THE IMPORTANCE OF SNAPPE II AS A PREDICTOR OF DEATH IN NEONATAL UNIT

A IMPORTÂNCIA DO SNAPPE II COMO PREDITOR DO ÓBITO EM UNIDADE NEONATAL

LA IMPORTANCIA DEL SNAPPE II COMO PREDICTOR DEL ÓBITO EN UNIDAD NEONATAL

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ABSTRACT

Objective: to evaluate the effectiveness of the SNAPPE II score as a predictor of neonatal death. **Method:** integrative review using the MEDLINE / PUBMED, SCOPUS, WEB OF SCIENCE and LILACS databases. Complete articles, available and published in the last ten years, in any language, were the criteria used. **Results:** the sample resulted in eight articles examined using an instrument adapted from Ursi. The researches showed that the scores evaluated are good predictors of hospital death, but not of morbidity or hospital stay. **Conclusion:** the possibility of measuring the severity of neonatal disease in the neonatal intensive care unit, through the use of severity scores, allows an adequate comparison between services and the standardization of good perinatal and neonatal practices, contributing to the reduction of neonatal and infant mortality. **Descriptors:** Perinatal Death; Mortality; Health Services Research; Practice Guideline; Severity of Illness Index; Infant Mortality.

RESUMO

Objetivo: avaliar a efetividade do escore SNAPPE II como preditor de óbito neonatal. **Método:** revisão integrativa na qual foram utilizadas as bases de dados MEDLINE/PUBMED, SCOPUS, WEB OF SCIENCE e LILACS. Artigos completos, disponíveis e publicados nos últimos dez anos, em qualquer idioma, foram os critérios utilizados. **Resultados:** a amostra resultou em oito artigos examinados mediante um instrumento adaptado de Ursi. As pesquisas mostraram que os escores avaliados são bons preditores de óbito hospitalar, porém, não de morbidade e nem de permanência hospitalar. **Conclusão:** a possibilidade de medir a gravidade da doença do recém-nascido na unidade de terapia intensiva neonatal, por meio da utilização dos escores de gravidade, permite a comparação adequada entre os serviços e a padronização das boas práticas perinatais e neonatais colaborando para a redução da mortalidade neonatal e infantil. **Descritores:** Morte Perinatal; Mortalidade; Pesquisa Sobre Serviços de Saúde; Guia de Prática Clínica; Índice de Gravidade de Doença; Mortalidade Infantil.

RESUMEN

Objetivo: evaluar la efectividad del score SNAPPE II como predictor de óbito neonatal. **Método:** revisión integrativa que se utilizó como base de datos MEDLINE / PUBMED, SCOPUS, WEB OF SCIENCE y LILACS. Artículos completos, disponibles y publicados en los últimos diez años, en cualquier idioma, fueron los criterios utilizados. **Resultados:** la muestra resultó en ocho artículos, examinados mediante un instrumento adaptado de Ursi. Las investigaciones mostraron que los puntajes evaluados son buenos predictores de óbito hospitalario, pero, no de morbilidad y no de permanencia hospitalaria. **Conclusión:** la posibilidad de medir la gravedad de la enfermedad del recién nacido en la unidad de terapia intensiva neonatal, por medio de la utilización de los puntajes de gravedad, permite la comparación adecuada entre los servicios y la estandarización de las buenas prácticas perinatales y neonatales, colaborando para la reducción de la mortalidad neonatal e infantil. **Descriptores:** Muerte Perinatal; Mortalidad; Investigación en Servicios de Salud; Guía de Práctica Clínica; Índice de Severidade de la Enfermedad; Mortalidad Infantil.

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INTRODUCTION

Infant mortality is a classic health indicator that measures the risk of a child dying before reaching one year of age, in addition to reflecting the quality of health services and the living conditions of the population.¹ It is divided into neonatal and postpartum components -neonatal. The neonatal infant estimates the risk of death during the first 27 days of life, being subdivided into early neonatal, from birth to six days of life; late neonatal, from seven to 27 days of life, and the post-neonatal period from 28 days to 11 months and 29 days of life.²

There was a decline in infant mortality in several countries, however, the reduction in neonatal mortality was lower in relation to post-neonatal mortality.³ In Brazil, neonatal mortality accounts for almost 70% of deaths in the first year of life, the early neonatal component. Approximately 25% of these deaths occur within the first 24 hours. Therefore, adequate care for the newborn has been one of the major challenges for the reduction of the infant mortality rate in the country, and it should be a priority of the health management to analyze the conditions of birth, as well as the quality of care provided in the neonatal units for the planning of the best actions in health services.⁴

In Brazil, about 60% of neonatal deaths occur due to preventable causes.⁵ It is considered an avoidable death, one whose occurrence is directly related to medical intervention and quality health services. The avoidability was classified according to several criteria to systematize and understand the various factors that contribute to the occurrence of these deaths and to evaluate the effectiveness of the health system.⁶ The analysis of the factors associated with avoidable deaths allows interventions more adequate to the needs of the populations contribute to the reduction of child inequities and child mortality in the country.²

The main causes of death in the neonatal period are prematurity, perinatal infection, asphyxia, congenital malformation and maternal factors.⁷ The high rates of perinatal and neonatal mortality that can be avoided in less developed regions of the country can be addressed by organizing and managing the care provided at the different levels of health care, with access to a quality perinatal care network.

Brazil achieved MDG Num. 4 with a 78% reduction in infant mortality between 1990 and 2013.⁸ The survival of newborns in the country has increased considerably compared

to previous years due to the deployment of intensive care beds neonatal care, combined with technological investments, the new tools of care management and the improvement of professional qualification.

When it comes to management innovations, the use of indicators, scales and other tools is necessary to enable the assessment of care delivery. In the context of neonatal units, the comparison of mortality rates between services becomes an excellent indicator and, for this, scores were created that allow the identification of the degree of gravity of the newborn and aim at the systematization and adequacy of care, taking into account the severity, with consequent reduction of neonatal mortality.⁹

Several instruments have been created that evaluate, in scores, the clinical severity of newborns in neonatal intensive care units. The SNAPPE II (Score for Neonatal Acute Physiology with Perinatal Extension II) evaluates the patient in the first 12 hours of admission to the neonatal intensive care unit, observing multiple physiological changes (Blood Pressure, Axillary Temperature, Urine Output, serum pH and PaO₂ / FiO₂ ratio , through arterial gasometry in patients with CPAP and mechanical ventilation), punctuating the worst moment during the period, besides the presence of multiple seizures and perinatal factors such as: birth weight, small to gestational age and Apgar less than seven in the fifth minute. The score can vary from zero to 162.¹⁰ The SNAPPE II is the score used in the Brazilian Network of Neonatal Research and the Vermont Oxford Network and is the object of this study.

OBJECTIVE

- To evaluate the effectiveness of the SNAPPE II score as a predictor of neonatal death.

METHOD

For the elaboration of the guiding question, the PICO strategy was used, which represents an acronym for Patient, Intervention, Comparison and Outcomes. P (patient) - newborns; I (intervention) - use of the SNAPPE II severity score; C (comparison or control) - predictor of mortality; O (outcome) - death in the neonatal intensive care units.¹¹ With this strategy, the following guiding question was established: The SNAPPE II severity score is a predictor of mortality in a neonatal intensive care unit?

The articles were selected in July 2016 by means of an electronic search using the MEDLINE / PUBMED (Scientific Literature

Analysis and Restriewel Online), SCOPUS, WEB CIRCUITS Index and LILACS Latin American and Caribbean Studies in Health Sciences).

Research was done to use the terminology in health, referred to in the Descriptors in Health Sciences (DeCS), and the following descriptors were identified: neonatal mortality and mortality, with the Boolean operator AND. To expand the search, we associated the keywords SNAPPE II and disease severity (Illness severity).

The inclusion criteria were: last ten years, as the date of publication; article, such as material type, in any language. Exclusion criteria were: review articles, articles not available in full, articles repeated in previous searches and articles that did not respond to the guiding question after reading the abstract. No filters were used due to the small number of articles found.

In the MEDLINE / PUBMED database, using the keyword SNAPPE II and the descriptor "neonatal mortality", eight articles were found, four of which were excluded after reading the abstracts, because they did not respond to the guiding question and one be repeated. In the subsequent search, using the same keyword SNAPPE II and the mortality descriptor, 39 articles were found, 34 being excluded because they did not respond to the guiding question and three because they were repeated on the first search. Continuing in the same database, with the keyword "illness severity" and the descriptor "neonatal mortality", 25 articles were found, of which 20 were excluded because they did not attend the theme, three because they were repeated in previous search and one because systematic review article.

In the SCOPUS database, using the keyword SNAPPE II and the descriptor "neonatal mortality", six articles were found, of which three were excluded, after reading the abstracts, because they did not respond to the guiding question, one because it was repeated in search and one because it is not available in full. In a subsequent search in the same database, using the keyword SNAPPE II and the mortality descriptor, 40 articles were found, of which 35 were excluded after reading the abstracts, because they did not respond to the guiding question and four because they were repeated in a previous search.

In the WEB OF SCIENCE database, using the keyword "illness severity" and the descriptor "neonatal mortality", 23 articles were found, of which 20 were excluded, after reading the abstracts, for not answering the guiding question and two for repeated in a previous search.

In the LILACS database, using the keyword SNAPPE II and the descriptor "neonatal mortality", two articles were found, one being excluded because it was repeated in a previous search.

In total, 143 articles with potential for analysis were found, of which 72 belonged to the MEDLINE / PUBMED database; 46, to SCOPUS; 23, WEB OF SCIENCE and two, to LILACS. In considering the inclusion and exclusion criteria mentioned above, the selection consisted of ten articles. After reading, two other articles were excluded: one for associating mortality with other morbidities and one for associating mortality with another severity score, thus totaling eight articles for review.

The eight references that constituted the study sample were examined using an adapted form of Ursi.¹² This instrument made it possible to analyze articles in relation to the following aspects: article title, country, year of publication and methodological characteristics.

For a better understanding, articles were translated, read and reread several times, the most relevant data being extracted from them.

RESULTS

In figures 1 and 2, the characteristics of the eight articles selected for review are shown. An order was created for the articles to facilitate the construction of the figures. The characteristics are: article title, country, year, type of search, population and sample size.

As for the place, there is predominance of the American continent, with four articles; two in Paraguay; one in Brazil and one in the United States. However, you can see countries from different continents such as Australia, India, Iran and Turkey.

Order	Article title	Country (Year)
01	Evaluation of the SNAPPE II and CRIB scoring systems with additional parameters ⁹	Turquia 2016
02	SNAPPE II (Score for Neonatal Acute Physiology with perinatal Extension II) in Predicting Mortality and Morbidity in NICU ¹³	Índia 2015
03	Comparing CRIB II and SNAPPE II as mortality predictors for very preterm infants ¹⁴	Austrália 2014
04	SNAP II and SNAPPE II as Predictors of Neonatal Mortality in a Pediatric Intensive Care Unit: Does Postnatal Age Play a Role? ¹⁵	Paraguai 2014
05	Scores de gravidade SNAP II y SNAP-PE II em la determinación de Riesgo de mortalidad neonatal em uma unidade de cuidados intensivos polivalente ¹⁶	Paraguai 2011
06	Fatores perinatais associados ao óbito precoce em prematuros nascidos nos centros da Rede Brasileira de Pesquisas Neonatais ¹⁷	Brasil 2010
07	Interinstitutional Variation in Prediction of Death by SNAP II and SNAPPE II Among Extremely Preterm Infants ¹⁸	Estados Unidos 2009
08	Neonatal Mortality Risk Assessment in a Neonatal Intensive Care Unit (NICU) ¹⁹	Irã 2007

Figure 1. Title, country and year of articles selected for review. Fortaleza (CE), Brazil, 2016.

All surveys are prospective with a quantitative approach; three, analytical observational, of which one is multicentric and four, cohorts. Of these, two are multicentric and one, observational.

The sample size used ranges from 198 to 1,688 patients.

The study population consisted of term and preterm infants in most of the studies, with

the exception of the cohorts. There is a cohort in the United States, with a population of premature infants less than 28 weeks; in Brazil, with premature infants between 23 and 33 weeks, and in Australia, with preterm infants less than 32 weeks of gestational age.

Order	Type of research	Population	Sample (n)
01	Multicentric analytical observational	Neonates admitted in the first 12 hours of life.	1.688
02	Observational	Admitted up to 48 hours of life.	248
03	Cohort	Neonates, less than 32 weeks old, admitted up to 48 hours old.	1.607
04	Cohort	Neonates admitted between 28 and 42 weeks.	290
05	Analytical observational	Neonates between 27 and 42 weeks.	288
06	Multicentric Cohort	Neonates with 23 to 33 weeks and six days and birth weight between 400 - 1,500 grams.	579
07	Multicentric Cohort	Neonates with 23 to 27 weeks.	1.467
08	Analytical observational	Admitted from September 2003 to August 2004.	198

Figure 2. Method, population and sample of articles selected for review. Fortaleza (CE), Brazil, 2016.

In Figure 3, the objectives, the outcomes and the conclusions of the research can be identified.

Regarding the objectives, the evaluation of SNAP II and SNAPPE II is predominant as predictors of mortality in neonatal intensive care units. Some of them presented particularities such as: the Brazilian cohort,

which evaluated the perinatal factors associated with early neonatal death in preterm infants weighing between 400 and 1,500 grams and the Australian cohort comparing SNAPPE II and CRIB II (Clinical Risk Index for Babies II) as predictors of hospital mortality in preterm infants. From the analytical observational, one compared

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SNAPPE II and CRIB as predictors of hospital mortality in newborns and additional effect of antenatal and / or surfactant corticoids in these scores and another determined the validity of SNAP II and SNAPPE II scores as predictors of neonatal mortality and of hospital stay in neonatal intensive care units.

Article	Objectives	Outcomes	Conclusions
01	To determine the risk of mortality by CRIB and SNAPPE II and additional effect of antenatal corticosteroids and / or surfactant in these scores.	Death	SNAPPE II is better predictor of death than CRIB between RN <1,500g. The use of antenatal corticosteroids improves the power of SNAPPE II
02	Evaluate the SNAPPE II as a predictor of mortality and morbidity.	Death and discharge	Best predictor of mortality, but not a good predictor of morbidity.
03	Compare CRIB II and SNAPPE II as predictors of death and to validate them in the Australian population.	Death	They were validated and are similar as predictors of death and in the evaluation of quality of care.
04	Evaluate SNAP II and SNAPPE II as predictors of death.	Death and Discharge	They are better predictors of death among those admitted from zero to six days.
05	To determine the validity of SNAP II and SNAPPE II as predictors of death and hospital stay.	Death, discharge and days of hospitalization	Good predictors of neonatal death, but not good predictors of hospital stay.
06	To evaluate the perinatal factors associated with early neonatal death.	Early neonatal death	Factors susceptible to intervention and the variation of the deaths between the units persists when compared with the SNAPPE II
07	To evaluate the interinstitutional variation in prediction of death by SNAP II and SNAPPE II	Death	They functioned as predictors of death.
08	To evaluate the performance of SNAPPE II as a predictor of the neonatal mortality rate.	Death and discharge	SNAPPE II can be used as a predictor of

mortality.

Figure 3. Objectives, outcomes and conclusions of the articles. Fortaleza (CE), Brazil, 2016.

Half of the investigations had, as an outcome, only the hospital death, and the rest, death and hospital discharge. An observational analytical study used, as a result, in addition to death and hospital discharge, the days of hospitalization.

The conclusion observed in the surveys was that the scores evaluated are good predictors of hospital death, however, they are not good predictors of morbidity and hospital stay.

DISCUSSION

In the cohort performed in Paraguay, there was no significant difference in the SNAP II and SNAPPE II scores among the three groups of newborns with different ages of admission in the neonatal intensive care unit. The mean of SNAP II was significantly higher in patients who evolved to death when compared to survivors in all groups. SNAPPE II was higher in those who died for groups 1 (0-6 days) and 3 (15-28 days), but not for group 2 (7-14 days), and the ROC curve (Receiver Operator Characteristic) for both scores showed an area below the curve with a moderate value for group 1 - 0.76 (CI 95% 0.67-0.85) and group 3 - 0.74 (CI 95% 0.52 - 0.95), but not in the group 2 - 0.60 (CI 95% 0.30-0.90), a fact attributed to the small number of patients in this group. The site where the research was performed is a pediatric hospital and all admitted patients are transported.

A very important variable is neonatal transport, which may influence the clinical deterioration of the patient at admission. Most of the patients studied were not transported adequately, which may have contributed to their severity at admission, and TRIPS (Transport Risk Index of Physiologic Stability) was not performed due to lack of data prior to transport.

The cohort study in the United States showed the importance of standardized comparison of mortality among services by adjusting the severity of the patient's illness using the SNAP II and SNAPPE II scores and the influencing differences in mortality rate assistance.

In the cohort study conducted in Brazil, newborns between 23 and 33 weeks of gestational age were included, excluding those with major congenital malformations and those transported from other hospitals, since these data increase the chance of death. Preterm births between 23 and 25 weeks were included for their survival in epidemiological

networks in developed countries, although viability in the maternity hospitals studied was around 26 weeks. Differences were observed in the prognosis of the patients in the units involved in the research. Early neonatal death was associated with care practices such as: non-use of antenatal corticosteroids, worsening of respiratory distress syndrome; the Apgar less than seven in the fifth minute; the absence of maternal hypertension and the center where the patient was born. SNAPPE II greater than 39 was considered the cut-off point as a predictor of death, and each point of the score increased by 7% the chance of death in 95% of the newborns who had the information for the score.

The observational study, conducted in India, showed that SNAPPE II is a good predictor of death regardless of gestational age, but it has the limitation of being an admission score and can not correctly predict death in neonates who remain longer hospitalized in the neonatal intensive care unit and develop other morbidities such as hospital infection.

The cohort performed in Australia, comparing CRIB II and SNAPPE II as predictors of death in preterm infants between 23 weeks and 31 weeks and six days of gestational age, shows that CRIB II is simpler to calculate since four of the five items of the score are collected on admission, not requiring a maximum time limit for collection. Although both had been shown to be good predictors of death, only 28% of the newborns had a gestational age of less than 27 weeks, with a predominance of newborns between 28-31 weeks, which had a better evolution, being a limitation of the study.

The observational research conducted in Iran on the assessment of neonatal mortality risks emphasizes the increasing importance of using the severity score in neonates admitted to neonatal intensive care units. This research shows that in the analysis of the relationship of death with the variables birth weight, gestational age, SNAPPE II and Apgar in the fifth minute, the last two were the most significant in the prediction of neonatal deaths.

When comparing the two scores, SNAPPE II and CRIB, in the observational study conducted in Turkey, involving neonates younger than 32 weeks of gestational age and birth weight of less than 1,500 grams, SNAPPE

II, with 0.74 in the area below showed a better predictor of death than CRIB, with the area below the curve of 0.54. SNAPPE II has more criteria of physiological instability. Perhaps, therefore, it is more a predictor of death than CRIB. A disadvantage of the CRIB is the variable fraction inspired by maximum and minimum oxygen, as it depends on the care of each center, and this interferes in the score of the score, being higher in places where the treatment is less appropriate. He also concluded that SNAPPE II is better than CRIB as a predictor of death among infants less than 1,500 grams and this power is higher in the group with antenatal corticoid.

In the analytical observational study carried out in Paraguay, with 288 newborns between 27-42 weeks, 54% were transferred from other hospitals of lower complexity, a fact that contributes to the severity of these patients at admission, since 24% evolved to death. SNAP II and SNAPPE II demonstrated the area below the curve of 0.79 and 0.77, with 95% confidence interval, respectively, and the best cutoff point in the ROC curve of nine, with a sensitivity of 70% and specificity of 76% for SNAP II and of 12.5 with a sensitivity of 71% and specificity of 75% for SNAPPE II, showing that both are good predictors of death. The relationship of these scores to hospital stay was analyzed by linear regression, $r = 0$ for SNAP II and $r = 0.03$ for SNAPPE II, with no significant relation.

CONCLUSION

This integrative review shows that the possibility of measuring the severity of the disease in the neonate in neonatal intensive care units, through the use of severity scores, allows the adequate comparison between services and the standardization of good perinatal and neonatal practices, contributing to reduce neonatal mortality and, consequently, infant mortality.

Most studies recommend the use of severity scores in services. SNAPPE II is the most used score, it can be applied to all newborns regardless of birth weight and gestational age, and all the studies have shown that it is a good predictor of death in neonatal intensive care units.

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