Original Article

DOI: 10.7860/IJNMR/2024/63004.2405

Paediatrics Section

Mortality Risk Assessment by SNAP-II and SNAPPE-II among Very Low Birth Weight Newborns- An Observational Study

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ABSTRACT

Introduction: Very Low Birth Weight (VLBW) babies are those with a birth weight of less than 1500 gm and require special care, attention, and resources. However, despite all efforts, their mortality rate remains high. Proper assessment of these neonates is crucial to identify high-risk cases and take early steps to reduce mortality. In addition to technical advances in neonatal care, severity scores have been developed to predict neonatal mortality. Richardson developed the Score for Neonatal Acute Physiology (SNAP-II) and SNAP with Perinatal Extension (SNAPPE-II) as scoring systems for predicting mortality in the Neonatal Intensive Care Unit (NICU).

Aim: To assess the usefulness of SNAP-II and SNAPPE-II as predictors of mortality in VLBW neonates.

Materials and Methods: This was an observational cross-sectional study involving 145 VLBW neonates admitted to the NICU of North Bengal Medical College and Hospital (NBMCH) from May 2019 to April 2020. Relevant data were collected to assess the mortality risk scores SNAP-II and SNAPPE-II. The outcome of discharge or death was recorded. Data entry was performed using MS excel and analysed using Statistical Package for Social Sciences (SPSS) version 20.0. The relationship between newborn survival and SNAP-II or SNAPPE-II final scores was determined using the Mann-Whitney U test, and the relationship between survival and various SNAP-II and SNAPPE-II score categories was determined using Fisher's-Exact Test. A p-value of less than 0.05 was considered statistically significant. An ROC curve was generated to determine the best cutoff score for predicting mortality.

Results: The mean scores of SNAP-II and SNAPPE-II were higher in babies who expired compared to those who survived. The mean (±SD) SNAP-II scores were 8.96 (±13.865) for survived newborns and 41.08 (±23.174) for expired newborns. The mean (±SD) SNAPPE-II scores were 20.01 (±14.54) for survived newborns and 48.85 (±25.02) for expired newborns. The optimal cutoff values for SNAP-II and SNAPPE-II in predicting mortality were 31.5 and 36, respectively. The sensitivity and specificity of SNAP-II were 83.0% and 89.1%, while for SNAPPE-II they were 69.8% and 89.1%, respectively.

Conclusion: The mean SNAP-II and SNAPPE-II scores were higher among expired VLBW neonates compared to those who survived. A SNAP-II score of 31.5 and SNAPPE-II score of 36 were associated with higher mortality, indicating that both scores are effective predictors of mortality regardless of Gestational Ages (GA) and birth weight.

Keywords: Gestational age, Illness severity score, Neonatal mortality, Preterm

INTRODUCTION

Lower birth weight is a crucial public health issue due to its strong relationship with infant mortality and morbidity. Nearly 4%-7% of live births have very low birth weight (less than 1500g) [1]. Despite efforts, these babies account for approximately 30% of early neonatal deaths [1]. While infant mortality rates have been decreasing globally, the decline in neonatal mortality has been slow. The Neonatal Mortality Rate decreased from 52 per 1000 births in 1990 to 28 per 1000 births in 2013 [2]. According to NFHS-5, the Neonatal Mortality Rate was reported as 24.9 per 1000 live births in 2021 [3]. Although survival is directly related to birth weight and inversely related to gestational age, these factors alone do not solely determine neonatal mortality. Other physiological and perinatal factors, particularly disease severity, also play a significant role [4-6]. In addition to technical advancements in neonatal care over time, the development of illness severity scores has become necessary to identify newborns with severe diseases or increased risk of mortality. This enables early intervention and optimal healthcare delivery to reduce neonatal mortality [7].

The severity of illness can be determined using four general approaches in paediatric and adult research: diagnosis-based, risk factor-based, therapy-based, and physiology-based [8]. Among these approaches, only the physiology-based scores genuinely reflect the patient's condition and minimise measurement bias. Recent advances in neonatology have led to the development of physiology-based scoring methods [9]. In 1993, a physiology-based scoring method called "SNAP" was introduced to predict mortality and morbidity for neonates of any birth weight [10]. SNAP is based on physiological factors and includes 34 routine laboratory parameters and available vital signs. SNAPPE incorporates weight after birth, Small for Gestational Age (SGA) status, and the APGAR score at five minutes post-birth in addition to SNAP [11,12]. However, SNAP, as a newborn illness severity score, is challenging to use due to its complex and numerous factors.

To address these issues, a second-generation SNAP score was validated, which was made easier by reducing the number of score items [13]. SNAP-II incorporated six physiological parameters: lowest temperature, urine output (mL/kg/hr), mean blood pressure, multiple seizures, lowest pH, and the ratio of partial oxygen pressure to inspired oxygen. On the other hand, SNAPPE-II considered SGA, birth weight, and the five-minute post-birth APGAR score in addition to SNAP-II [13]. Both SNAP-II and SNAPPE-II, being physiology-based scores, offer various advantages. They are universal across different ICUs, generally

applicable across diagnoses and conditions, objective, countable, and reasonable. Moreover, they can be obtained within a brief period after admission, and their sequential scoring reflects changes in the patient's condition. However, a disadvantage is that data collection for these scores can be time-consuming [8]. SNAPPE-II is only useful if calculated within the first 12 hours after birth, as perinatal factors remain constant over time. On the other hand, SNAP-II is based solely on physiological parameters, which can be measured over time. Therefore, the SNAP-II score can also be used to estimate the severity of illness later in the course. SNAPPE-II score is an effective predictor of mortality regardless of gestational age, but it is not a good predictor of morbidity. A mean score of 37 was associated with higher mortality [14].

The SNAPPE-II score recorded within the first 48 hours of life can be a reliable predictor of mortality in babies admitted to the NICU [15]. Additionally, both SNAP-II and SNAPPE-II are useful and superior tools in predicting mortality compared to the APGAR score at 5 minutes after birth [16]. Numerous studies have been conducted abroad to assess the effectiveness of various illness severity scores, including SNAP-II and SNAPPE-II, in predicting neonatal mortality [16-19]. However, there is a lack of data in the Indian context. Furthermore, very few studies have demonstrated the effectiveness of both of these scores in a single study conducted in Indian settings, particularly among very low birth weight (VLBW) babies, who have a high mortality rate. In this study, the authors aim to evaluate the usefulness of SNAP-II and SNAPPE-II as predictors of mortality in VLBW neonates in the NICU.

MATERIALS AND METHODS

An observational cross-sectional study was conducted on VLBW neonates admitted to the NICU in the Paediatric Department of North Bengal Medical College and Hospital, Siliguri, West Bengal, India,, from May 2019 to April 2020. Ethical clearance was obtained from the Institutional Ethics Committee of NBMCH (memo number: IEC/NBMC/2018-19/38) prior to the initiation of the study. Informed consent was obtained from the parents or guardians of the newborn babies beforehand.

Sample size estimation: The sample size was calculated using the formula for a descriptive study, considering that VLBW mortality varies from 14.8% to 40.9% among birth cohorts reported from India [20]. Assuming a prevalence (P) of 40%, a confidence interval of 95%, an absolute error of 10%, and a non-response rate of 10%, the minimum sample size required was determined to be 103. A total of 152 VLBW neonates were admitted to the NICU during the study period, and after considering the exclusion criteria, seven were excluded. Therefore, the final sample size of the study comprised 145 neonates.

Inclusion criteria: Newborn babies with a birth weight between 1000 grams and 1500 grams who were admitted to the NICU during the study period.

Exclusion criteria: Neonates with a gestational age less than 22 weeks, neonates with any major congenital malformation, newborn babies who died within 12 hours of life, parents not giving consent, and newborn babies who left against medical advice (LAMA) were excluded from the study.

Study Procedure

Within 12 hours of NICU admission, non-invasive mean blood pressure was measured using the proper cuff size in either of the arms via a multichannel monitor (PHILIPS-MX430/MX450 monitor). The temperature was measured at the axilla using a digital thermometer (ROSSMAX). The ratio of serum pH to PaO2/fiO2 was estimated by performing an arterial blood gas analysis using an OPTI-CCA-TS blood gas analyser. All types of seizures were also considered for this score. Urine output was monitored using a urine collection bag or catheterisation. After one minute and five minutes, the APGAR score [21] and birth weight were noted from the baby information sheet. Gestational age (GA) was determined using antenatal ultrasonography (USG), the modified Ballard score [22], and the last menstrual period (LMP). Fenton's Growth Chart [23] (2013) was applied to classify small for gestational age (SGA). Data were collected for each variable of both scores after 12 hours of admission and entered into a master chart. Points were assigned based on the values obtained for each variable, as described in [Table/Fig-1,2]. The total score was calculated by summing the points for all six variables for SNAP-II score and all nine variables for SNAPPE-II scores.

Parameters	Range	Point
1. Lowest temperature	<35°C	15
	35-35.6°C	8
	>35.6°C	0
2. Lowest mean blood pressure	<20 mmHg	19
	20-29 mmHg	0
	>29 mmHg	9
3. Lowest serum pH	<7.10	16
	7.10-7.19	7
	>7.19	0
4. The ratio of PaO2/FiO2	<0.3	28
	0.3-0.99	16
	1.0-2.49	5
	>2.49	0
5. Urine output	<0.1 mL/BW/hour	18
	0.1-0.9 mL/BW/hour	5
	>0.9 mL/BW/hour	0
6. Seizure	Multiple	5
	No	0

[Table/Fig-1]: Variables used for calculating SNAP-II scores [13].

Parameters	Range	Point
1. Lowest temperature	<35° C	15
	35-35.6° C	8
	>35.6° C	0
2. Lowest mean blood pressure	<20 mmHg	19
	20-29 mmHg	0
	>29 mmHg	9
3. Lowest serum Ph	<7.10	16
	7.10-7.19	7
	>7.19	0
4. The ratio of PaO_2/FiO_2	<0.3	28
	0.3-0.99	16
	1.0-2.49	5
	>2.49	0
5. Urine output	<0.1 mL/BW/hour	18
	0.1-0.9 mL/BW/hour	5
	>0.9 mL/BW/hour	0

6. Seizure	Multiple	5
	No	0
7. APGAR score at five min	<7	18
	>7	0
8. Small for Gestational Age (SGA)	<3rd percentile	12
	>3rd percentile	0
9. Birth weight	<750 g	17
	750-999 g	10
	>999 g	0

[Table/Fig-2]: Variables used for calculating SNAPPE-II scores [13].

STATISTICAL ANALYSIS

The data entry in MS excel was conducted for SPSS version 20.0. The data were checked for normal distribution using a test for normality, and a non-parametric test was performed accordingly. The non-parametric test used to determine the relationship between newborn survival and SNAP-II or SNAPPE-II final score was the Mann-Whitney U test. The relationship between newborn survival and various categories of SNAP-II and SNAPPE-II final scores was determined using Fisher's Exact Test. To assess the sensitivity, specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) in predicting neonatal mortality, validation analysis of both scores was performed using the number of expired and survived VLBW neonates. An ROC curve was generated to identify the best cut-off score for predicting mortality. A p-value of less than 0.05 was considered statistically significant.

RESULTS

In the current study, out of 145 VLBW neonates, the majority 91(62.8%) were males, while 54 (37.2%) were females. Among them, 142 newborns were preterm (97.9%), and only 3 (2.1%) were term. Out of the 145 newborn babies, 53 (36.6%) expired. Since none of these deaths occurred within 12 hours of life, all of them were included in the present study.

The mean (SD) SNAP-II score was 20.70 (±23.587), and among 74 (51%) babies, the score was ≤ 9. The mean (SD) SNAPPE-II score was 30.55 (±23.54), and among 48 (33.1%) babies, the score was 10-19 [Table/Fig-3,4]. Higher scores were associated with higher mortality, as 30 (85.7%) VLBW neonates died with a SNAP-II score of 40 or more, and 29 (85.3%) VLBW neonates died with a SNAPPE-II score of 50 or more, which was statistically significant (p<0.001) [Table/Fig-5,6]. The mean (±SD) for SNAP-II was 8.96 (±13.86) and 41.08 (±23.17), and the mean (±SD) for SNAPPE-II was found to be 20.01 (±14.54) and 48.85 (±25.02) for survived and expired newborns, respectively [Table/Fig-7,8].

SNAP-II score		Values
Mean (±SD)	**20.70 (±23.587)**	
Median (IQR)	**8.0 (0.0-37.0)**	
Categories	**Frequency (n)**	**Percentage (%)**
≤9	74	51.0
10 to 19	20	13.8
20 to 29	9	6.2
30 to 39	7	4.8
≥ 40	35	24.1
Total	145	100.0

[Table/Fig-3]: Distribution of SNAP-II score among study subjects (n=145).

SNAPPE-II score		Values
Mean (±SD)	**30.55 (±23.54)**	
Median (IQR)	**20.0 (12-47)**	
Categories	**Frequency (n)**	**Percentage (%)**
≤ 9	15	10.3
10 to 19	48	33.1
20 to 29	26	17.9
30 to 39	16	11.0
40 to 49	06	4.3
≥ 50	34	23.4
Total	145	100.0

[Table/Fig-4]: Distribution of SNAPPE-II score among study subjects (n=145).

SNAP-II	Survived N (Percent) (N=92)	Expired N (Percent) (N=53)	p-value
≤9	67 (90.5%)	7 (9.5%)	**0.001***
10 to 19	15 (75.0%)	5 (25.0%)	
20 to 29	2 (22.2%)	7 (77.8%)	
30 to 39	3 (42.9%)	4 (57.1%)	
≥40	5 (14.3%)	30 (85.7%)	

[Table/Fig-5]: The relationship between newborn's survival and SNAP-II score (n=145).
Test applied: Fisher's-Exact Test, *statistically significant p-value <0.05

SNAPPE-II	Survived No. (Percent)	Expired No. (Percent)	p-value
≤9	12 (80.0%)	3 (20.0%)	**0.001***
10 to 19	43 (89.6%)	5 (10.4%)	
20 to 29	18 (69.2%)	8 (30.8%)	
30 to 39	11 (68.8%)	5 (31.2%)	
40 to 49	03 (50%)	3 (50%)	
≥50	05 (14.7%)	29 (85.3%)	

[Table/Fig-6]: The relationship between newborn's survival and SNAPPE-II score (n=145).
Test applied: Fisher's-Exact Test, *statistically significant p-value <0.05

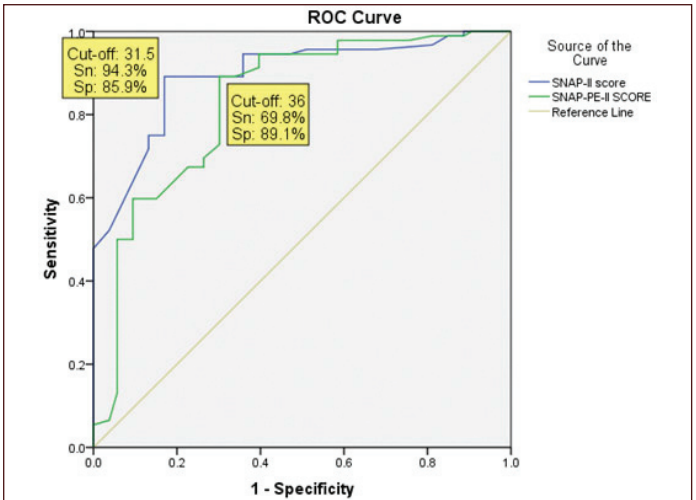
SNAP-II	Survived	Expired	Statistics
Median (IQR)	5 (0-14.5)	47 (20-56)	**p<0.001***
Mean±SD	8.96±13.865	41.08±23.174	

[Table/Fig-7]: The relationship between newborn's survival and SNAP-II final score (n=145).
Mann-Whitney U test; *Statistically significant p-value <0.05

SNAPPE-II	Survived	Expired	Statistics
Median (IQR)	14 (12-27)	56 (22-67)	**p<0.001***
Mean±SD	20.01±14.54	48.85±25.02	

[Table/Fig-8]: The relationship between newborn's survival and SNAPPE-II final score (n=145).
Mann-Whitney U test; * Statistically significant p-value <0.05

The Area Under the Curve (AUC) by using Receiver Operating Characteristic (ROC) for SNAP-II was 0.894, and for SNAPPE-II, it was 0.830, indicating a strong predictive value for newborn survival. The optimum cut-off value was noted as 31.5 for SNAP-II and 36 for SNAPPE-II in mortality prediction. For SNAP-II scores of 31.5 and above, the sensitivity, specificity, PPV, and NPV were noted as 83.0%, 89.1%, 81.5%, and 90.1%, respectively. For SNAPPE-II scores of 36 and above, the sensitivity, specificity, PPV, and NPV were noted as 69.8%, 89.1%, 78.7%, and 83.7%, respectively [Table/Fig-9,10].



[Table/Fig-9]: Optimum cut-off value, sensitivity and specificity of SNAP-II and SNAPPE-II score for identifying VLBW newborns with poor outcomes (n=145).

Measures of validity	SNAP-II	SNAPPE-II
Sensitivity	83.0%	69.8%
Specificity	89.1%	89.1%
PPV	81.5%	78.7%
NPV	90.1%	83.7%

[Table/Fig-10]: Sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) of SNAP-II and SNAPPE-II (n=145).
PPV: Positive predictive value; NPV: Negative predictive value

DISCUSSION

The present study was conducted among 145 VLBW neonates to assess the usefulness of SNAP-II and SNAPPE-II as predictors of mortality among VLBW neonates. It was observed that the mean SNAP-II and SNAPPE-II scores were higher in the VLBW newborns who expired compared to those who did not. Higher scores of both SNAP-II and SNAPPE-II were associated with a greater number of mortalities among the VLBW newborns. Additionally, it was observed that both SNAP-II and SNAPPE-II scores showed a good association with mortality among the VLBW newborns.

In the present research, the mean (±SD) for SNAP-II was 8.96 (±13.86) and 41.08 (±23.17), while the mean (±SD) for SNAPPE-II was found to be 20.01 (±14.54) and 48.85 (±25.02) for the survived and expired newborns, respectively. This result was consistent with the study conducted by Harsha SS and Archana BR, which reported the mean (±SD) for SNAPPE-II as 21.04 (±15.418) and 45.72 (±18.689) for the survived and expired newborns, respectively [14]. Another study conducted by Mia RA et al., found similar findings, with SNAPPE-II scores of 17.4±14.05 and 42.75±18.59 for survived and expired babies, respectively [16]. A similar finding was also reported in a study conducted by Radfar M et al., where the mean (±SD) for SNAP-II was 9 (±6) and 49 (±15), and the mean (±SD) for SNAPPE-II was 15 (±25) and 69 (±33) for survived and expired babies, respectively [17]. Similar findings were also demonstrated in a study done in Nepal, where a significantly higher median (IQR) for SNAPPE-II score was seen in the babies who expired compared to those who survived {57 (42-64) vs 22 (14-32), $p < 0.001$} [18].

In the present research, both SNAP-II and SNAPPE-II (AUC=0.894 and 0.830, respectively) had strong predictive value for newborns' survival. Radfar M et al., reported a similar observation with even stronger values for both SNAP-II and SNAPPE-II (AUC=0.994 and 0.992, respectively) [17]. In contrast, Rachuri S et al., reported a much lower AUC for SNAPPE-II (0.622 vs. 0.830) in a study at a tertiary care hospital compared to the present study [15]. This difference could possibly be due to the inclusion of newborn babies with congenital heart diseases, which is an independent risk factor for mortality regardless of the SNAPPE-II score. Helal NF et al., found an AUC ROC of 0.699 (95% CI 0.58-0.818) for SNAP-II in predicting death [19]. Similarly, a study conducted in India at the NICU of Indira Gandhi Institute of Child Health, Bangalore, reported an AUC of 0.849 for SNAPPE-II [14]. Muktan D et al., reported an AUC of 0.917 (95% CI 0.854-0.980) in Nepal for a SNAPPE-II score of ≥ 38 [18].

In the present study, the optimum cut-off value was noted at 31.5 for SNAP-II and 36 for SNAPPE-II in predicting mortality. For SNAP-II scores of 31.5 and above, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were noted as 83.0%, 89.1%, 81.5%, and 90.1%, respectively. For SNAPPE-II scores of 36 and above, sensitivity, specificity, PPV, and NPV were noted as 69.8%, 89.1%, 78.7%, and 83.7%, respectively. Rachuri S et al., reported a similar observation, considering SNAPPE-II scores higher than 34 as a good predictor of mortality with a sensitivity of 78.8% and specificity of 47% [15]. Harsha SS and Archana BR reported that SNAPPE-II scores of 37 and above had 87.1% specificity, 76.9% sensitivity, and 95.3% predictive value for mortality [14]. The study by Muktan D et al., reported that a score ≥ 38 had sensitivity, specificity, PPV, and NPV of 84.4%, 91%, 66.7%, and 96.5%, respectively, in estimating overall mortality [18]. Sundaram V et al., reported in a study that SNAP-II scores higher than 40 had specificity, sensitivity, NPV, and PPV of 60%, 86.6%, 88%, and 56.5%, respectively, in predicting mortality [24].

Limitation(s)

To determine the usefulness of SNAP-II and SNAPPE-II as predictors of mortality and establish causal relationships, a study with a multidisciplinary approach would be more appropriate. Since the data were collected upon admission, the subsequent clinical course was not taken into consideration. Consequently, some very low birth weight (VLBW) newborn babies with lower scores in the first hour of life experienced mortality as their clinical condition deteriorated due to hospital-acquired infections. Therefore, the outcome of those VLBW neonates could not be accurately predicted by both scores, considering the development of hospital-acquired infections later in their course.

CONCLUSION(S)

Both SNAP-II and SNAPPE-II scores are reliable and efficient predictors of hospital mortality among newborn VLBW babies. They help medical professionals identify the very sick VLBW neonates and provide early and proper care, reducing mortality in the NICU. They also play a crucial role in making parents aware of the disease's severity, possible outcome, and the probable cost of treatment. Therefore, SNAP-II and SNAPPE-II scores should be routinely used in every NICU setup. They will also guide health policymakers in allocating resources for neonatal care.

REFFERENCES

[1] Su YY, Wang SH, Chou HC, Chen CY, Hsieh WS, Tsao PN, et al. Morbidity and mortality of very low birth weight infants in Taiwan-Changes in 15 years: A population-based study. J Formos Med Assoc. 2016;115(12):1039-45.
[2] Sankar MJ, Neogi SB, Sharma J, Chauhan M, Srivastava R, Prabhakar PK, et al. State of newborn health in India. J Perinatol. 2016;36(3):S03-08.
[3] International Institute for Population Sciences (IIPS) and ICF. 2021. National Family Health Survey (NFHS-5), 2019-21: India. Mumbai: IIPS.

[4] Richardson DK, Phibbs CS, Gray JE, McCormick MC, Workman-Daniels K, Goldmann DA. Birth weight and illness severity: Independent predictors of neonatal mortality. Paediatrics. 1993;91(5):969-75.

[5] Petridou E, Richardson DK, Dessypris N, Malamitsi-Puchner A, Mantagos S, Nicolopoulos D, et al. Outcome prediction in Greek neonatal intensive care units using a score for neonatal acute physiology (SNAP). Paediatrics. 1998;101(6):1037-44.

[6] Marshall G, Tapia JL, D'apremont I, Grandi C, Barros C, Alegria A, et al. A new score for predicting neonatal very low birth weight mortality risk in the NEOCOSUR South American Network. J Perinatol. 2005;25(9):577-82.

[7] Pollack MM, Koch MA, Bartel DA, Rapoport I, Dhanireddy R, ElMohandes AA, et al. A comparison of neonatal mortality risk prediction models in very low birth weight infants. Paediatrics. 2000;105(5):1051-57.

[8] Richardson DK, Tarnow-Mordi WO. Measuring illness severity in newborn intensive care. J Int Care Med. 1994;9(1):20-33.

[9] Maiya P, Nagashree S, Shaik M. Role of score for neonatal acute physiology (SNAP) in predicting neonatal mortality. Indian J Paediatr. 2001;68(9):829-34.

[10] Richardson DK, Gray JE, McCormick MC, Workman K, Goldmann DA. Score for Neonatal Acute Physiology: A physiologic severity index for neonatal intensive care. Paediatrics. 1993;91(3):617-23.

[11] Escobar GJ, Fischer A, Li DK, Kremers R, Armstrong MA. Score for neonatal acute physiology: Validation in three Kaiser Permanente neonatal intensive care units. Paediatrics. 1995;96(5):918-22.

[12] Morse S, Groer M, Shelton MM, Maguire D, Ashmeade T. A systematic review: The utility of the revised version of the score for neonatal acute physiology among critically ill neonates. J Perinat Neonatal Nurs. 2015;29(4):315.

[13] Richardson DK, Corcoran JD, Escobar GJ, Lee SK. SNAP-II and SNAPPE-II: Simplified newborn illness severity and mortality risk scores. J Paediatr. 2001;138(1):92-100.

[14] Harsha SS, Archana BR. SNAPPE-II (score for neonatal acute physiology with Perinatal extension-II) in predicting mortality and morbidity in NICU. J Clin Diagn Res. 2015;9(10):SC10.

[15] Rachuri S, Paul S, Jaidev MD. SNAPPE-II score: Predictor of mortality in NICU. Int J Contemp Paediatr 2019;6(2):422-26.

[16] Mia RA, Etika R, Harianto A, Indarso F, Damanik SM. The use of score for neonatal acute physiology perinatal extention II (SNAPPE-II) in predicting neonatal outcome in neonatal intensive care unit. Paediatrica Indonesiana. 2005;45(11-12):24145.

[17] Radfar M, Hashemieh M, Fallahi M, Masihi R. Utilization of SNAP-II and SNAPPE-II scores for predicting the mortality rate among a cohort of Iranian newborns. Arch Iran Med. 2018;21(4):153-57.

[18] Muktan D, Singh RR, Bhatta NK, Shah D. Neonatal mortality risk assessment using SNAPPE-II score in a neonatal intensive care unit. BMC Pediatr. 2019;19:01-04. https://bmcpediatr.biomedcentral.com/articles/10.1186/s12887-019-1660-y

[19] Helal NF, Samra NM, Abdel Ghamy E, Said E. Can the Score for Neonatal Acute Physiology II (SNAPII) predict morbidity and mortality in neonates with sepsis. J Neonatal Biol. 2013;2(2):121.

[20] Chawla D. Survival of very-Low-birth-weight neonates in India. Indian Journal of Paediatrics. 2021;88(4):326-27.

[21] Cnattingius S, Johansson S, Razaz N. Apgar score and risk of neonatal death among preterm infants. N Eng J Med. 2020;383(1):49-57.

[22] Aggarwal M, Simalti AK, Negi V, Parik B. Assessment of gestational age by modified ballard score and its correlation with assessment based on ultrasound and date of last menstrual period. Journal of Medical Academics. 2022;4(2):48-50.

[23] Fenton TR, Kim JH. A systematic review and meta-analysis to revise the Fenton growth chart for preterm infants. BMC Pediatr. 2013;13(1):01-03.

[24] Sundaram V, Dutta S, Ahluwalia J, Narang A. Score for neonatal acute physiology II predicts mortality and persistent organ dysfunction in neonates with severe septicemia. Indian Pediatr. 2009;46(9):775-80.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Feb 06, 2023
- Manual Googling: Aug 29, 2023
- iThenticate Software: Sep 01, 2023 (13%)

ETYMOLOGY: Author Origin

EMENDATIONS: 8

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes (parent)
- For any images presented appropriate consent has been obtained from the subjects Yes (parent)

Date of Submission: **Jan 28, 2023**
Date of Peer Review: **Apr 13, 2023**
Date of Acceptance: **Sep 02, 2023**
Date of Publishing: **Mar 31, 2024**