ORIGINAL ARTICLE

https:/doi.org/10.3126/njms.v10i1.77664

Epidemiology of Pediatric Intensive Care Unit Admissions and Predictive Value of PEWS Score at Manipal Teaching Hospital, Pokhara: A 12-Month Observational Study

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Received: October 13, 2024 **Accepted: December 15, 2024** **Published: January 31, 2025**

Cite this paper: Timilsina M, Basnet S, Hirachan B. Epidemiology of Pediatric Intensive Care Unit Admissions and Predictive Value of PEWS Score at Manipal Teaching Hospital, Pokhara: A 12-Month Observational Study. *Nepal Journal of Medical Sciences*, 2025;10(1):19:22-30. https:/doi.org/10.3126/njms.v10i1.77664

ABSTRACT

Introduction: Pediatric Intensive Care Units (PICUs) play a crucial role in managing critically ill children, providing specialized life support and intensive monitoring. In Nepal infectious diseases, malnutrition, and limited access to healthcare are the primary drivers of pediatric critical illness. This study aims to assess the causes of PICU admissions and evaluate outcomes at Manipal Teaching Hospital (MTH) in Pokhara, Nepal.

Methods: This was a hospital-based, cross-sectional observational study conducted at MTH, Pokhara, Nepal, from October 2023 to September 2024. A total of 355 pediatric patients, aged 1 month to 15 years, were included. Sociodemographic details, clinical findings, and laboratory results were recorded through structured proformas and analyzed with SPSS.

Results: The average age of patients was 47.04 months (± 45.35), with 56.34% males and 43.66% females. Of the 355 patients, Pneumonias were the most common diagnosis 122 (34.4%), followed by sepsis 78 (22%) and status epilepticus 38(10.7%). The study found that 87.61% of patients improved, 7.61% left against medical advice, 2.54% died, and 2.25% were referred to other centers. Mortality was significantly higher among those diagnosed with pneumonia (p-value 0.05). The ROC curve showed an area under the curve (AUC) of 0.77, indicating that the PEWS score is an acceptable predictor of mortality in the PICU setting.

Conclusions: This study observed Pneumonia to be a significant contributor to adverse outcome in PICU patients. PEWS score serves as an acceptable prognostic tool for predicting mortality risk in pediatric ICU patients, with higher scores indicating increased risk.

Keywords: *Child mortality; Critical illness; Developing countries; Nepal; Pediatric intensive care units; Respiratory infections.*

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INTRODUCTION

Pediatric Intensive Care Units (PICUs) are essential for managing critically ill children, with admission causes influenced by regional healthcare and socioeconomic factors.[1,2] Globally, around 1.5% of hospitalized children require intensive care,[3] with infections and trauma being leading causes.[4] Low- and middle-income countries (LMICs) face higher PICU mortality between 9.7% to 14% due to resource limitations.[5-7] In Nepal, preventable diseases like pneumonia, sepsis, and malnutrition remain leading causes of morbidity and mortality.[8,9]

Early identification tools like the Pediatric Early Warning Score (PEWS) can help predict clinical deterioration and improve outcomes in PICUs [10,11] Manipal Teaching Hospital (MTH) in Pokhara, treats diverse pediatric cases but lacks data on PICU admission.

This study analyzes twelve months of PICU data to identify critical illness patterns, assess outcomes, and inform healthcare policy, aiming to enhance pediatric critical care and reduce morbidity and mortality in Nepal and similar settings.

METHODS

This was a prospective, observational study conducted at the Pediatric Intensive Care Unit (PICU) of Manipal Teaching Hospital (MTH) in Pokhara, Nepal, over a twelve-month period (October 2023 to September 2024.). The approval for the study was taken from the Institutional Review Committee (Reference number ID MCOMS/IRC/590/GA). Written informed consent was taken from all the patients. This study included all pediatric patients aged 1 month to 15 years who were admitted to the PICU during the study period. Patients with incomplete medical records and patients who did not provide informed consent were excluded from the study. Patients who were readmitted were also excluded from the study as they had already been included in the previous admission.

This study included all pediatric patients aged 1 month to 15 years who were admitted to the PICU during the study period. Structured questionnaires were used for data collection.

Sociodemographic characteristics and admitting diagnoses were obtained from history taking, physical examination, and laboratory tests done within 24 hours of admission.

Bedside Pediatric Early Warning Score (PEWS) was assigned and scores were noted at the time of admission.[12]

The PEWS components include the assessment of several parameters: Heart Rate (HR), Respiratory Rate (RR), Oxygen Saturation (SpO2), Mental Status/Consciousness, Response to Clinical Observation (Behavior), and Systolic Blood Pressure (SBP). For Heart Rate, 0 points are awarded if it is within the normal age-specific range, 1 point for mildly abnormal (tachycardia or bradycardia), and 2 points for severely

abnormal (significant tachycardia or bradycardia). Respiratory Rate is scored as 0 points for normal, 1 point for mildly abnormal (tachypnea or bradypnea), and 2 points for severely abnormal (severe tachypnea or bradypnea). Oxygen Saturation receives 0 points for ≥95%, 1 point for 90-94%, and 2 points for <90%. Mental Status/Consciousness is scored as 0 points for alert and responsive, 1 point for mildly altered (irritable or lethargic), and 2 points for severely altered (unresponsive or comatose). Behavior is scored as 0 points for normal (engaged and alert), 1 point for mildly abnormal (fussy, crying, or slightly agitated), and 2 points for severely abnormal (difficult to console, inconsolable, or unresponsive). Systolic Blood Pressure is scored as 0 points for normal for age, 1 point for mildly low (hypotension requiring observation), and 2 points for critically low (severe hypotension requiring intervention). The total score places the patient in one of three risk categories: 0-2 points indicates low risk, 3-4 points indicates moderate risk, and 5 or more points indicates high risk.

For patients who had multiple diagnoses, the principal author assigned the primary diagnosis to be either the most severe of those listed or the main diagnosis from which others were considered complications.

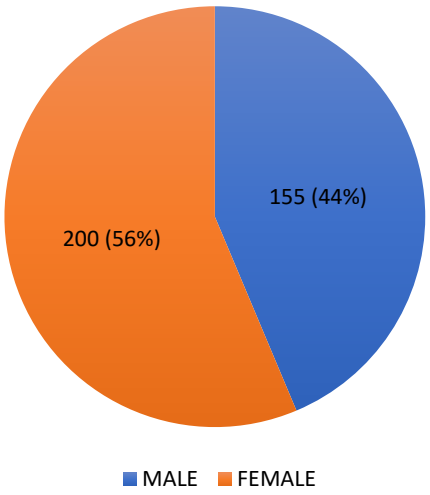
Data entry and analysis were done using SPSS version 25. Descriptive statistics were summarized in frequency distribution tables and pie charts. Findings with p-values <0.05 were considered statistically significant. Association between PEWS score and mortality were analyzed by Receiver Operating Characteristics (ROC) curve.

RESULTS

A total of 355 pediatric patients were admitted to the PICU during the study period. The average age was 47.04 months (± 45.35), The average age of admission was 50.14 months (+/-45.63) for females and 44.72 months (+/-45.35) for males with p-value of 0.26.

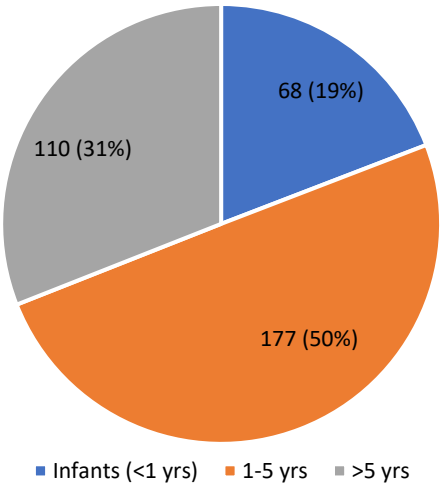
Total number of males were 200 (56.34%) and females 155 (43.66%) with M:F ratio 1.3:1 (Figure 1). The majority of patients (50.7%) were from the Kaski district, where Pokhara is located, while others came from surrounding districts.

Figure 1: Distribution of patients by sex (n=355)



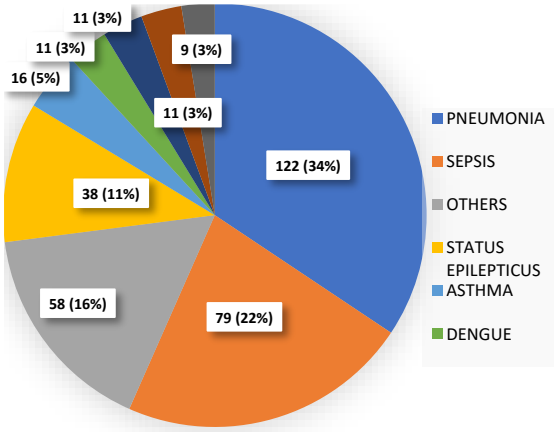
68 (19.15%) were <1 yrs group, 177 (49.86%) were between 1 and 5, and 110 (30.99%) were more than 5 yrs of age (Figure 2).

Figure 2: Distribution of patients by age group (n=355)



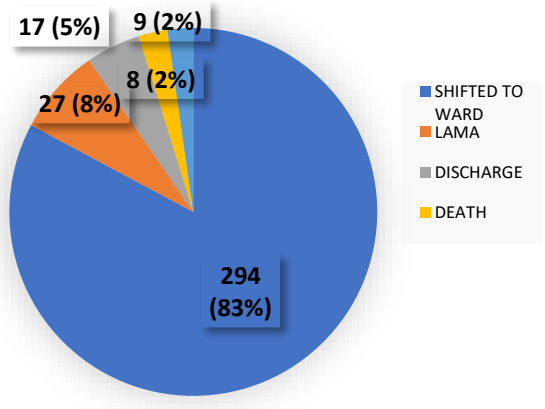
Pneumonias were the most common diagnosis 122 (34.4%), followed by Sepsis 78 (22%) and Status epilepticus 38(10.7%). Other conditions included Asthma, Meningitis, Dengue, Poisoning and other diseases (Figure 3).

Figure 3: Distribution of patients by Diagnosis (n=355)



The average length of stay (LOS) in the PICU was 2.06 days (± 1.65). Mean PICU stay was 1.93+/-1.48 for males and 2.23+/-1.84 for females with p-value 0.09. Of the 355 patients, 87.61% improved (82.82% shifted to ward, 4.79% discharged from PICU), 7.61% left against medical advice, 2.54% died and 2.25% referred to other center for further management (Figure 4). Fischer's exact test p-value 0.58. So, there was no difference in the outcome between males and females.

Figure 4: Distribution of patients by outcome (n=355)



Mortality was particularly high among those with Pneumonia (P-value 0.04).

There were 224, 84, and 47 patients with PEWS Score of 0-2, 3-4, and 5-12 with mortality rate of 0.45%, 5.95% and 6.38% respectively (Figure 5).

Figure 5: Distribution of patients by PEWS score (n=355)

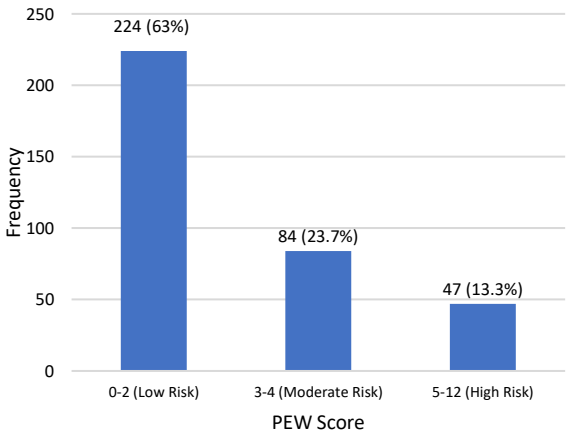
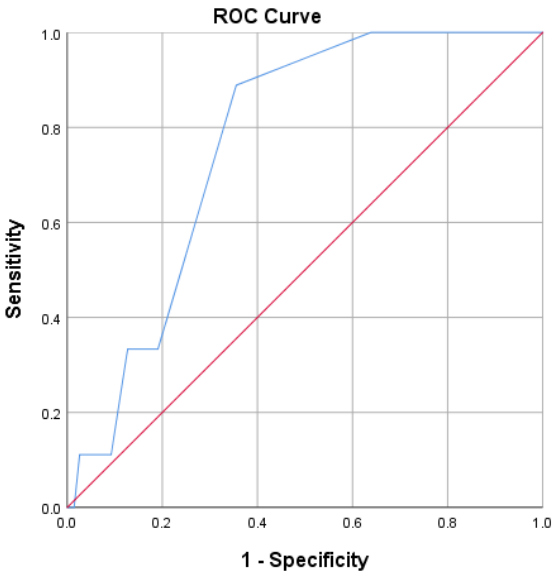


Table 1: Correlation of PEWS score with mortality (n=355)

PEWS Score Range	Total Cases	Mortality Cases	Mortality Rate
0-2 (Low Risk)	224	1	0.45%
3-4 (Moderate Risk)	84	5	5.95%
5-12 (High Risk)	47	3	6.38%

The ROC curve shows an area under the curve (AUC) indicating the predictive power of the PEWS score in assessing mortality. In this study, the AUC is 0.77, suggesting that the PEWS score is an acceptable as predictor of mortality (Figure 6).

Figure 6: The relation between PEWS score and mortality as show by ROC cure



DISCUSSION

The burden of pediatric critical illness in LMICs is particularly exacerbated by delayed healthcare interventions, which often lead to worse outcomes for children. [13] Inadequate access to early diagnosis and appropriate treatments for conditions like pneumonia, sepsis, and malnutrition increases the likelihood of severe disease progression and mortality. [14]

69% of the patients admitted to PICU in our study were less than 5 years of age, especially infants, which is similar to that in other studies from this region. [15,16]

In Nepal, the leading causes of pediatric ICU admissions have remained consistent over the years, with pneumonia, sepsis, and malnutrition being the predominant contributors to morbidity and mortality.[17] Pneumonias were the most common diagnosis 122 (34.4%) in our study. This is similar to other studies across Nepal. [15,18] In LMICs, the challenge is further compounded by the high prevalence of infectious diseases and limited availability of high-quality nutritional support in PICUs. [19] However, there is a need for more localized research to understand the unique challenges faced by pediatric critical care units in the country. Such studies could identify regional patterns of disease prevalence and guide resource allocation for pediatric critical care in Nepal. [20] The average length of stay (LOS) in the PICU was 2.06 days (± 1.65). This is less than average stay of 4.4 days (+/-6.1) in TUTH. [15] Other studies have found duration of stay to be longer if it is associated with health care associated infections. [21]

In our study, 7.61% patient opted to discontinue treatment and take the patient home against medical advice. This is significantly more than 4.36% in similar study at TUTH.[15] Majority of

patients were admitted from lower socioeconomic background and high cost of intensive care treatment seems to be major cause. [22] High number of patients opting to take patients home before completing treatment might be one of the reasons for relatively low mortality in our study.

In our study, out of 355 patients, mortality was 2.54% which is significantly less than 9.2% in a study conducted in Kathmandu and 14.8% in India. [15, 18, 23]

In our study, the performance of PEWS score showed an acceptable prediction of mortality with ROC showing 0.77 (77% correct prediction) the curve with a 95% confidence interval. A study was done in USA to assess the ability of PEWS to predict PICU admission and mortality within 24 hours of hospitalization. The ROC value was 0.71 for mortality, which is comparable to our study. [24]

Studies have found that PEWS consistently showed high sensitivity and moderate specificity for predicting adverse outcomes, including the need for PICU admission, cardiac arrest, or emergency interventions. [25]

The importance of early identification and management of critical illnesses cannot be overstated, particularly in settings like Nepal, where healthcare resources are limited. Timely intervention can significantly reduce the risk of complications and improve survival outcomes for critically ill children.[26]

This study has certain limitations. Firstly, the study is conducted in a single center, which may limit the generalizability of findings to other settings or populations. Secondly, while PEWS is a valuable tool for early detection of clinical deterioration, it lacks the predictive precision of more advanced scoring systems like Pediatric Risk of Mortality (PRISM), which incorporate detailed physiological and laboratory data. Additionally, PEWS does not account for specific comorbidities or underlying conditions that can influence outcomes, potentially limiting its applicability in more complex cases. Finally, this study on a small sample size of 355 in a single center may not be reliable enough to generalize over whole population.

CONCLUSIONS

This study provides valuable insights into the leading causes of pediatric critical illness and the risk factors that impact patient outcomes in the PICU at MTH, Pokhara. The findings suggest that respiratory infections, sepsis and seizure disorders are the most common diagnoses among critically ill children. Efforts to improve early diagnosis, enhance nutritional support, and expand vaccination programs are essential for reducing pediatric mortality and improving outcomes in critically ill children. Strengthening healthcare infrastructure and addressing socio-economic disparities will be critical in improving pediatric healthcare in Nepal and other LMICs.

CONFLICT OF INTEREST

NONE

SOURCE OF FUNDING

NONE

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