e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(11); 325-332

Original Research Article

Assessment of Paediatric Risk of Mortality Score (PRISM III) As A Predictor of Mortality in PICU

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Received: 20-09-2023 / Revised: 19-10-2023 / Accepted: 13-11-2023

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Conflict of interest: Nil

Abstract

Background: The Pediatric Risk of Mortality III (PRISM III) score is a widely used clinical scoring system designed to assess the severity of illness and predict mortality risk in pediatric patients admitted to the Intensive Care Unit (ICU). Developed in 1996, PRISM III builds upon its predecessors, PRISM and PRISM II, refining the predictive accuracy and clinical utility. We in this study tried to assess the pediatric mortality risk using PRISM III in the patients admitted to our hospital.

Methods: This study was conducted in the Department of Pediatrics, Nilofer Hospital Hyderabad. The clinical status upon arrival in the Pediatric Intensive Care Unit (PICU) will be documented, with emphasis on the condition at PICU arrival rather than the Emergency department arrival. For variables 1–5 (clinical parameters), the most aberrant reading in the initial 24 hours will be recorded, encompassing the monitoring of vital parameters such as blood pressure, heart rate, temperature, pupillary reaction, and Glasgow Coma Scale. Laboratory parameters will include values obtained at the time of admission.

Results: A total of 300 cases were included in the study. Out of patients with a PRISM III score of 7-10, 23.5% died. Out of patients with a PRISM III score greater than 10, 68.4% died. There is a clear relationship between PRISM III score and mortality. The higher the PRISM III score, the higher the risk of death. This is because the PRISM III score is a measure of the severity of illness, and patients with more severe illnesses are more likely to die. Associated factors with mortality are high in patients on ventilators with a risk of 11.2, followed by a GCS score of 7.67 risk. If 7.5 is set as the cut-off value for the PRISM III Score, then the sensitivity is 82.4 and the specificity is 62.1.

Conclusion: In conclusion, this study underscores the imperative need for standardized scoring systems for pediatric critical care. The PRISM III score has emerged as a valuable tool for predicting mortality outcomes in the PICU, providing clinicians with a reliable means of assessing severity and making informed decisions.

Keywords: Pediatric Mortality, Pediatric Intensive Care Unit, PICU, PRISM III (Pediatric Risk of Mortality III) score.

Introduction

Pediatric and neonatal intensive care in India has significantly improved in recent years. The establishment of numerous tertiary care hospitals equipped with advanced infrastructure and a dedicated workforce reflects the growing demand for specialized intensive care unit (ICU) services in rural India. While the need for aggressive treatment of critically ill infants and children, along with sophisticated equipment, is widely acknowledged, comprehensive reporting of the outcomes of intensive care in India has been relatively limited. The outcome assessment of intensive care requires accurate and easily applicable methods to evaluate both the patients and their overall outcomes. Estimating the risk of mortality in the ICU is crucial for physicians to assess patient prognosis, plan appropriate therapies, and evaluate performance

and resource utilization within the ICU. [1-3] Recognizing the subjective nature of mortality risk prediction by pediatricians, there is a clear need for a quantitative scoring system for patients admitted to the Pediatric Intensive Care Unit (PICU). Clinical scoring systems have become indispensable tools in ICU care. One of the early scoring systems in pediatrics, the Index of Physiological Stability score (1984), comprised 34 variables. [4] In 1988, Pollack et al. introduced the Paediatric Risk of Mortality (PRISM) score, consisting of 14 variables, for predicting mortality in PICU. [5] Subsequently, PRISM was refined into PRISM III (17 variables) in 1996, with the addition of three variables by Pollack. PRISM III, tested among 11,165 patients in 32 PICUs across the USA, demonstrated superior results in predicting mortality compared to PRISM. [6] The Pediatric Index of Mortality (PIM), consisting of eight variables, has gained popularity in Europe, particularly for immediate use upon patient admission. [7] However, the drawback of mortality-predicting models lies in their population sensitivity, necessitating a pilot study before implementation in any PICU. While PRISM III has shown success in various PICUs, an Italian study conducted in 26 PICUs did not fully support its predictive power. [8-12] Against this backdrop, the present study aimed to assess the utility of Pediatric Risk of Mortality Score III as a predictor of mortality in the PICU of a tertiary care hospital.

Material and Methods

This prospective study was conducted in the Department of Pediatrics, Niloufer Hospital, Hyderabad. Institutional Ethical approval was obtained for the study after following the protocol for human research. Written consent from parents/guardians of the participants was obtained after explaining the nature of the study in the vernacular language. After obtaining written informed consent from parents/guardian detailed history, physical examination, and systemic examination is performed and recorded in a predesigned pro forma.

Inclusion criteria

1. All children aged from 1 month to 12 years were admitted to PICU in Niloufer Hospital, Hyderabad.

Exclusion criteria

1. Patients in ICU for less than 2 hours
2. Aged below one month
3. Presence of multiple congenital anomalies
4. Patients admitted with continuous CPR who do not achieve stable vital signs for 2 hours
5. Parents for willing to give consent

PRISM III scoring, encompassing both clinical and laboratory data, will be conducted once during admission or within 24 hours after admission, utilizing a pretested pro forma. The clinical status upon arrival in the Pediatric Intensive Care Unit (PICU) will be documented, with emphasis on the condition at PICU arrival rather than the Emergency department arrival. For variables 1–5 (clinical parameters), the most aberrant reading in the initial 24 hours will be recorded, encompassing the monitoring of vital parameters such as blood pressure, heart rate, temperature, pupillary reaction, and Glasgow Coma Scale. Laboratory parameters will include values obtained at the time of admission. The patient's course throughout their PICU stay will be meticulously observed, and outcomes will be documented. Each record will be assigned a PRISM III score, covering systolic blood pressure (mm Hg), heart rate (beats per minute), temperature (°F), pupillary reflexes, mental status assessed by Glasgow Coma Scale (GCS), pH, pCO_2 (mm Hg), HCO3- (mEq/L), PaO_2 (mm Hg), glucose (mg/dl), potassium (mmol/L), creatinine (mg/dl), blood urea nitrogen (mg/dl), white blood cell count (cells/mm^3), platelet count, and PT/PTT.

Statistical Analysis:

All the data were pooled into Statistical Package for Social Science (SPSS) software version 23.0 (IBM, Armonk, NY) and all the analyses were carried out through it. The continuous variables such as age were reported as means or medians with standard deviations. T-test and chi-square tests were used to find any relation between different variables. The receiver operating characteristics (ROC) curve was plotted to find the sensitivity and specificity of PRISM III. The Hosmer and Lemeshow goodness-of-fit chi-square test was carried out to see the goodness of the predictive model. Data were collected, and the PRISM III score was calculated within 24 hours of admission at PICU. PRISM III score evaluation was done as per the recommendation of Pollack et al. [6]. The outcome was calculated from the total score achieved by each patient as the survivor versus the non-survivor.

Results

Total number of cases enrolled in this study are 300 cases. In these cases, age-wise distribution, sex-wise distribution, diagnosis and mortality analysis, the association between PRISM III Score and outcome, and associated factors like shock, assisted ventilation and GCS were analyzed. Among 300 participants majority 53% (159) were children (between >1 to <6 yrs) of age. The Mean age was 4.3±3.6yrs (Table 1). Out of 300 children, 53% (159) were males and 47% (141) were females.

Table 1: Age-wise distribution of study participants

Age group	Frequency (N)	Percentages (%)
Infants	96	32
Children (1-5 years)	159	53
Children (6-12 years)	45	15
Total	300	100

Diagnosis of the children enrolled was classified based on the system involved and the distribution of the diseases is given below. Neurological diseases were the major cause of admission to the PICU, followed by infections and respiratory diseases.

Table 2: Clinical diagnosis in the present study

Clinical diagnosis	Frequency (N)	Percentages (%)
Neurological	98	32.7
Cardiovascular	25	8.3
Respiratory	68	22.6
Gastrointestinal	15	5
Renal	3	1
Hematological	8	2.7
Infections	68	22.7
Others	15	5
Total	300	100

Subjects with miscellaneous and cardiovascular diagnoses have more discharges and the death rate is high in gastrointestinal and renal failure cases, with an overall mortality of 28.3% depicted in Table 3.

Table 3: Diagnosis and Mortality Analysis

Diagnosis	Total	Discharged	Discharged%	Died	Died %
Neurological	98	68	69.4	30	30.6
Cardiovascular	25	21	84	4	16
Respiratory	68	55	80	13	19
Gastrointestinal	15	2	13.3	13	86.7
Renal	3	1	33.3	2	66.6
Hematological	8	3	37.5	5	62.5
Infections	68	50	73.5	18	26.5
Others	15	15	100	0	0
Total	300	215	71.7	85	28.3

Table 4 shows that out of patients with a PRISM III score less than 7, only 7.4% died. Out of patients with a PRISM III score of 7-10, 23.5% died. Out of patients with a PRISM III score greater than 10, 68.4% died. The table shows a clear relationship between PRISM III score and mortality. The higher the PRISM III score, the higher the risk of death. This is because the PRISM III score is a measure of the severity of illness, and patients with more severe illnesses are more likely to die.

Table 4: Association between ranges of PRISM III Score and Outcome

	Outcome		
PRISM III Score	**Died**	**Discharge**	**Total**
<7	9	113	122
7-10	24	78	102
>10	52	24	76
Total	85	215	300

Table 5 shows the number and percentage of patients with neurological diseases who died, as well as the overall mortality rate. The most common neurological diseases in the table were acute encephalitis and pyogenic meningitis, followed by seizure disorder/status epilepticus and Guillain-Barre syndrome. The mortality rate for neurological diseases varies depending on the specific disease. The highest mortality rate was for cervical cord lesions (100%), followed by TB meningitis (50%). The mortality rate for all neurological diseases combined was 30.6%. The table suggests that neurological diseases are a significant cause of mortality, particularly in patients with cervical cord lesions and TB meningitis.

Table 5: Neurological diseases and mortality.

Neurological diseases	*Total*	*%*	*Died*	*%*
Acute encephalitis	38	38.7	13	34.21
Pyogenic meningitis	25	26	6	24.00
Seizure disorder/status epilepticus	15	15.3	4	26.67
Guillain-Barre syndrome	5	5	1	20.00
TB meningitis	6	6	2	50.00
Cervical cord lesion	4	4	4	100.00
Hydrocephalus	3	3	0	0.00
Bulbar palsy	2	2	0	0.00
Total	*98*	*32.7*	*30*	*30.6*

Table 5 shows the number and percentage of patients with neurological diseases who died, as well as the overall mortality rate. The most common neurological diseases in the table were acute encephalitis and pyogenic meningitis, followed by seizure disorder/status epilepticus and Guillain-Barre syndrome. The mortality rate for neurological diseases varies depending on the specific disease. The highest mortality rate was for cervical cord lesions (100%), followed by TB meningitis (50%). The mortality rate for all neurological diseases combined was 30.6%. The table suggests that neurological diseases are a significant cause of mortality, particularly in patients with cervical cord lesions and TB meningitis.

Table 6: Respiratory diseases and infection and their mortality

Diagnosis	*Frequency*	*%*	*Mortality*	*%*
Respiratory diseases	68	22.3	13	19.11
Bronchopneumonia	44	64.7	8	18.18
Pyopneumothorax	5	7.3	4	80.00
Pneumothorax	3	4.4	0	0.00
Bronchial asthma	4	5.8	0	0.00
Croup	3	4.4	1	33.33
Bacterial tracheitis	2	2.9	0	0.00
Bronchiectasis	2	2.9	0	0.00
Vocal cord palsy	2	2.9	0	0.00
Bronchiolitis	3	4.4	0	0.00
Infections	68	22.7	18	26.47
Dengue hemorrhagic fever	43	63.2	7	16.27
Septic shock	20	29.4	8	40.00
Cerebral malaria	5	7.3	3	60.00

Table 6 shows the frequency and mortality rate of various respiratory diseases and infections. The most common respiratory diagnosis in this table was bronchopneumonia, followed by pyopneumothorax and croup. The most common infection in this table was dengue hemorrhagic fever, followed by septic shock and cerebral malaria. The mortality rate for respiratory diseases and infections in this table was relatively high, with an overall mortality rate of 26.47%. The highest mortality rate was for pyopneumothorax (80.00%), followed by cerebral malaria (60.00%) and septic shock (40.00%). The lowest mortality rate was for pneumothorax (0.00%), followed by bronchial asthma (0.00%), bacterial tracheitis (0.00%), bronchiectasis (0.00%), vocal cord palsy (0.00%), and bronchiolitis (0.00%). Despite having the highest frequency of cases, bronchopneumonia has a relatively low mortality rate (18.18%). This suggests that bronchopneumonia is often treatable, but it can still be fatal in some cases. Septic shock has a relatively high frequency (29.4%) and mortality rate (40.00%). This suggests that septic shock is a serious and life-threatening condition that requires prompt treatment. Cerebral malaria has a relatively low frequency (7.3%) but a very high mortality rate (60.00%). This suggests that cerebral malaria is a very serious and life-threatening condition, even with prompt treatment. Overall, it is found respiratory diseases and infections are a significant cause of mortality, especially for patients with certain diseases and infections, such as pyopneumothorax, cerebral malaria, and septic shock. It is important to seek prompt medical attention if you

are experiencing symptoms of any respiratory disease or infection.

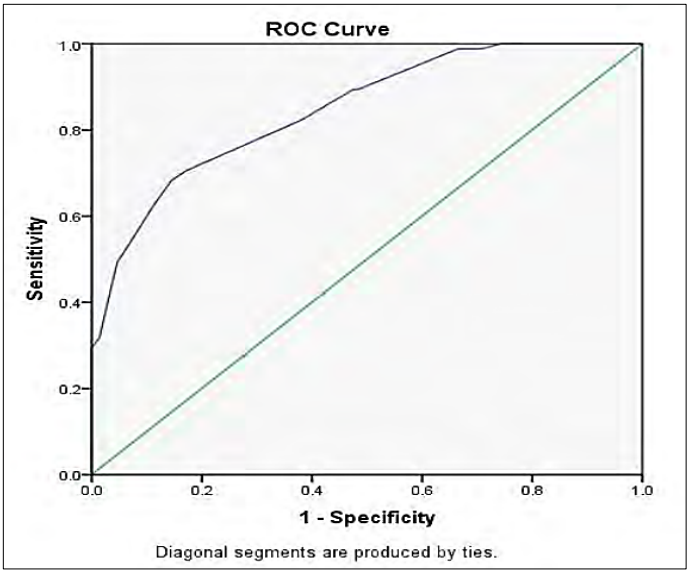

Figure 1: ROC curve of PRISM III score in the cases of the study

Associated factors with mortality are high in patients on ventilators with a risk of 11.2, followed by a GCS score of 7.67 risk. If 7.5 is set as the cut-off value for PRISM III Score, then the sensitivity is 82.4 and the specificity is 62.1 (Figure 1)

Discussion

Pediatric patients are particularly vulnerable and require standardized care in critical medical situations. However, establishing standard pediatric critical care presents challenges, as protocols in Pediatric Intensive Care Units (PICUs) are often adapted from adult critical care practices. The lack of consistency among physicians in assessing patient mortality highlights the need for an objective and reproducible clinical prognostic scoring system. [13] An ideal scoring system should be institution- and population-independent, well-calibrated, possess high discrimination, easily utilize recordable variables, and predict post-critical care quality of life. Initially designed for trauma patients, scoring systems use specific anatomical or physiological methods. Previously, scoring systems were developed for trauma patients and were either specific anatomical methods (abbreviated injury scale-1974) or specific physiological Methods. [14] The first scoring system in PICU was the Therapeutic Intervention Scoring System (TISS), it was mainly based on the fact that "therapeutic intensity defines the severity of illness". [14] Then came the APACHE (Acute Physiology and Chronic Health Evaluation) score in 1981 which was based on 34 laboratory and clinical parameters. [14] Among the first PICUs were the Therapeutic Intervention Scoring System (TISS) and Acute Physiology and Chronic Health Evaluation (APACHE) score. [14] The Physiology Stability Index (PSI) in 1984 was the first physiology-based scoring system for assessing acute illness severity in PICU patients. However, this method is time-consuming. In 1996, the Pediatric Risk of Mortality (PRISM) score, which proved to be a simple and effective tool, was introduced. Another widely used score is the Pediatric Index of Mortality (PIM). [15] This study focused on assessing the utility of the PRISM III score in predicting mortality outcomes for patients in our tertiary care hospital's PICU. Over 18 months and 300 participants, the majority were children aged 1 to 10 years.

In the present study done over a period of 18 months, among 300 participants majority 53% (159) were children (between >1 to<10 yrs) of age. The Mean age was 4.3 ± 3.6yrs 53% (159) were males and 47% (141) were females. In MM Nasser et al. [16] study the median age of the studied patients was 8 months, and 58 subjects (58.00% of the sample) were males. PK Dey et al. [17] study showed a maximum number of patients belonged to the category of 60 months to 120 months and gender distribution showed 147(65.3%) were males and 78 (34.6%) were females. Males outnumbered females in each age category. Abbas Q et al. [18] studied 231 patients admitted to PICU. The mean age was 67 ±50 months, 54% (n=125) were under-five and 138 (59.7%) were males, S Mirza et al. [19] study with the majority being males (54.5%). The mean age was 27±33 months. The mean age of the study population by Pollack et al. [5], who reported a mean age

of 33 months, and initial reports from China reflected similar findings where severe and critical cases were reported in 10.6% of children aged less than one year. [20, 21] However, multiple reports from the USA have found that older children (> 12 years) are the most vulnerable group for PICU admission. [35,36] Neurological (32.6%) was the major cause of admission to the PICU, followed by infections and respiratory diseases (22.6%). Bell et al. [22] 26.2% of acutely ill children were admitted to PICU with neurological diagnosis.

The overall mortality rate was 28.3%, with bronchopneumonia (61.5%) being the leading cause of death among respiratory diseases. This study establishes a direct relationship between the PRISM III score and mortality, indicating that as the PRISM III score increased, so did the mortality rate. Factors such as ventilator use and Glasgow Coma Scale (GCS) scores were associated with higher mortality risk. Children with neurological diagnoses in the PICU had a longer hospital length of stay and greater hospital costs. [23] Recently, Elbeleidy et al. [24] described the pattern of neurological disorders in their PICU, which constituted 30% of the total PICU admissions. This is similar to the observations of another study conducted by El-Nawawy et al. [25] Several studies have reported that CNS infections are the major cause of acute neurological illness and non-traumatic coma in children from developing countries, including meningitis, encephalitis, and cerebral malaria. [26, 27] On the other hand, the rates of CNS infections in PICU of developed countries were low. Infections of the CNS in our study were acute encephalitis syndrome (n=38). Reports from developing countries have shown that CNS-related infections constitute approximately 50% of all acute neurological disorders. Acute seizures, status epilepticus, and traumatic brain injuries were the most common causes of PICU admissions in the USA. [23] Acute encephalitis syndrome (38.7%) was the most common cause of death in neurological cases in our PICU. Typpo et al [28] reported similar data, as did a study that involved PICUs in England, Wales, and Scotland. [29] However, the most common cause of death in children without a chronic illness is encephalopathy/encephalitis. Previous studies have reported cardiovascular disease as the most common chronic condition, followed by neuromuscular diseases and respiratory problems [29, 30] and our study reported similar findings. The Pediatric Risk of Mortality III (PRISM III) score and mortality, that is, as the PRISM III score increases, the mortality rate also increases. This finding was similar to research carried out in India. [31] Statistical analyses conducted in this study revealed a significant correlation between the PRISM III score and mortality. The area under the Receiver Operating Characteristic (ROC) curve was 0.848, indicating excellent discrimination and accuracy. This study's findings align with international research, emphasizing the effectiveness of the PRISM III score in predicting mortality in PICUs. In the present study out of 300 participants 215 (71.6%) cases recovered and got discharged and 85 (29.4%) cases died so the probability of death increases significantly with an increase in PRISM score. This is similar to the findings of other studies by Singhal et al. [32], where the mortality rate was 18%. However, a study by Ahmed El Nawawy [25] in Egypt reported a high death rate of 50.49%. With the increase in PRISM III and PIM 3 scores, there was an increase in the percentage of mortality, as PRISM III median scores were 37.9 among non-survivors and 1.2 among Survivors, and PIM 3 median scores were 22.6 among non-survivors and 20.1 among Survivors.

Conclusion

In conclusion, this study underscores the imperative need for standardized scoring systems for pediatric critical care. The PRISM III score has emerged as a valuable tool for predicting mortality outcomes in the PICU, providing clinicians with a reliable means of assessing severity and making informed decisions. These findings emphasize the importance of resource allocation and practice in PICUs to enhance patient outcomes. This study contributes to the broader conversation on improving pediatric critical care and highlights the significance of evidence-based approaches in optimizing patient care in this vulnerable population.

References

1. Keene AR, Cullen DJ. Therapeutic intervention scoring system: update 1983; Crit Care Med. 1983; 11:1-3.
2. Pollack MM, Ruttimann UE, Getson PR: Accurate prediction of the outcome of pediatric intensive care. N Engl J Med. 1987; 316:134-139.
3. Pollack MM, Ruttimann UE, Glass NL, Yeh TS. Monitoring patients in pediatric intensive care. Pediatrics. 1985; 76:719-724.
4. Yeh TS, Pollack MM, Ruttimann UE, Holbrook PR, Fields AI. Validation of a physiologic stability index for use in critically ill infants and children. Pediatr Res. 1984; 18:445-451.
5. Pollack MM, Ruttimann UE, Getson PR. Pediatric Risk of Mortality (PRISM) score. Crit Care Med. 1988; 16:1110-1116.
6. Pollack MM, Patel KM, Ruttimann UE. PRISM III: an updated pediatric risk of mortality score. Crit Care Med. 1996; 24:743-527.
7. Shann F, Pearson G, Slater A, Wilkinson K. Paediatric index mortality (PIM): a mortality

prediction model for children in intensive care. Intensive Care Med. 1997; 23:201-207.
8. De León AL, Romero-Gutiérrez G, Valenzuela CA, González-Bravo FE. Simplified PRISM III score and outcome in the pediatric intensive care unit. Pediatr Int. 2005; 47:80-83.
9. Varma A, Damke S, Meshram R, Vagha J, Kher A, Vagha K. Prediction of mortality by pediatric risk of mortality (PRISM III) score in tertiary care rural hospital in India. Int J Contemp Pediatr. 2017; 4:322-331.
10. Alkhalifah AS, AlSoqati A and Zahraa J. Performance of Pediatric Risk of Mortality III and Pediatric Index of Mortality III Scores in Tertiary Pediatric Intensive Unit in Saudi Arabia. Front. Pediatr. 2022; 10: 926686.
11. Volakli EM, Mantzafleri PE, Sdougka M: Pediatric risk of mortality (PRISM III-24) performance in a Greek pediatric intensive care unit. The Greek E-Journal of Perioperative Medicine. 2013; 11:31-43.
12. Bertolini G, Ripamonti D, Cattaneo A, Apolone G: Pediatric risk of mortality: an assessment of its performance in a sample of 26 Italian intensive care units. Crit Care Med. 1998; 26:1427- 32.
13. Gemke RJ, Bonsel GJ, van Vught AJ. Effectiveness and efficiency of a Dutch pediatric intensive care unit: validity and application of the Pediatric Risk of Mortality score. Crit Care Med. 1994 Sep;22(9):1477-84.
14. Bhadoria Poonam, Bhagwat Amit. Severity Scoring Systems in Paediatric Intensive Care Units. Indian Journal of Anaesthesia 2008;52:Suppl(5):663-675.
15. Qiu J, Lu X, Wang K, Zhu Y, Zuo C, Xiao Z. Comparison of the pediatric risk of mortality, pediatric index of mortality, and pediatric index of mortality 2 models in a pediatric intensive care unit in China: A validation study. Medicine (Baltimore). 2017 Apr;96(14):e6431.
16. Mosallam M Nasser, Ahmed Y Al-Sawah, Wael R Hablas, Ahmed M Mansour. Reliability of pediatric risk of mortality III (prism III) and pediatric index of mortality 3 (pim3) scores in the pediatric intensive care unit of El-Hussein University Hospital. Al Azhar Journal of Ped. 2020; 23(49):1048-71.
17. PK Dey, JB Kumar Prusty, T Ghosh, S Kumar, J Choudhury. Prediction of mortality risk by application of Pediatric Risk of Mortality (PRISM) score in tertiary care Pediatric Intensive Care Unit-A prospective observational study JMSCR 2019; 7(4):54-61.
18. Abbas Q, Shabbir A, Siddiqui NR, Kumar R, Haque A. Burden of neurological illnesses in a pediatric intensive care unit of a developing country. Pak J Med Sci. 2014 Nov-Dec;30(6):1223-27.
19. Mirza S, Malik L, Ahmed J, Malik F, Sadiq H, Ali S, Aziz S. Accuracy of Pediatric Risk of Mortality (PRISM) III Score in Predicting Mortality Outcomes in a Pediatric Intensive Care Unit in Karachi. Cureus. 2020 Mar 31;12(3):e7489.
20. Dong Y, Mo X, Hu Y, Qi X, Jiang F, Jiang Z, Tong S. Epidemiology of COVID-19 Among Children in China. Pediatrics. 2020 Jun;145(6):e20200702.
21. Feldstein LR, Tenforde MW, Friedman KG, Newhams M, et al. Characteristics and Outcomes of US Children and Adolescents with Multisystem Inflammatory Syndrome in Children (MIS-C) Compared with Severe Acute COVID-19. JAMA. 2021 Mar 16;325(11):1074-1087.
22. Bell MJ, Carpenter J, Au AK, Keating RF, Myseros JS, Yaun A, et al. Development of a pediatric neurocritical care service. Neurocrit Care. 2009;10(1):4–10.
23. Moreau JF, Fink EL, Hartman ME, Angus DC, Bell MJ, Linde-Zwirble WT, et al. Hospitalizations of children with neurologic disorders in the United States. Pediatr Crit Care Med. 2013;14(8):801–810.
24. Elbeleidy SA E-A, Algebaly FH, Alkhatib MN. Pattern of neurological dysfunctions in pediatric intensive care unit. J Pediatr Intesive Care. 2013;2:105–110.
25. Ahmed El-Nawawy. Evaluation of the outcome of patients admitted to PICU in Alexandria using the PRISM score. Journal of Tropical Paediatrics 2003 Apr;49(2):109-14.
26. Ahmed S, Ejaz K, Shamim MS, Salim MA, Khan MUR. Non-traumatic coma in pediatric patients: etiology and predictors of outcome. J Pak Med Assoc. 2011;61(7):671.
27. Bansal A, Singhi SC, Singhi PD, Khandelwal N, Ramesh S. Nontraumatic coma. Indian J Pediatr. 2005;72(6):467–473.
28. Typpo KV, Petersen NJ, Petersen LA, et al. Children with chronic illness return to their baseline functional status after organ dysfunction on the first day of admission in the pediatric intensive care unit. J Pediatr 2010;157:108–13.
29. Hardelid P, Dattani N, Gilbert R, et al. Estimating the prevalence of chronic conditions in children who die in England, Scotland, and Wales: a data linkage cohort study. BMJ Open 2014;4:e005331.
30. Edwards JD, Houtrow AJ, Vasilevskis EE, et al. Chronic conditions among children admitted to U.S. pediatric intensive care units: their prevalence and impact on risk for mortality and prolonged length of stay. Crit Care Med 2012;40:2196–203.

31. Bora R. Prediction of mortality by pediatric risk of mortality (PRISM) III score In NGMC pediatric intensive care unit. JNGMC. 2019;17:5–9.

32. Singhal D, Kumar N, Puliyel JM, Singh SK, Srinivas V. Prediction of mortality by application of PRISM score in Intensive Care Unit. Indian Pediatrics 2001; 38: 714 – 719.