Baldino & Cardoso, 2017; Pimenta & Alves, 2016; Junior, 2016), two from Italy (Belini et al., 2019; Gente et al 2019), one from Jamaica (Henry & Trotman, 2017), one from India (Mondal et al 2021), one from Canada (Lee, 2019), one from Japan (Hiroma et al., 2011) and one from the United States (Akula, 2020); only three studies were in Portuguese. Among the included studies that focused on the subject, the majority of them addressed the care of newborns in transport (Baldino & Cardoso, 2017; Junior, 2016; Belini et al., 2019; Gente et al., 2019; Henry & Trotman, 2017), human resources and equipment (Balbino, Cardoso & Queiroz, 2019; Baldino, Cardoso, 2017; Romanzeira & Sarinho, 2015; Belini et al 2019; Henry & Trotman, 2017; Mondal et al 2021; Lee, 2019), conditions of the transport (Pimenta & Alves, 2016; Gente et al 2019; Lee, 2019) and complications during the transport (Silva et al 2017) (Chart 1).

Chart 1. Summary of the articles with their titles, journals and countries, type of study, study design and participants and/or sample of the analyzed articles. Maringa, Parana, Brazil. 2021.

Author/Y ear	Title	Journal/ Country	Study design and participants	Main results
Mondal T et al 2021	Epidemiology of newborn transport in India the reality check	Medical Journal	Prospective study with 1103 newborns	Factors related to the transport logistics, as transport in a well-equipped ambulance, followed-up by trained health personnel that gives stabilization assistance during transport, efficient communication and referral documentation are important. Almost half of the babies did not have prerequisite intervention and one third did not have referral notes.
Akula et al 2020	Neonatal transport in california: findings from a qualitative investigation	Journal of perinatology	Focus group with 19 teams and a total of 158 team members	Characteristics of neonatal transport and staff performance. The professionals identified challenges such as availability of ambulance, administrative support and lack of training as important for an effective work.
Balbino A.C; CardosoM VML, Queiroz MVO 2019	Planning of neonatal transport: perception of mobile emergency service teams	Enferm Foco	Exploratory and descriptive study with 17 SAMU health professionals (5 doctors, 5 nurses and 7 ambulance drivers)	Structure for the execution of the transport (intended for monitoring and warming the newborn, ventilatory assistance and medications to deal with possible complications); Planning of the newborn's safety (need of evaluation of the newborn before the transport and effective communication between the teams and the checking of resources. Need for team training.
Bellini DP et al 2019	Rethinking the neonatal transport ground ambulance	Italian Journal of Pediatric	Transport ground ambulance	The ambulances used for transport are specific to the care of adult patients, ignoring newborn care. Thus, the specific ambulance project highlights essential resources with glove, catheter, intubation material or central catheter in lockers.
Lee KS 2019	Neonatal transport metrics and quality improvement in a regional transport service	Transl Pediatr	Quality metrics to measure and compare performance among the transport teams	Performance among the transport teams is essential. Age group, clinical indicators;
Gente et al 2019	Nationwide survey of neonatal transportation practices in italy	Italian Journal of Pediatric	Exploratory study with 44 professionals of neonatal transport operating in 20 Italian regions	60% of the 20 regions were covered by the neonatal transport service; 15% partially covered and 25% not covered. Out of those that have coverage, they are well equipped, but do not include an adequate number of professionals and workers.
Balbino A.C; CardosoM VML 2017	Difficulties in the inter-hospital transport of critical newborn carried out by the teams of the mobile emergence care service	Texto Contexto Enferm, Brazil	Exploratory and descriptive study with 17 SAMU health professionals (5 doctors, 5 nurses and 7 ambulance drivers)	Lack of materials, equipment and exclusive vehicles for the transport of newborns; deficient knowledge, practice and training for assisting the newborn and poor communication between the professionals.
Silva GE et al 2017	Risk Assessment of Morbidity and Mortality in the Neonatal Transport	International Medical Society	Cross-sectional study with 57 newborn transports	The TRIPS result was possible in only 26% of the population, and most scores were above 10.
Henry, Trotman 2017	Challenges in neonatal transport in Jamaica: A resource-limited setting	Journal of tropical pediatric	Prospective descriptive study with 50 newborns	Fifty newborns were transferred to the UHWI; the most common reason for transfer was for respiratory support (30); 17 experienced some adverse event during transport; 54% needed warming.
Pimenta PCO, Alves VH 2016	Inter-hospital transport of the high-risk newborn: a challenge for the nursing staff	Cogitare Enferm.	Descriptive study with 35 nurses who are part of the transport team	The results show that the city lacks the material resources to provide adequate care for newborns.
Junior, F. I	Pre-hospital care for newborns:	SOPERJ Journal of Pediatrics	Systematic review, from the	The care provided by all team members must be systematized in accordance with protocols. Many pre-

2016	diagnostic approach		main problems for pre-hospital care for a newborn	hospital care groups, especially those following American protocols, develop a strategy or a systematic approach to a patient based on the ABCDE (airway, breathing, circulation, disability and exposure) regardless of age.
Hiroma T, et al 2016	Nationwide survey of neonatal transportation practices in Italy	Pediatrics International	Brief report	20% of the hospitalized babies were transported to medical centers in other cities. More than half of the specialized centers had specialized ambulances for neonatal transport. 13% reported problems with transportation, without the necessary equipment for neonatal care.
Romanzeira JCF; Sarinho SW 2015	Quality Assessment of Neonatal Transport performed by the Mobile Emergency Medical Services (SAMU)	J Pediatr	Cross-sectional study with 33 newborns.	The study sought to verify the quality of neonatal transport provided by the Mobile Emergency Care Service (SAMU). Respiratory failure was responsible for 42.4% of the requests. In order to evaluate the quality of the transport, we used the TRIPS score.

Source: Authors.

4. Discussion

The care given to the critically ill newborn is complex and demands nursing care technology and specific qualified care. Next, the thematic categories involving the neonatal transport and the influence on the quality of newborn care will be presented.

Care provided to newborns in neonatal transport

As defined by the Brazilian Ministry of Health, neonatal hospital transport occurs when there is a need to transfer the newborn at risk from the neonatal unit to other hospital facilities (intra-hospital) or between different health institutions (inter-hospital) in order to perform diagnostic tests or treatments not available in the sector or service of origin (Nogueira, 2018).

In this context, the newborn transport must be seen not only as a routine procedure, performed by health professionals, but as an action of vital importance, inserted in the care of hospitalized newborns. On the other hand, Balbino and Cardoso (2017) emphasize the importance of carrying out "safe" neonatal transport, in which, according to the Ministry of Health, it is essential that there be an adequate clinical stabilization of the patient prior to transport, and the presence of a well-trained team.

The highlight's four main points for stabilization in neonatal transport: care for maintaining body temperature; stabilization and maintenance of open airways; stabilization and maintenance of capillary blood glucose; and guarantee of open vascular access during the entire transport. It is important to note that transporting critically ill newborns in an ambulance requires much more than equipment and materials.

Hyperthermia in newborns associated to the incubator overheating can be related to blocking the passage of air and to sensors overheating, due to the use of plastic blankets inside the incubator hood. Another relation is to the placement of blankets and other objects on the incubator hood and to the exposure of the incubator to direct sunlight (Belini et al., 2019).

During its use, the incubator may be subjected to inadequate handling, in addition to the wear and tear resulting from the time of use. Therefore, trained personnel must periodically evaluate and maintain this equipment, ensuring its performance with quality and safety for the patients and professionals (Belini et al., 2019).

Another type of risk concerns the inadequate control of the supply of oxygen to the newborn, which can cause hyperoxia or hypoxia. Despite the benefits of oxygen therapy, the use of this gas in concentrations above 40% increases the risk of retinopathy of prematurity and, as a consequence, progresses to blindness. Therefore, it is essential to control of the arterial blood gases in newborns (Romanzeira & Sarinho, 2015). This is particularly important because respiratory failure is

responsible for 42.4% of transport requests, according to Romanzeira, Sarinho (2015). As stated by Henry and Trotman, more than half of all the transports happened due to respiratory disorders.

The TRIPS score, a user-friendly tool, uses parameters such as the temperature, respiratory status, blood pressure and response to stimuli to evaluate the risk of neonatal mortality related to the transport (Romanzeira & Sarinho, 2015). The instrument is composed of four empirically weighed variables: axillary temperature, neurological status, respiratory pattern (respiratory rate and/or oxygen saturation) and systolic blood pressure measured immediately before and after the neonatal transport (Lee et al 2019). Still in accordance with Silva et al (2017), the TRIPS score ranges from 0 to 65. A value of difference higher than 10 in the final transport score is associated to higher index of mortality and of severe intraventricular hemorrhage in the newborn at risk.

Equipment and materials used in safe neonatal transport

In order for the neonatal transport to be the successful, the Brazilian Society of Pediatrics (SBP) recommends a series of cares related to institutional infrastructure, transport team, vehicle, personal protective equipment, materials and emergency medication, among others. In developed countries, the quality of the neonatal transport has been the object of study and evaluation in the context of the health services. In developing countries, the interest for the subject is increasingly growing, despite being recent in the field of knowledge production of neonatology (Baldino & Cardoso, 2017; Pimenta & Alves, 2016).

The necessary conditions to offer quality neonatal transport are well established in the literature. However, several studies have described severe complications resulting from non-compliance with the rules regarding the procedure (Pimenta & Alves, 2016)

It is known that neonatal transfers performed under ideal conditions decrease perinatal morbimortality, creating the necessity of developing a health strategy in which the transportation of the newborn is considered as part of the child overall treatment (Hiroma et al 2016).

Neonatal transport with quality care and effective team involvement can be an efficient mechanism, with the potential to reduce infant mortality rates and the risks to which the newborn is exposed during the inter-hospital journey (Romanzeira & Sarinho, 2015; Henry & Trotman, 2017)

In Japan, Hiroma et al (2016) emphasized the importance of specialized equipment for neonatal transfer. It must include incubators, breathing and heart rate monitors, SpO₂ monitors, infusion pumps, aspirators, air-oxygen blender, artificial respirators and seat belts.

Balbino, Cardoso, Queiroz (2019) highlighted the importance of planning each stage of the transport, from the equipment needed during the process to the vehicle to the need of an exclusive ambulance for the newborn transport, optimizing the team's time and increasing the survival of the newborn.

Professional training for effective and safe care

The mobile emergency care is an area with comprehensive knowledge and specific performance. From the professionals, it has demanded a formation that is compatible with the services that the population requires. These services encompass several professional classes with specific practices and knowledge, what forms interrelated teams in a collective way, resulting in acts developed by each and every one of them, having to be prepared to assist any type of injury in all age groups (Marba et al 2017; Diniz et al.; 2022).

In Brazil, the protocols that rule neonatal transport recommend that the transport team be composed of, at least, one doctor that is able to perform the necessary procedures to care for the critically ill newborn (preferably a pediatrician or a

neonatologist), in addition to nurses and nursing technicians with knowledge and practice in newborn care (Romanzeira & Sarinho, 2015).

Neonatal transport teams in California reported that having a transfer center with a centralized number at the receiving hospital helped them have proper transfer information and reduce the preparation time. Furthermore, simulations of neonatal transport will be initiated on SimuLab as a way to improve the processes that affect reaction times, teamwork and staff training. Finally, the introduction of dedicated neonatal transport teams must be considered as a way to consistently lessen the preparation times, since unit-based neonatal transport teams withdraw the staff from inpatient care, delay the departure and lack flexibility.

So that the problems arising from transport are avoided, the assessment of neonatal transport compliance represents an important aspect of patient care, considering essential elements for the system of neonatal transfer, such as: organization, communication, personnel, equipment and transport units, as well as the regionalized and hierarchical system of perinatal care (Baldino & Cardoso, 2017).

Still in accordance with Silva et al (2017), the TRIPS score ranges from 0 to 65. A value of difference higher than 10 in the final transport score is associated to higher index of mortality and of severe intraventricular hemorrhage in the newborn at risk.

5. Conclusion

The scientific evidence from the study points to a care that is not only directed to the newborn, but also to professional training. The study may contribute to medical and nursing care in inter-hospital transport of newborns and to broad care for the newborn, since this type of care and the reduction of infant mortality are guiding principles of childcare, which, due to its particularities, brings new modalities of care.

It is concluded that more studies are needed in order to contribute to the improvement of the care provided to the newborn during hospital transport and, above all, it aims to contribute to the improvement of the quality of the working conditions of health professionals, providing subsidies for the realization of safer, more comfortable and quality neonatal transfers.

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