

# Disease Spectrum and Outcome of Patients in PICU of Federal Govt. Polyclinic Hospital (FGPC) Islamabad

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<sup>1</sup>Conception, synthesis, planning of research, and writing of the manuscript, <sup>2,3</sup>Active participation in methodology, interpretation, and discussion, review of the manuscript, <sup>4,6</sup>Review of literature <sup>4,5</sup>Data collection, data entries, and statistical data analysis, Final Approval of the study to be published

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## ABSTRACT

**Objective:** To summarize the spectrum of disease and outcome in children admitted to the Pediatric Intensive Care Unit of FGPC.

**Methodology:** It is a retrospective descriptive study conducted at Pediatric ward and Intensive care unit of Pediatric department of Federal Govt. Polyclinic Hospital, Islamabad from June 2018 to June 2020. A total number of 424 Children from 1 month to 12 years of age, admitted to PICU were enrolled in the study by non-probability sampling technique. The data was analyzed by using SPSS version 23. The outcome variables are classified as discharge from PICU, death, shift to the ward after stabilization, and referral to other hospitals due to the unavailability of further specialized services.

**Results:** A total of 424 pediatric patients were included in this study. The overall mean age was 19.6±29.2 months and there were 239 (56.4%) males and 185 (43.6%) females. The most common diagnosis was pneumonia 37.3% (158/424), followed by sepsis and meningitis 14.6% each (62/424 each), and acute gastroenteritis 11.3% (48/424). There were 116 out of 424 (27.4%) who required ventilatory support in the PICU, while the remaining 308 (72.6%) did not require ventilatory support. In terms of outcomes, there were 106 (25.0%) pediatric patients who expired, 277 (65.3%) were shifted to the ward from PICU, 29 (6.8%) were discharged and 12 (2.8%) were referred to a specialized facility. The mean duration of stay was 3.1±2.7 days.

**Conclusion:** The most susceptible age group was under five years with the highest mortality rate and the most common cause of death is pneumonia preceded by other infections which can be controlled with better preventive measures.

**Keywords:** Disease spectrum, Disease outcome, Paediatric Intensive Care Unit.

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## Introduction

In a hospital setting, intensive care units hold the utmost importance. The pediatric ICU is the part, where critically ill patients need close monitoring with respiratory and hemodynamic support. The objective of pediatric critical care is early intervention and better care to achieve good outcomes. This is one of the most challenging situations for all pediatricians, especially in developing countries.<sup>2</sup> According to the WHO, the highest mortality among children is under 5 years of age.<sup>3</sup> It has been reported that

under 5-year mortality in Pakistan for the year 2022 is 56.88 deaths per 1000 live births.<sup>3,4</sup> The leading cause of death among 1-5-year-old children is pneumonia, especially in South Asia and Africa.<sup>3,4</sup> It accounts for 14% of all deaths in children under 5 years of age.<sup>4</sup> It is also the most common cause of admissions in Pediatric Intensive Care Unit comprising more than 30-50% of all admissions.<sup>5</sup> The causative agents of pneumonia are Streptococcus Pneumonia, Hemophilus Influenza, Respiratory Syncytial Virus, and Influenza.<sup>6</sup> The incidence of Pneumonia can be decreased with

immunization of children, early diagnosis, and better health facilities.<sup>6,7</sup>

A well-equipped Pediatric Intensive Care Unit helps improve the outcome and decrease the mortality among critically ill patients. In developing countries due to limited resources such services are offered only to those patients whose condition is potentially reversible and they have a good chance of survival.<sup>1</sup>

As medical sciences are advancing day by day, the outcomes of critically ill patients have dramatically improved. Pediatric intensive care has progressed a lot over the years, and many serious clinical diseases that were proven to be fatal are treatable now. In Pakistan, the field of intensive care is evolving and very few well-equipped ICU care centers and intensive specialists are available and very limited data is available about the outcome of admitted patients. Our study aims to explore the age and disease distribution of the patients and their outcomes. The study of outcomes helps to plan a strategy to deal with the common diseases and their complications in the community and redistribution of resources.

## Methodology

This retrospective study reviewed the admissions in the PICU of FGPC from June 2018 to June 2020. During this study patients with the age of 1 month to 12 years were included. PICU records of all admissions during this period were utilized for this study. Data extracted from the records included age, sex, diagnosis, duration of hospital stay, required ventilation, and outcome of the patient. The patients with congenital heart disease and congenital malformation (based on clinical examination and relevant investigation), those without any established diagnosis, and those patients who left against medical advice were not included in the study. The cause of admission in PICU was classified into different categories based on diagnosis at the time of admission which included pneumonia, acute gastroenteritis, sepsis, meningitis, dengue hemorrhagic fever, asthma, and others which include malignancy, and chronic renal disease. The outcome is classified as discharge from PICU, death, shift to the ward after stabilization, and referred to other hospitals for specialties like neurosurgery, pediatric surgery, oncology, etc. Ethical approval from the hospital's ethical committee was taken. The identity outcome of patients was kept confidential.

The data was entered into the Statistical Package for Scientific Solution (SPSS) version 23 spreadsheet and analyzed. Means, Standard Deviation, Percentages, and

Ranges were used to describe continuous variables. Data were tabulated and analyzed using frequency and percentage. Nominal data were compared using the chi-square tests. P values less than 0.05 were considered significant

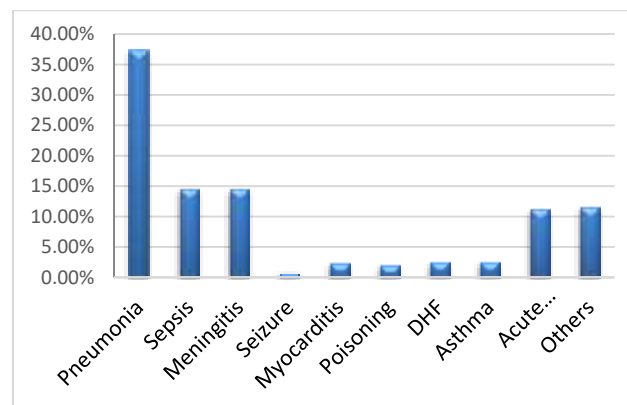
## Results

There were a total of 424 pediatric patients included in this study who were admitted to the Paediatric Intensive Care Unit (PICU). The overall mean age was  $19.6 \pm 29.2$  months, with an age range of a minimum of 1 month to a maximum of 144 months. Out of 424, there were 239 (56.4%) males and 185 (43.6%) females with a mean age of  $20.1 \pm 29.3$  months and  $19.1 \pm 29.0$  months respectively ( $p=0.730$ ). Table 1 summarizes the baseline demographic characteristics of the study population.

**Table 1: Baseline characteristics of study population. (n=424)**

Characteristics	N	%
Mean age in months		$19.6 \pm 29.2$
Age range		1 – 144
Gender		
• Male	238	56.1%
• Female	185	43.6%

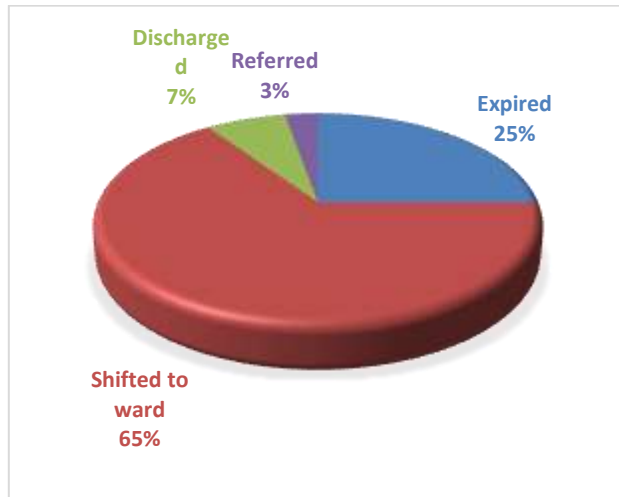
In terms of diagnosis, the most common cause of admission in the PICU was pneumonia 37.3% (158/424), followed by sepsis and meningitis 14.6% each (62/424 each), and acute gastroenteritis 11.3% (48/424). The full spectrum of diagnosis is given in Figure 1.



**Figure 1. Frequency distribution of diagnosis for PICU admission.**

There were 116 out of 424 (27.4%) on ventilator support in the PICU, while the remaining 308 (72.6%) were not on ventilator support. Comparison of ventilation and outcome revealed that among those who died, all were on ventilator support, among those shifted to the ward, 6 (2.2%) were on ventilator, while 1 (3.5) and 3 (25.0%) who were discharged and referred were on ventilator support

( $p < 0.001$ ). Table III shows the association of various factors with outcomes. In terms of outcomes, there were 106 (25.0%) pediatric patients who expired, 277 (65.3%) were shifted to the ward from PICU, 29 (6.8%) were discharged while 12 (2.8%) were referred to a specialized facility as shown in figure 2. The mean duration of stay was  $3.1 \pm 2.7$  days.



**Figure 2. Percentage of pediatric patients experiencing different types of outcomes. (n=424)**

## Discussion

There is limited data available regarding the disease spectrum and outcome of patients in PICU in Pakistan. The admission criteria and outcome in Pediatric ICU depends on the availability of facilities in the hospital, presence of trained staff and bed strength which varies from hospital to hospital. Reviewing and auditing of the data of PICU is crucial not only in improving patient care but also helpful in modifying hospital management policy. In our study 424 patients were admitted to PICU with overall mean age of  $19.6 \pm 29.2$  months which is comparable to another study<sup>8</sup>. Similar number of patients i.e 358 with a mean age of 1.83 years were enrolled in a PICU study conducted in India.<sup>9,10</sup> Our study shows the majority of patients admitted were less than 5 years of age as observed by Eran SK<sup>10</sup>. However, Nirmala C, et al found that the children aged 5 years and above accounts for 43.8% of total admission.<sup>12</sup>

There were no significant difference regarding the gender distribution of patients admitted in PICU. Out of 424, there were 239 (56.4%) males and 185 (43.6%) females with M:F ratio of 1.29:1 comparable to findings in another tertiary care PICU study.<sup>13</sup> There was a female predominance

**Table III: Association of outcomes with demographic and clinical characteristics. (n=424)**

Factors	Outcomes				P value
	Expired (n=106)	Shifted (n=277)	Discharged (n=29)	Referred (n=12)	
<b>Age in months</b>	14.1 $\pm$ 23.0	21.3 $\pm$ 30.6	23.2 $\pm$ 34.1	21.3 $\pm$ 28.4	0.151
<b>Gender</b>					
Male	55 (51.9%)	162 (58.5%)	17 (58.6%)	5 (41.7%)	0.478
Female	51 (48.1%)	115 (41.5%)	12 (41.4%)	7 (58.3%)	
<b>Diagnosis</b>					
Pneumonia	44 (41.5%)	109 (39.4%)	4 (13.8%)	1 (8.3%)	<0.001
Sepsis	27 (25.5%)	27 (9.7%)	7 (24.1%)	1 (8.3%)	
Meningitis	13 (12.3%)	44 (15.9%)	4 (13.8%)	1 (8.3%)	
Seizure	0 (0%)	4 (1.4%)	0 (0%)	0 (0%)	
Myocarditis	2 (1.9%)	6 (2.2%)	2 (6.9%)	0 (0%)	
Poisoning	1 (0.9%)	6 (2.2%)	2 (6.9%)	0 (0%)	
DHF	1 (0.9%)	9 (3.2%)	1 (3.4%)	0 (0%)	
Asthma	0 (0%)	9 (3.2%)	1 (3.4%)	1 (8.3%)	
Acute gastroenteritis	9 (8.5%)	36 (13.0%)	3 (10.3%)	0 (0%)	
Others	9 (8.5%)	27 (9.7%)	5 (17.2%)	8 (66.7%)	
<b>Ventilator support</b>					
Yes	106 (100%)	6 (2.2%)	1 (3.4%)	3 (25.0%)	<0.001
No	0 (0%)	271 (97.8%)	28 (96.6%)	9 (75.0%)	
<b>Duration of stay (days)</b>	3.05 $\pm$ 2.8	3.02 $\pm$ 2.4	4.7 $\pm$ 3.9	1.8 $\pm$ 1.4	0.003

The comparison of outcome and diagnosis revealed a significant association between death and diagnosis ( $p < 0.001$ ). Most of the patients who died were diagnosed with pneumonia (41.5%), followed by sepsis (25.5%) and meningitis (12.3%). Comparison of gender and outcome revealed no significant difference, where an almost equal number of males and females experienced death i.e. 51.9% vs 48.1% respectively,  $p = 0.478$ .

observed over males in a study done in India<sup>10</sup> while male patients were admitted more in a study by Ibielele et al.<sup>5</sup>

Our study identifies the spectrum of diseases of patients that require intensive care. In terms of diagnosis, the most common cause of admission in the PICU was pneumonia 37.3% (158/424), followed by sepsis and meningitis 14.6% each (62/424 each), and acute gastroenteritis 11.3%

(48/424). Pneumonia is the most common cause of admission to PICU in some similar studies.<sup>14,15</sup> However, in another study conducted at Agha Khan Hospital meningitis is more common than pneumonia and the most common cause in their study was acute kidney disease.<sup>16</sup>

The outcome of patients receiving ventilatory support depends upon the facilities and availability of skilled staff. In our study out of 424 patients, 116 (27.4%) required ventilatory support, while the remaining 308 (72.6%) did not require ventilatory support. However, a study done at AKUH showed that 50.7% of patients admitted to the PICU required ventilation for more than 24 hours. Similar results have been observed in Spain where 45.5% of patients required ventilation during hospital stay.<sup>17,18</sup> The outcome of ventilated patients showed that only 2.2 percent of patients were shifted to the ward after stabilizing in PICU only 1 patient was discharged and most patients who died were on ventilatory support. This mortality of the ventilated patient does not signify poor outcomes of the ventilated patients but the patients who are critically ill with severe disease at presentation need ventilation more and are therefore associated with poor outcomes. The severity of the disease assessed by different tools like PRISM (pediatric risk of mortality) and PIM (Pediatric index of mortality) was not included in our study so could not comment on its effects on outcome. It was observed in a study done in a Military hospital in Rawalpindi that patients with higher PRISM scores have an increased risk of death.<sup>18</sup>

The mortality rate of patients admitted to PICU in our study was 25.0% which is comparable to another study carried out in Pakistan where the mortality rate was 23.8%<sup>19</sup>. A study done in India had similar results with a mortality of 28%, 52.5% of patients improved with treatment, and 19.5% were shifted to other departments.<sup>20</sup> Overall, the mortality rate in developed countries is much better as compared to developing countries, it was 4-6 % in America, 5.8% in Europe, and 7.3% in Canada, this is because of better resources and more equipped PICU with well-trained staff<sup>18</sup>. The majority of our patients (65.3%) were shifted to the ward from PICU after stabilization, a few (6.8%) were discharged and a very small number of patients (2.8%) were referred to other setups with specialized facilities. Despite working in a public setup with a low resource setting and lack of multidisciplinary setup our mortality rate is comparable to some PICU studies conducted in the country.<sup>18,21</sup>

The mean duration of stay in our study is  $3.1 \pm 2.7$  days which is comparable to another study conducted by Haque

A in which the mean duration of stay was 3.2 days<sup>21</sup>. According to a study in Nepal the length of stay significantly affects the outcome of patients as the patients with one day or less length of stay have shown mortality up to 31 % but the mortalities observed in patients with two to seven days PICU stay and in those greater than 7 days were similar. The severity of illness at the time of admission and co-morbid factors also contribute to making the first 24 hours of hospital stay the most crucial period with one-third of the patients dying in this period.<sup>1,8</sup> we have not assessed the severity of the patients so could not determine the effect of co-morbid conditions affecting the outcome.

Pneumonia is one of the leading cause of death among young children in developing countries.<sup>3</sup> Correspondingly in our observation most of the patients who died were diagnosed with pneumonia (41.5%), followed by sepsis (25.5%) and meningitis (12.3%). The results of the study regarding the cause of death in patients admitted to our PICU are comparable to another study conducted by Khan Q where the majority of the patients admitted to their PICU died due to respiratory diseases and LRTI (25.5%).<sup>22</sup> However, in another study in Riyadh Sepsis (30.7%) is more common than Pneumonia (18.8%).<sup>23</sup> A study conducted in South India also shows that most of the patients died due to cardiopulmonary arrest (29%) followed by sepsis (19%) and Pneumonia (16%).<sup>24</sup> Infections of the central nervous system like meningitis, and meningoencephalitis were the most common cause of mortality in India<sup>11</sup> and were also the second most common cause following sepsis in a study in Karachi<sup>19</sup>. Though gastroenteritis was 11.9% of the admitted patients, not a single death was reported in our study as observed in Andhra Pradesh.<sup>11</sup> Although gastroenteritis is a common cause of death in children under 5 years of age, with use of vaccination, better nutrition and hygiene and improved management of dehydration with the use of ORS has significantly reduced mortality with diarrhea.<sup>1</sup>

The female infant mortality rate is lower than the male infant mortality rate in Pakistan.<sup>25</sup> However in a study on children admitted to Paediatric ICU mortality has been reported to be lower in males, although males have higher admission rates.<sup>26</sup> Comparison of gender and outcome revealed no significant difference in our study, where an almost equal number of males and females experienced death i.e. 51.9% vs 48.1% respectively,  $p=0.478$ .

It is noteworthy to point out that in our study no trauma or surgical patients were included. Due to the lack of a pediatric surgical unit, our pediatric ICU doesn't cater to

these patients. Trauma and post-surgery admissions were very significant in some studies accounting for almost equal medical causes or sometimes greater admissions in PICU.<sup>22</sup>

The quality of patient care is highly dependent on the availability of trained and experienced staff and the presence of modern and advanced equipment. We have 1 nurse to 2 nurse-to-patient ratio in our setting supervised by a pediatric specialist doctor though we don't have any certified Paediatric intensivist and no biomedical engineer. It is inevitable as shown by studies that a one nurse to one patient ratio<sup>23</sup> and a fully trained intensivist not only improve the quality of care but also lower the mortality.<sup>13,22</sup>

Needless to say, a great deal of effort and resources are needed to improve the quality of health care that is accessible to the common man. A well-equipped pediatric intensive care center and trained pediatric intensivist are the need of the hour. Further studies are needed to assess the severity of the diseases on presentation, so timely diagnosis and referral can help save more lives.

## Conclusion

Our study provides significant data regarding the spectrum of the diseases, their outcome and demographic distribution of patients admitted in Paediatric ICU. Majority of patients were under 5 years with pneumonia as the most common cause of admission and mortality. This study of outcomes of PICU patients can help to plan a strategy to deal with diseases, their management and prevention, and the redistribution of the resources accordingly

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