

# DEMOGRAPHIC, CLINICAL PROFILE, DIAGNOSIS, TREATMENT, AND OUTCOMES OF CRITICALLY ILL CHILDREN IN TERTIARY CARE HOSPITAL, INDIA

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## ABSTRACT

**Background:** Pediatric Intensive Care Units (PICUs) provide critical care for children with life-threatening illnesses. Identifying morbidity patterns and patient outcomes is crucial for improving pediatric critical care strategies. Objective: To analyze the morbidity pattern, length of stay (LOS), mortality rate, and nosocomial infection burden in a PICU. **Methods:** A retrospective, observational study was conducted in a tertiary care PICU over two years, analyzing 978 pediatric admissions. Data on demographics, disease categories, clinical outcomes, and microbiological findings were extracted and analyzed. **Results:** The study observed a male predominance among PICU admissions, accounting for 61.6% of cases, with infants aged 1 month to 1 year being the most affected group (46.8%). The leading causes of admission included infectious diseases (21.5%), respiratory illnesses (18.9%), and neurological disorders (14.3%). The mean length of stay (LOS) was  $4.1 \pm 2.7$  days, ranging from 0 to 30 days. The overall mortality rate was 4.4%, with sepsis identified as the leading cause of death (32.5%), followed by pneumonia (20%) and encephalitis (17.5%). Additionally, the nosocomial infection rate was 4.8%, with ventilator-associated pneumonia (12.8%) and central line-associated bloodstream infections (19.1%) being the most common hospital-acquired infections. **Conclusion:** Infectious diseases remain the leading cause of PICU admissions and mortality. The study highlights the need for early sepsis detection, stringent infection control, and improved critical care practices. Strengthening pediatric critical care infrastructure and implementing standardized sepsis management protocols can significantly improve patient outcomes.

**Keywords:** Pediatric Intensive Care Unit, Sepsis, Mortality, Nosocomial Infections, Respiratory Illnesses, Critical Care Outcomes, Infectious Disease in Children.

## INTRODUCTION

Pediatric Intensive Care Units (PICUs) play a critical role in managing critically ill children, providing specialized care that significantly improves survival rates and overall health outcomes. The morbidity patterns observed in PICUs vary depending on several

factors, including geographical location, socio-economic conditions, prevalence of infectious diseases, and availability of healthcare resources. Understanding these patterns is essential for improving treatment protocols, optimizing resource

allocation, and reducing mortality rates among critically ill children (1).

Globally, infectious diseases remain a leading cause of PICU admissions, particularly in low- and middle-income countries. Conditions such as pneumonia, sepsis, meningitis, and gastroenteritis are among the most common reasons for hospitalization in pediatric intensive care settings (2). However, in developed nations, congenital disorders, traumatic injuries, and chronic diseases like asthma and congenital heart diseases contribute significantly to PICU admissions (3). The variation in disease burden highlights the need for region-specific studies to tailor interventions effectively and reduce mortality and morbidity rates (4).

Advancements in pediatric critical care medicine have contributed to improved survival outcomes over the past few decades. Despite this progress, morbidity and mortality rates remain high, particularly in resource-limited settings where access to advanced medical interventions, skilled healthcare professionals, and life-saving equipment is often restricted (5). The ability to predict patient outcomes based on morbidity patterns is essential for guiding clinical decision-making and improving the quality of care provided in PICUs (6).

Several studies have analyzed the relationship between admission diagnosis and patient outcomes in PICUs. It has been observed that early recognition and timely management of critical conditions significantly improve survival rates (7). Scoring systems such as the Pediatric Risk of Mortality (PRISM) and the Pediatric Index of Mortality (PIM) have been widely used to assess disease severity and predict outcomes (8). These tools help in stratifying patients based on the risk of mortality, allowing for appropriate resource allocation and timely interventions to improve prognosis (9).

In addition to medical conditions, various socio-demographic factors influence morbidity patterns and outcomes in PICUs. Age, nutritional status, immunization history, and underlying co-morbidities play a crucial role in determining disease progression and recovery rates (10). Children with malnutrition,

immunodeficiency disorders, and pre-existing chronic conditions have higher morbidity and mortality risks compared to otherwise healthy children (11). Furthermore, delays in seeking medical care, financial constraints, and limited access to specialized healthcare services often lead to worse outcomes, particularly in developing regions (12).

Despite the challenges, continuous improvements in pediatric critical care, early disease recognition, and the adoption of evidence-based management strategies have enhanced survival rates among critically ill children. Research focusing on morbidity patterns and patient outcomes is crucial for refining treatment protocols and ensuring the delivery of high-quality, patient-centered care (13). A deeper understanding of these patterns will not only aid in reducing PICU mortality but also contribute to long-term health improvements in pediatric populations worldwide (14).

This study aims to examine the morbidity patterns and outcomes of children admitted to a PICU, providing insights into prevalent diseases, risk factors, and predictors of survival. By identifying key trends and challenges, this research seeks to contribute to the ongoing efforts in optimizing pediatric critical care management and improving child health outcomes globally.

## MATERIAL AND METHODS

This study was a retrospective, record-based analysis conducted in the Pediatric Intensive Care Unit (PICU) of a tertiary care hospital over a period of two years, from January 2014 to December 2015. The hospital houses a well-equipped, ten-bedded PICU, providing critical care services to pediatric patients up to 18 years of age across various medical and surgical subspecialties.

### Data Collection and Patient Selection

PICU records were systematically reviewed to extract relevant patient data, including demographic details such as age and gender, primary diagnosis at admission, duration of PICU stay, and final outcome. Patient outcomes were classified into four categories: transfer to the main pediatric wards for continued

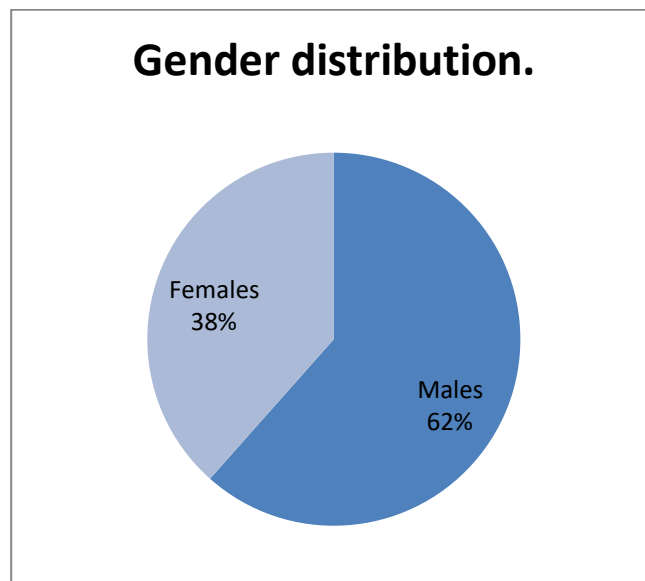
management, discharge home following recovery, discharge against medical advice (DAMA), or death. Only complete medical records containing the necessary clinical and laboratory details were included in the study.

All patients received treatment based on the hospital's standardized clinical protocols. Upon admission, comprehensive investigations were conducted, including complete blood count (CBC) to assess hemoglobin levels and leukocyte counts, serum electrolytes, urea, and creatinine for renal function evaluation, blood glucose monitoring for metabolic stability, and blood cultures in suspected sepsis cases. Additional tests such as arterial blood gas (ABG) analysis were performed for respiratory and metabolic assessment, while cerebrospinal fluid (CSF) analysis was conducted in cases with suspected central nervous system (CNS) infections. Blood investigations were repeated based on clinical judgment and patient progression. Empiric antibiotic therapy was initiated at admission and adjusted based on culture and sensitivity results. Patients presenting with shock or poor perfusion were managed with vasopressors following standard guidelines.

Infectious disease cases were categorized into three groups. Proven sepsis was defined by a positive blood culture or viral marker confirming infection, while suspected sepsis included patients meeting the Systemic Inflammatory Response Syndrome (SIRS) criteria without a confirmed positive culture. SIRS was identified by the presence of tachycardia, tachypnea, fever above 38.5°C or hypothermia below 36°C, abnormal leukocyte count, or an elevated percentage of band cells. The third category, tropical diseases, encompassed cases of malaria, typhoid, dengue, or scrub typhus diagnosed based on clinical presentation and laboratory confirmation. This systematic approach facilitated the accurate classification of morbidity patterns and their impact on PICU outcomes. The collected data were analyzed to identify key trends in pediatric critical care, guiding future interventions and optimizing resource allocation.

## RESULTS

Among the 978 pediatric patients admitted to the PICU, males accounted for 61.6% (n = 602), while females comprised 38.4% (n = 376). The majority of admissions were in the younger age groups, with infants aged 1 month to 1 year representing the largest proportion at 46.8% (n = 458). Neonates (0–1 month) constituted 15.9% (n = 156), while children aged 1–5 years accounted for 24.7% (n = 242). Admissions declined with increasing age, with 9.2% (n = 90) of cases in the 6–12 years group and only 3.3% (n = 32) among adolescents aged 13–18 years. These findings indicate a higher prevalence of PICU admissions among male patients and younger children, particularly infants under one year of age.

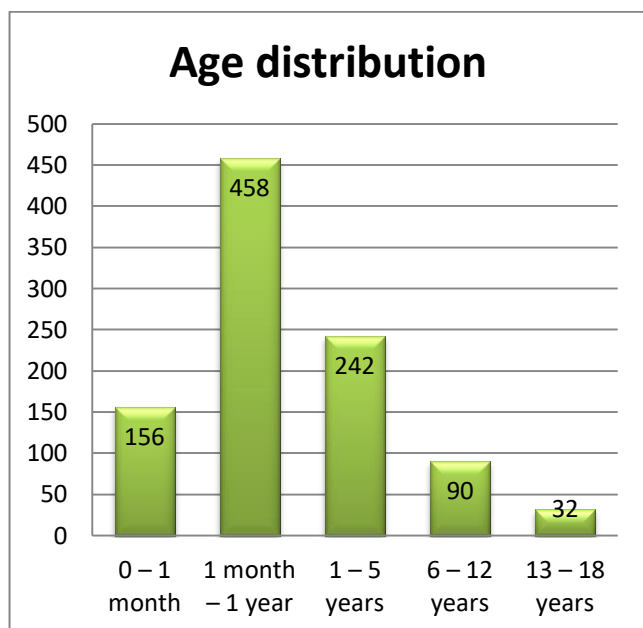


**Figure 1: Gender distribution.**

The mean length of stay (LOS) in the PICU was 4.1 ± 2.7 days, with a range from 0 to 30 days. The leading causes of PICU admissions were infectious diseases (22.1%), followed by respiratory diseases (19.6%) and central nervous system disorders (14.6%). Cardiovascular diseases (10.4%), gastrointestinal disorders (8.7%), and trauma or surgical cases (7.7%) were also noted as significant causes of admission.

Regarding patient outcomes, 70.5% of patients improved and were transferred to pediatric wards, while 23.0% were discharged directly from the PICU.

The mortality rate was 4.4%, with 2.1% of patients leaving against medical advice (DAMA).



**Figure 2: Age distribution of patients.**

A total of 912 culture samples were processed, of which 4.6% returned positive results. Among 63 sepsis cases, 28.6% had positive blood cultures, with *Staphylococcus aureus* being the most common bloodstream pathogen. The nosocomial infection rate was 4.8%, with ventilator-associated pneumonia (12.8%) and central line-associated bloodstream infections (19.1%) being the most frequent hospital-acquired infections. The primary nosocomial pathogens were *Acinetobacter* and *Staphylococcus aureus*.

A total of 978 pediatric patients were admitted to the Pediatric Intensive Care Unit (PICU) during the study period. The most common morbidity category was infectious diseases and sepsis (21.5%), followed by respiratory illnesses (18.9%) and neurological disorders (14.3%).

Cardiovascular conditions accounted for 10.7% of admissions, while gastrointestinal diseases (7.7%) and surgical cases (5.6%) were also notable contributors. Less frequent conditions included hematological (3.9%), renal (3.3%), and poisoning cases (1.8%). The "Others" category, comprising various miscellaneous conditions, accounted for 12.3% of the admissions.

**Table 1: Distribution of Patients Based on Morbidity Patterns**

Condition	No. of Patients	% of Total Admissions
<b>Infections/Sepsis</b>	210	21.5
<b>Respiratory Diseases</b>	185	18.9
<b>Neurological Disorders</b>	140	14.3
<b>Cardiovascular Diseases</b>	105	10.7
<b>Gastrointestinal Diseases</b>	75	7.7
<b>Surgical Cases</b>	55	5.6
<b>Hematological Disorders</b>	38	3.9
<b>Renal Diseases</b>	32	3.3
<b>Poisoning Cases</b>	18	1.8
<b>Others</b>	120	12.3
<b>Total</b>	978	100.0

**Table 2: Mortality According to Disease**

Disease	No. of Cases	Deaths ( <i>n</i> = 40, %)
<b>Sepsis</b>	63	13 (32.5%)
<b>Pneumonia</b>	94	8 (20%)
<b>Encephalitis</b>	58	7 (17.5%)
<b>Congenital Heart Disease</b>	30	5 (12.5%)
<b>Leukemia</b>	9	3 (7.5%)
<b>Aplastic Anemia</b>	6	1 (2.5%)
<b>Hepatic Encephalopathy</b>	2	1 (2.5%)
<b>Neuroblastoma</b>	2	1 (2.5%)

A total of 40 deaths were recorded in the Pediatric Intensive Care Unit (PICU) during the study period. Sepsis was the leading cause of mortality, accounting for 32.5% of total deaths (13 out of 40 cases). This highlights the high fatality rate associated with sepsis, reinforcing the need for early detection and aggressive management of septic cases.

Pneumonia (20%) and encephalitis (17.5%) were the next most significant contributors to mortality. These findings underscore the high burden of infectious diseases in critically ill pediatric patients. Congenital heart disease accounted for 12.5% of deaths, emphasizing the vulnerability of children with cardiac conditions requiring intensive care support.

Among hematological conditions, leukemia (7.5%) and aplastic anemia (2.5%) contributed to mortality, reflecting the severity of hematological malignancies in pediatric patients. Other conditions, such as hepatic encephalopathy (2.5%) and neuroblastoma (2.5%), were less frequent causes of death but still significant in critically ill children.

## DISCUSSION

The findings of this study highlight the morbidity patterns and outcomes of pediatric patients admitted to the Pediatric Intensive Care Unit (PICU). The high prevalence of infectious diseases (21.5%) and respiratory illnesses (18.9%) aligns with previous research, which indicates that sepsis, pneumonia, and central nervous system infections remain the leading causes of PICU admissions worldwide (15). The predominance of male patients (61.6%) in this study is consistent with previous reports suggesting that male children are at a higher risk of critical illness due to genetic, immunological, and environmental factors (16).

Infectious diseases, particularly sepsis and pneumonia, were the most common causes of admission. Studies have shown that sepsis contributes significantly to pediatric morbidity and mortality due to delayed recognition and antibiotic resistance (17). The presence of neurological disorders (14.3%) and cardiovascular diseases (10.7%) among admissions highlights the increasing burden of congenital and acquired neurological and cardiac conditions in critically ill children (18).

The mean length of stay (LOS) in the PICU was  $4.1 \pm 2.7$  days, similar to previously reported durations in tertiary care centers (19). However, this varies based on disease severity, need for mechanical ventilation, and presence of nosocomial infections, which can

extend hospitalization and increase complications (20).

The overall mortality rate was 4.4%, with sepsis (32.5%) as the leading cause of death, followed by pneumonia (20%) and encephalitis (17.5%). These findings align with global studies showing infectious diseases as the primary contributors to pediatric ICU mortality (21). Early recognition and aggressive management of septic cases are crucial, as studies indicate that delayed intervention significantly increases mortality rates (22).

Congenital heart disease (12.5%) was another major contributor to mortality, emphasizing the need for specialized pediatric cardiac care. Research suggests that early surgical intervention and improved post-operative critical care can enhance survival rates in these patients (23). Among hematological disorders, leukemia (7.5%) and aplastic anemia (2.5%) were associated with significant mortality, consistent with findings that children with malignancies have increased vulnerability to infections and multi-organ failure (24).

The nosocomial infection rate in this study was 4.8%, with ventilator-associated pneumonia (12.8%) and central line-associated bloodstream infections (19.1%) being the most common. These findings are in agreement with studies that report a high incidence of hospital-acquired infections in critically ill children, leading to prolonged ICU stays and increased mortality risk (25). The primary nosocomial pathogens were *Acinetobacter* and *Staphylococcus aureus*, which are commonly identified in PICUs and are often multi-drug resistant, posing significant treatment challenges (26).

This study has several limitations. Being a retrospective, record-based study, it relied on pre-existing medical records, which may have incomplete or missing data affecting the accuracy of results. The study was conducted in a single tertiary care center, limiting the generalizability of findings to other settings, especially in different geographic and socio-economic contexts. Additionally, factors such as underlying co-morbidities, socio-economic status, and access to healthcare before PICU admission were not



extensively analyzed. The study also did not assess long-term outcomes of discharged patients. A larger, multi-center prospective study is recommended for a more comprehensive analysis.

## CONCLUSION

This study highlights infectious diseases, respiratory illnesses, and neurological disorders as the leading causes of PICU admissions and identifies sepsis as the primary contributor to mortality. The findings emphasize the importance of early diagnosis, aggressive management, and stringent infection control measures to improve survival outcomes. The nosocomial infection rate of 4.8% underscores the need for better ICU hygiene and antimicrobial stewardship. Strengthening critical care infrastructure, implementing evidence-based sepsis management, and improving specialized pediatric care can significantly reduce mortality rates. Future research should focus on long-term patient outcomes and multi-center studies to enhance pediatric intensive care strategies globally.

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