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Pediatric Index of Mortality (PIM) 2 Score as Predictor of Mortality in PICU

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Abstract: ***This is a prospective type of study done in paediatric intensive care unit (PICU) in GGH hospital, Jamnagar from January 2022 to October 2022 .Total 100 patients aged 1month to 12 yrs were included in this study as per inclusion and exclusion criteria. Data including demographics, diagnostic categories, duration of hospital stay, 10 variables, predicted death rate (PDR) measured by PIM 2 score was compared between survivors and non survivors. Using logistic regression analysis PIM 2 logit score was calculated and compared with the observed mortality value. In our study we found mortality is high among infants (50 %), M:F ratio is 1.3 : 1, respiratory diseases were major cause of admission in PICU(33%) , mortality was high among CNS disease (58%), Using ROC , cutoff for pim2 score was calculated was 99.8 , which predicts mortality with highest possible sensitivity and specificity , P value- 0.0031.Association factors such as presence of shock (odds ratio – 40, P value- 0.002), need for mechanical ventilation (odds ratio -38, P value -0.0001), GCS < 8 (odds ratio-16 , P value – 0.0015), were found to be significantly associated with the mortality , which was proven by odds ratio and P value.***

Keywords: PIM 2 score, mortality, Predicted death rate (PDR), Glasgow coma scale (GCS), receiver operator curve (ROC)

1. Introduction

Many illness severity scoring systems are being used for predicting the outcome of patients admitted to intensive care units (ICU). Although it is difficult to predict individual outcome of ICU patients accurately, there have been attempts to codify and validate models which may prognosticate groups of patients having similar presentations of the illness. Scoring systems are primarily being used to predict the general prognosis of patients but are also used as performance indicators of ICUs.

Pediatric Index of Mortality (PIM) was introduced by Shann *et a*l in 1997 to predict outcome in children admitted to ICUs. This system was revised (PIM-2) and published in the year 2003 and is supposedly better than the earlier version in outcome- predictability

Scoring systems and their need:
There is an increase in emphasis on the evaluation and monitoring of various aspects of health care services. Scoring systems aim at providing an objective and measurable value for any such service. The goal is to provide the highest quality of care with available resources to achieve best outcome. All scoring systems are designed to quantify and reduce a number of discrete but interrelated patient characteristics to a single value. This value can be used to compare and analyze disease severity, therapies used or final outcome. The scoring system forms the backbone of any hospital audit.

Aims and Objectives
Primary:
To evaluate the usefulness of PIM 2 score in predicting mortality in PICU in a tertiary care pediatric hospital.

Secondary:
To assess the associated factors predicting mortality such as need for assisted ventilation, presence of shock and poor Glasgow coma scale.

2. Material and Methods

This study was conducted in the children age group of one month to 12 yrs , who gets admitted in the paediatric intensive care unit of a tertiary care hospital. Data were collected within one hour of admission of patient by resident doctor who posted in PICU. Data includes demographics, diagnostics categories, duration of hospital stay, PIM 2 score will be calculated using 10 variables.

1) Elective admission to PICU
2) Recovery post procedure
3) Cardiac bypass
4) High risk diagnosis
5) Low risk diagnosis
6) No response of pupils to light
7) Mechanical ventilation
8) Systolic blood pressure
9) Base excess
10) Fio2 /PaO2 ratio

Yes/ no response for these variables was entered into the system (www.sfar.org/score2/pim22.html) for calculating PIM 2 LOGIT SCORE and PDR , which was calculated by the system using logistic regression equation and was compared with the observed mortality value.

Study Design: Prospective observational study to evaluate the usefulness of a diagnostic scoring system namely, PIM 2 score.

Study Place: Department of peadiatric intensive care unit (PICU), Guru Gobind Government Medical College and Hospital, Jamnagar.

Inclusion Criteria: All patients admitted in PICU, GGGH aged 1 month to 12 years.

Exclusion Criteria: Neonates were excluded from the study.

Risk Criteria: The child needed some invasive procedures like intubation, intercostal drainage, blood sampling depending on the clinical need of the child.

Statistics and Analysis: Using logistic regression equation

PIM 2 LOGIT score and Predicted death rate (PDR) was calculated.

Predicted death rate = eLogit / 1 + eLogit.

Results were analysed using Receiver Operative curve , to get cutoff for PIM 2 LOGIT Score, Odds ratio and P- Value were used to check the statistical significance.

3. Results

Total number of children admitted at PICU from Jan 2022 to Oct 2022 were 300. Among them, 100 consecutive children who met with the inclusion and exclusion criteria and whose parents consented for study were analyzed. The observation were discussed below

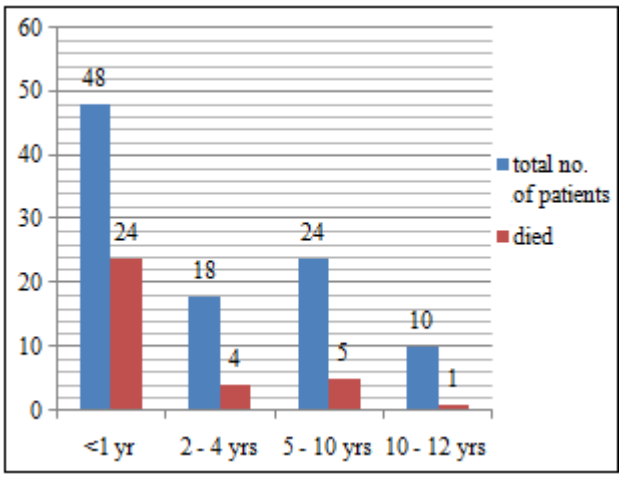
Table 1

	Total no .of patient studied	No. of males		No. of female		M:F
	N	N	%	N	%	
	100	55	55%	45	45%	1.3:1
No. of pt expired	34	17	50%	17	50%	

Out of 100 patients enrolled in our study, 55 were male and 45 were female, total no .of patients expired is 34 in which 17 were male and 17 were female.

Age Distribution with Percentage
Patient aged one month to 12 yrs were the study population.

Age distribution were given in the figure 1



From the figure, we infer that more than 50% patients were infants, mortality also more among them.

Gender distribution with percentage

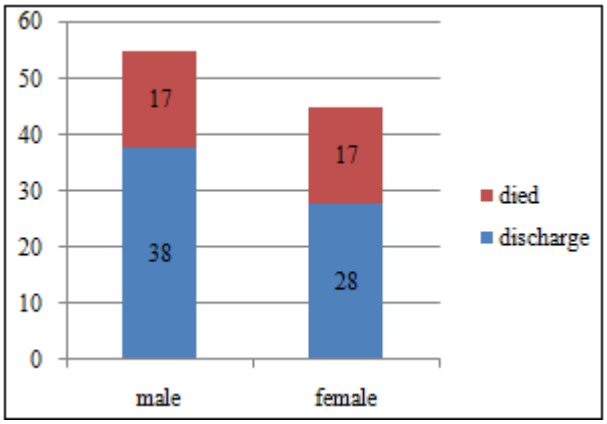


Figure 2

This figure, infers that the male to female ratio is 1.3:1

Clinical Diagnosis
The diagnosis of the children enrolled was classified based on the system involved and the distribution of the diseases, was shown in Fig. 3. Respiratory diseases are the major cases of admission in PICU followed by nervous system, cardiovascular system, gastrointestinal

Infectious other causes.

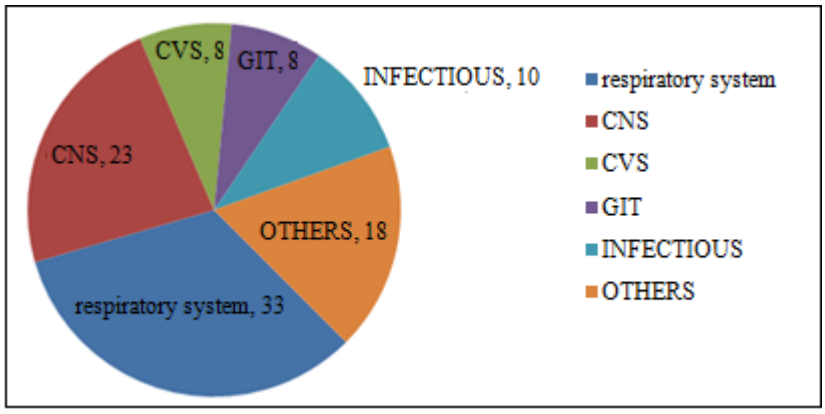


Figure 3

The diagnosis were classified into 6 broad categories and were given in Table .The tabular column was arranged as per total number of admissions in each system in descending order. Because of small sample size, children with DKA, Poisoning, scorpion sting, snake bite were included in others list.

Clinical Diagnosis with percentage

Table 2

Disease	Total	Discharged		Died	
		N	%	N	%
Respiratory System	33	23	70	10	30
CNS	23	11	47.8	12	52.2
CVS	8	5	62.5	3	37.5
GIT	8	5	62.5	3	37.5
Infectious Disease	10	6	60	4	40
DKA	2	2	100	-	-
Poisoning	5	4	66.67	1	33.33
Post OP	4	3	66.67	1	33.33
Snake Bite	5	4	66.67	1	33.33
Scorpion Bite	2	2	100	-	-

Table 3 shows the distribution of respiratory disease, which formed the major clinical diagnosis admitted in PICU

Table 3

Diagnosis	Total		Mortality	
	N	%	N	%
Respiratory disease	33		10	
Pneumonia	4	72.7	5	50
Bronchiolitis/episodic viral wheeze / asthma	4	12.12	2	20
Empyema	3	9	1	10
Pneumothorax	2	6.18	1	10

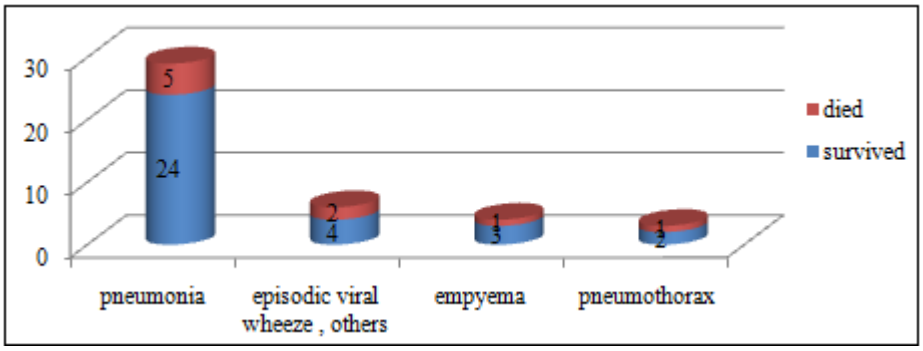


Figure 4: Respiratory diseases

Table 4: Neurological disease with percentage

Diagnosis	Total		Mortality	
	N	%	N	%
Neurological disease	23			12
Acute encephalitis	9	39.12	4	33.3
Pyogenic meningitis	6	26.05	3	25
TB meningitis	3	13	2	16.66
GBS	3	13	1	8.3
SOL	1	4.45	1	8.3
ADEM	1	4.45	1	8.3

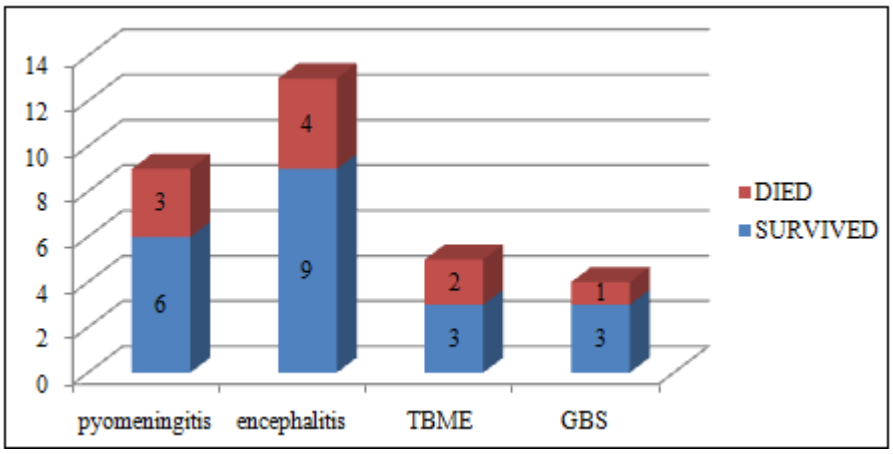


Figure 5: Neurological diseases

Table 6: Cardiovascular disease with percentage

Diagnosis	Total		Mortality	
	N	%	N	%
CVS DISEASE	8		3	
Acyanotic CHD	5	62.5	1	25
Cyanotic CHD	3	37.5	2	75

Mortality in highest for neurological disease , followed by infectious disease, cardiac diseases.

Distribution of PIM2 Score

The distribution of the PIM 2 (logit) score with the number of patients is shown in the following fig. There was clustering of cases in the region of PIM2 (logit) score 99.9 and 100.

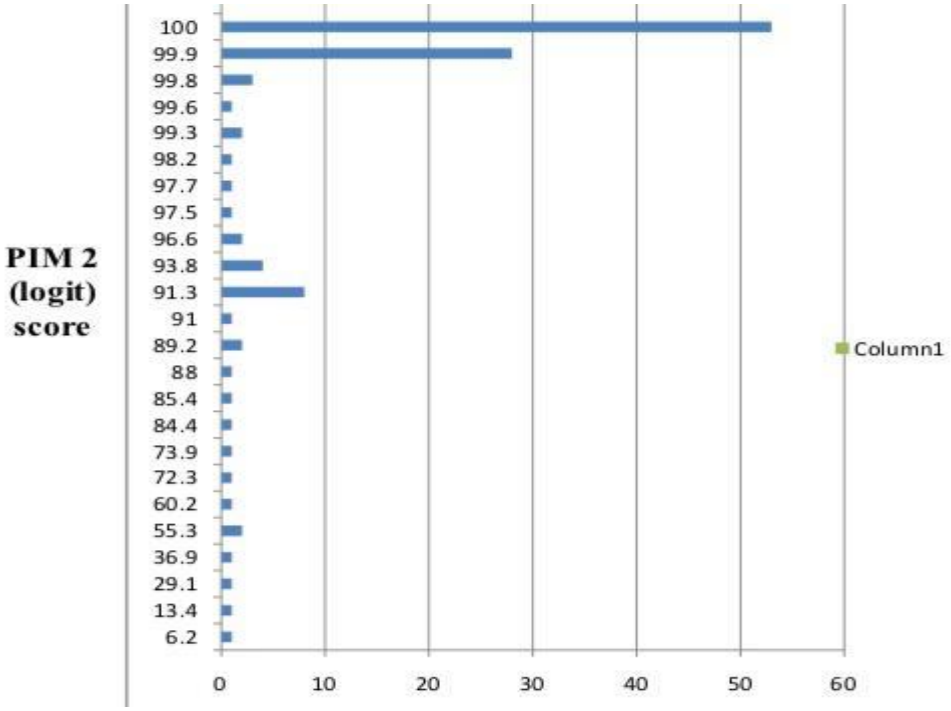


Figure 7: The Distribution of PIM 2 (Logit) Score

Mean : 94.26
Median : 99.9
Mode : 100

Mortality risk was found to be increasing with increase in the PIM 2 (logit) score. When the score was less than 90, mortality risk was 2% and while the score was between 90 and 99, the risk increased to 37%. When the score was above 99, mortality raised to 55%.This is given in Table.8

Table 8

PIM 2 LOG IT Score	Total Patients		Mortality	
	N	%	N	%
<90	38	38	1	2.6
90-99	8	8	3	37.5
>99	54	54	30	55.5

Receiver Operating Characteristic Curve:

To find out the cutoff of PIM 2 (logit) score which would predict the mortality optimally, receiver operating characteristic curve (ROC) was constructed. The best cutoff value at which sensitivity and specificity were optimal was 99.8.

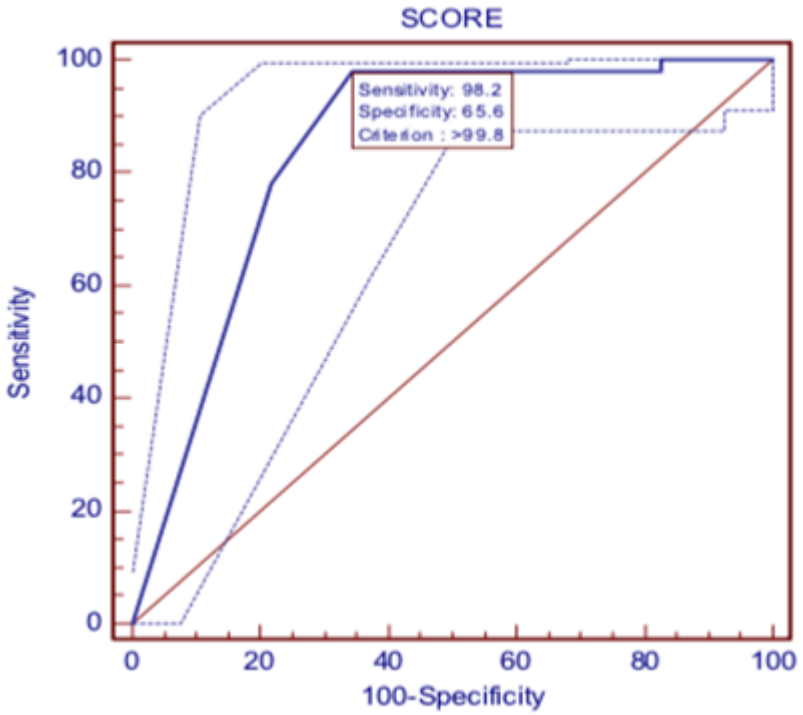


Figure 8: Receiver operating characteristic curve

From the figure, the area under the ROC curve was 0.843 with the 95% confidence interval being 0.765 to 0.903. The best cutoff of PIM 2 (log it) score was at 99.8 with a sensitivity of 98.2% and specificity of 65.6%

Area under Curve: 0.843 (95% C.I: 0.765, 0.903)
Sensitivity at criterion 99.8: 98.18
Specificity at criterion 99.8: 65.62
Positive predictive value at criterion 99.8: 71.1
Negative predictive value at criterion 99.8: 97.7

PIM 2 (Logit) Score and Mortality
Based on observation, cut off for PIM 2 (log it) score which predicts mortality with highest possible sensitivity and specificity, from ROC curve was arrived as 99.8. The analysis was done for those who had score less than or equal to 99.8 and those who had more than 99.8. Those who had a score of less than or equal to 99.8, had a mortality risk of 26.3% and those who crossed it had a higher mortality (55.6%) rate. The difference was statistically significant.(p-value 0.003).

PIM 2 (Logit) Score and Mortality

Table 9

PIM2 LOGIT Score	Died		Discharged	
	N	%	N	%
>99.8	29	55.3	23	44.3
<99.8	5	10.4	43	89.1

Chi-square value : 8.797
P value : 0.0031

Associated Factor Analysis
Common risk factors for poor outcome like patient with Glasgow come scale score of less than 8, those who presented with shock and those who required mechanical ventilation were analysed to find out whether there was any statistically significant association with mortality.

All variables were found to be statistically significant

Table 9

Factors	Discharged		Death		P value
	N	%	N	%	
Shock					
Present	8	21.6	29	78.3	0.002
Absent	58	92	5	7.9	
Mechanical ventilation					
Required	5	16.1	26	83.8	0.0001
Not required	26	76.4	8	23.5	
GCS					
<8	6	18.1	27	81.9	0.0015
>8	60	89.6	7	10.4	

Presence of shock:
Presence of shock is a common indication for admission to our PICU. There were about 37(37%) of total cases presented with shock. presence of shock had 40 times (odds ratio-40) increased risk for mortality

Presence of Glasgow scale scale <8 and mortality:
GCS is one of the important tools in assessing general condition of patients. In this study , 33 patients had Glasgow coma scale less than 8.

38 times (odds ratio- 38) increased risk of mortality when pt had Glasgow coma scale < 8 when compared to patient whose GCS > 8.

Need for ventilation:
Need for ventilation is a risk factor of mortality. Around 16 times risk (odds ratio- 16) is there for mortality in patients required mechanical ventilation than who did not required it.

4. Conclusion

1) PIM 2 score discriminated well between survivors and death at PICU of this tertiary pediatric care hospital.
2) PIM 2 score provides an objective assessment of severity of illness.
3) PIM 2 score helps to assess the severity of illness earlier (within an hour). Based on this, early vigorous management can be done in clinically borderline severe cases, which would have been missed otherwise and patients can be saved.
4) Associated factors such as presence of shock, need for mechanical ventilation were significantly associated with mortality.

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