# A Retrospective Analysis of Factors Associated with Prolonged (≥ 30 Days) Stay at the Pediatric Intensive Care Unit: A Single Center Experience

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### **ABSTRACT**

**Objective:** This study aims to analyze the clinical and demographic characteristics of patients with prolonged pediatric intensive care unit (PICU) stay, focusing on medical and social factors that prolong stay.

**Methods:** To assess factors that prolong hospitalization, we reviewed medical records of patients hospitalized for at least 30 days in the PICU between January 1, 2017, and May 1, 2025.

**Results:** A total of 328 patients with prolonged PICU stay were identified. The mean age was 4.3 years (range, I months to 17.8 years), and the mean length of PICU stay was 92 days (range 30-920 days). The most common condition at admission was respiratory failure (68.9%). The vast majority of patients (71.6%) had underlying chronic conditions, the most common being central nervous system diseases (30.2%) followed by chronic respiratory diseases (23%). Two hundred fourteen patients (65.2%) required tracheostomy, 72 (22%) gastrostomy, and 328 (100%) mechanical ventilation. Mortality occurred in 34 patients (14.8%), with 21 cardiac (13.4%) and 13 (1.4%) brain deaths. In patients requiring tracheostomy, the PICU stay was considerably prolonged due to causes other than the clinical condition of the patient.

**Conclusion:** Patients admitted for social reasons had longer lengths of stay, with higher rates of tracheostomy, chronic ventilation support and underlying chronic diseases. Social reason-based admissions were increased after the pandemic. Developing different solutions for this group, which significantly uses intensive care resources, will help alleviate the burden on PICU's.

## INTRODUCTION

A long-stay patient in the intensive care unit refers to a patient who has survived an acute critical illness but cannot be discharged due to the need for continuous monitoring or support.<sup>[1]</sup> Long-stay patients contribute to increased utilization of intensive care resources and medical costs, thereby exacerbating capacity issues in intensive care units. <sup>[2]</sup> Although research indicates that the proportion of long-

stay patients is less than 10% of all admissions, they account for one-third of intensive care bed days. With the rising global costs of critical care, access to specialized acute care resources and the availability of intensive care beds have become ongoing challenges.<sup>[3]</sup> To ensure the effective use of these important beds, it is essential to draw attention to this area and propose solutions. Advances in medicine have transformed many pediatric conditions, previously associated with poor prognoses, into chronic and

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Characteristics	Number (%)	Medical (%)	Social (%)
	328	112(34.1)	216(65.9)
Male/ Female, n (%)	182/146 (55.5/44.5)	58/54 (51.8/48.2)	118/98 (54.6/45.4)
Age, mean (range)	4.3 (I month to I7.8 years)	4.6 (I month to I5.2 years)	4.1 (I month to 17.8 years)
PRISM scores	12.1	22.4	9.8
Length of Stay (days), mean (range)	92 (30-920)	62 (30-154)	163 (30-920)
Indications for PICU admission, n (%)			
Respiratory failure	226 (68.9)	39 (62.9)	146 (89.5)
Shock/ multi organ failure	46 (14.0)	11 (17.7)	4 (2.5)
Postoperative care	23 (7.0)	5 (8.1)	9 (5.5)
Trauma	33 (10.1)	7 (11.3)	4 (2.5)
Underlying Chronic Diseases, n (%)			
Present	235 (71.6)	69 (61.6)	166 (76.9)
Absent	93 (28.4)	43 (76.9)	50 (23.1)
Chronic central nervous system diseases	71 (30.2)	17 (24.6)	54 (32.5)
Chronic respiratory diseases	54 (23.0)	19 (27.5)	35 (21.1)
Muscle diseases	48 (20.4)	22 (31.9)	26(15.7)
Central nervous system tumors	24 (10.2)	6 (8.7)	18 (10.9)
Metabolic diseases	19 (8.1)	2 (2.9)	17 (10.2)
Heart diseases	12 (5.1)	2(2.9)	10(6.0)
Hematologic – oncologic diseases	7(3.0)	1(1.5)	6(3.6)
Place of referral			
Emergency service	117 (35.7)	51 ( <del>4</del> 5.5)	66 (30.6)
Clinical ward	141 (43.0)	46 (41.1)	95 (44.0)
Operating room	43 (13.1)	11 (9.8)	32 (14.8)
Foreign health center	27 (8.2)	4 (3.6)	23 (10.6)
Chronic device use			
Tracheostomy	214 (65.2)	93 (43.5)	159 (74)
Gastrostomy	72 (22.0)	39 (54.2)	33 (45.8)
Mechanical ventilation	328 (100)	112 (100)	216 (100)
İnvaziv	276 (84.1)	98 (87.5)	178 (82.4)
Noninvaziv	52 (15.9)	14 (12.5)	38 (17.6)
Treatments & interventions during PICU stay			
Antibiotic therapy	302 (92.1)	103 (92)	199 (92.1)
Central venous catheters	143 (43.6)	61 (54.5)	82 (38)
Dialysis	18 (5.5)	11 (9.8)	7 (3.2)
Plasmapheresis	12 (3.7)	8 (7.1)	4 (1.9)
Treatment for liver failure	38 (11.6)	23 (20.5)	15 (6.9)
ECMO	8 (2.4)	5 (4.5)	3 (1.4)
Cardiopulmonary resuscitation	98 (29.9)	46 (41.1)	52 (24.1)
Patient outcome	<b>.</b>	A - 1 - 1 - 1	
Tranfer to clinical ward	244 (74.4)	89 (79.5)	155 (71.8)
Discharged home	28 (8.5)	13 (11.6)	15 (6.9)
Tranfer to palliative intensive care unit	22 (6.7)	8 (7.1)	14 (6.5)
Cardiac death	21 (6.4)	9 (8.0)	12 (5.6)
Brain death	13 (4)	4 (3.6)	9 (4.2)
Covid-19 Pandemic	140 (40.0)	F0 (F0 F)	22 (52 )
Yes	142 (43.3)	59 (52.7)	83 (38.4)
No	186 (56.7)	53 (47.3)	133 (61.6)

often complex situations. This not only extends hospitalization periods but also contributes to longer stays for social reasons. This study conducts a retrospective analysis of long-stay patients, highlighting those whose hospitalization is extended for non-medical reasons. Given the inevitable presence of long-stay patients, this research aims to contribute to the literature by exploring different approaches to improve resource utilization in pediatric intensive care units (PICU), considering the reasons for hospitalization.

#### **MATERIALS AND METHODS**

The study was approved by the Marmara University Medical Faculty Clinical Research Ethics Committee (Date: 17/05/2024, Decision No: 05.2024.659) and was conducted in accordance with the principles of the Declaration of Helsinki.

We retrieved medical records of patients who were admitted 30 days or longer at the PICU between January I, 2017, and May I, 2025. Data included age, gender, underlying diseases, indications for PICU admission, interventions, device use, length of PICU stay, reasons for death, and Pediatric Risk of Mortality (PRISM) scores. The use of interventions and treatments during the PICU stay were assessed, including antibiotic therapy, inotropic agents, mechanical ventilation, central venous catheters, dialysis, cardiopulmonary resuscitation (CPR), plasmapheresis, and extracorporeal membrane oxygenation (ECMO). The study was approved by the institutional review board (05.2024.659).

## Statistical Analysis

Data were processed using the SPSS 26.0 (Statistical Program for Social Sciences) package. For quantitative descriptive statistics, mean and standard deviation were used for normally distributed data, while median and interquartile ranges were used for non-normally distributed data. The chi-square test was used for comparisons of categorical data. The Mann-Whitney U-test was used for comparison of non-normally distributed quantitative variables between two independent groups, while Student's t-test was used for normally distributed variables. All statistical calculations were evaluated at a 95% confidence interval, with a significance level of p<0.05.

#### **RESULTS**

During the study period, a total of 328 patients required PICU stay of 30 days or longer, including 182 (55.5%) males and 146 (44.5%) females (Table I). The mean age was 4.3 years (range I month to 17.8 years). The mean length of PICU stay was 92 days (range 30-920 days). The most common indications for admission were respiratory failure (68.9%), shock (14%), trauma (10.1%) and postoperative care (7%).

Of the patients, 235 (71.6%) had underlying chronic conditions. The average PRISM score was 9.8. One hundred

seventeen patients (35.7%) were admitted through emergency service, 141 (43%) from the clinical ward, 43 (13.1%) from the operating room, and 27 (8.2%) from foreign health center. Two hundred fourteen patients (65.2%) had tracheostomy, 72 (22%) with gastrostomy, and 328 (100%) required mechanical ventilation. The average duration of mechanical ventilation was 3200 hours (768-9160 hours). Two hundred forty four patients (64.8%) were transferred to clinical wards, 28 (16.9%) were discharged directly, and 22 (3.5%) were transferred to palliative intensive care unit. Thirty-three patients (10.4%) were dead, with 21 deaths (6.4%) due to cardiac death and 13 (4%) due to brain death. Of the patients, 302 (92.1%) received antibiotic therapy, 143 (43.6%) had central venous catheters, 18 (5.5%) underwent dialysis, 12 (3.7%) had plasmapheresis, 38 (11.6%) required treatment for liver failure, and 8 (2.4%) received ECMO therapy. Cardiopulmonary resuscitation (CPR) was performed on 98 patients (29.9%) an average of 2 times. When evaluating the primary diagnoses, chronic central nervous system disorders were the most common, observed in 161 patients (49.1%). Respiratory diseases were present in 76 patients (23.2%), followed by central nervous system tumors in 46 patients (14%) and muscular disorders in 48 patients (14.6%). Additionally, 35 patients (10.7%) were diagnosed with metabolic diseases, while 28 patients (8.5%) had cardiac conditions.

# Factors Influencing Length of Stay in the Pediatric Intensive Care Unit

The summary values related to the findings are presented in Table 2. Over an 8-year period, a total of 3,714 patients were admitted to PICU of whom 316 (8.5%) were foreign nationals. Among these patients, 328 (8.8%) had a prolonged PICU stay exceeding 30 days. Of the long-stay cohort, 112 (34.1%) were admitted for medical reasons, while 216 (65.9%) were admitted due to social circumstances. Foreign nationals comprised 9.8% (n=32) of the long-stay group.

Male patients had an average length of stay 6 days longer than females, and those referred from other PICUs stayed approximately 20 days longer. The most significant medical contributors to prolonged stay were chronic central nervous system (CNS) diseases and neuromuscular disorders. Patients with tracheostomies stayed an average of 66 days longer, a statistically significant difference (p<0.05).

Of the 48 patients (14.6%) diagnosed with neuromuscular disorders, 42 (12.8%) had spinal muscular atrophy. In these patients, chronic respiratory failure necessitated tracheostomy placement to facilitate stepwise discharge to ward care and eventually home. This procedure required informed consent, which could not be obtained in 21 cases; in these, tracheostomy was performed following a court order. The average time to obtain the court decision was 26 days. Among patients who underwent tracheostomy, 17 (5.2%) could not be discharged due to lack of access to home ventilators—largely attributable to their foreign national status and lack of insurance coverage.

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Factors	Finding	
Gender	Male patients stayed on average 6 days longer than females	p<0.05
Tracheostomy	Associated with an average of 66 days longer stay	
Neuromuscular disorders	14.6% of long-stay patients; SMA most common (12.8%)	
Lack of home ventilator (foreign nationals)	17 patients could not be discharged	p<0.05
COVID-19 pandemic effect	Increase in patients without chronic disease: $44.2\% \rightarrow 84\%$	p<0.05
	Tracheostomy rate increase: 50% → 68.8%	p<0.05
	Long-term ventilator need: $84\% \rightarrow 98\%$	p<0.05
Admission Reason: Social vs. Medical	Tracheostomy more frequent: 74% (social) vs. 43.5% (medical)	p<0.05
	CNS tumors more common in medical group: 23% vs. 8%	p<0.05
	Chronic CNS disorders more common in social group: 10% vs. 4%	p<0.05
	Social admissions stayed 66 days longer on average	p<0.05
	Medical admissions decreased: 59.3% → 40.7	p<0.05
PRISM score	Lower in socially admitted patients	p<0.05
Length of Stay (Social vs. Medical)	Social admissions stayed 66 days longer on average	p<0.05

#### Impact of the COVID-19 Pandemic

The COVID-19 pandemic significantly altered PICU admission patterns. The proportion of patients without chronic conditions rose from 44.2% pre-pandemic to 84% post-pandemic (p<0.05). Tracheostomy prevalence increased from 50% to 68.8%, and the need for long-term ventilator support rose from 84% to 98% (p<0.05).

#### Comparison by Admission Reason

Tracheostomy was more frequent in patients admitted for social reasons (74%) compared to those with medical indications (43.5%) (p<0.05). CNS tumor prevalence was higher in the medical group (23%) versus the social group (8%), whereas chronic CNS disorders were more frequent in social admissions (10% vs. 4%). Following the pandemic, the rate of medical admissions decreased from 59.3% to 40.7%, while social admissions increased from 39.6% to 60.4% (p<0.05).

PRISM scores were significantly lower in socially admitted patients. Moreover, their average length of stay was 66 days longer than that of medically admitted patients (p<0.05). This group was also more likely to be referred from emergency departments or other PICUs.

#### **DISCUSSION**

This study highlights the burden imposed by long-stay patients admitted for social reasons. Although these patients are often clinically stable, discharge is delayed due to factors such as dependence on chronic devices or lack of home care resources. Previous studies reported average PICU stays of 64 days and 107±124 days. [4,5] In our study, 37% of long-stay cases were due to social reasons, with a significantly longer average stay than those admitted for

medical reasons, consistent with the literature. Prolonged mechanical ventilation is a well-known factor contributing to extended PICU stays. [6-9] Tracheostomy, commonly performed in pediatric intensive care units, is primarily indicated for prolonged intubation due to cardiopulmonary and neurological conditions, aiming to ensure a secure airway, improve ventilation, and reduce hospital stay. [10] In our cohort, tracheostomy was performed in 43.5% of medically admitted and 74% of socially admitted patients, all of whom required chronic ventilator support.

Long ICU stays are associated with resource overutilization, bed shortages, and increased infection risk. Facilitating discharge through home mechanical ventilation programs could reduce PICU burden.<sup>[11]</sup> Families of long-stay patients are often better adapted to ICU care, which may facilitate transition to home settings.<sup>[12]</sup> However, the lack of a structured home care system and caregiver hesitancy—due to concerns over medical management, family dynamics, economic stress, and isolation—pose barriers.<sup>[13]</sup>

Following the COVID-19 pandemic, there was a marked shift in admission dynamics. Graciano et al.<sup>[14]</sup> reported a 70% decline in PICU admissions. In our study, medical admissions dropped while social admissions increased, likely due to increased caregiver anxiety during the pandemic.

Chronic conditions are frequently observed in PICU patients. Reported rates include 25.5%, 47.2%, and 46.9%. [15-17] Our study found a 71.6% rate among long-stay patients. This suggests the need for dedicated intermediate care units for patients with chronic conditions.

Neurologic disorders are the most frequent chronic diagnoses in these patients. One study reported that 296 out of 378 patients requiring home ventilation had neurologic disorders. Another identified technology-dependent neurologic conditions as the most common among patients

receiving home health services. In our cohort, chronic CNS disorders were more prevalent in socially admitted patients (32.5%) compared to medically admitted ones (24.6%). Establishing palliative rehabilitation centers for such patients may help reduce ICU burden.<sup>[18]</sup>

#### Limitations

The main limitations of this study are its retrospective design and single-center setting. Despite this, the findings underline a significant issue in pediatric critical care and offer insights into potential interventions.

#### Conclusion

Long-stay patients in the PICU consume a disproportionate share of resources. This study emphasizes the impact of social factors on prolonged hospitalization. These patients often have stable clinical status but cannot be discharged due to chronic device dependency and insufficient home care infrastructure. Expanding home care programs, establishing intermediate care units, and developing palliative rehabilitation centers are essential strategies to reduce PICU strain and maintain capacity during public health crises such as the COVID-19 pandemic.

#### **Ethics Committee Approval**

The study was approved by the Marmara University Medical Faculty Clinical Research Hospital Ethics Committee (Date: 17.05.2024, Decision No: 05.2024.659).

#### Informed Consent

Retrospective study.

Peer-review

Externally peer-reviewed.

#### **Authorship Contributions**

Concept: F.I.G.; Design: F.I.G., B.A., M.N.Y.; Supervision: F.I.G., B.A., M.N.Y.; Materials: F.I.G., B.A.; Data collection &/or processing: F.I.G., B.A.; Analysis and/or interpretation: F.I.G., B.A., A.S.; Literature search: F.I.G., B.A., A.S.; Writing: F.I.G., B.A; Critical review: F.I.G., B.A.

#### Conflict of Interest

None declared.

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# Pediatrik Yoğun Bakım Ünitesinde Uzamış (≥30 Gün) Yatışla İlişkili Faktörlerin Retrospektif Analizi: Tek Merkez Deneyimi

Amaç: Bu çalışmanın amacı, çocuk yoğun bakım ünitesinde (ÇYBÜ) uzun süre kalan hastaların klinik ve demografik özelliklerini, yatış süresini uzatan tıbbi ve sosyal nedenlere odaklanarak analiz etmektir.

Gereç ve Yöntem: ÇYBÜ'de I Ocak 2017 ile I Mayıs 2025 tarihleri arasında 30 günden fazla yatan hastaların tıbbi kayıtları yatış süresini uzatan nedenler açısından retrospektif olarak incelendi.

**Bulgular:** Toplam 328 uzamış ÇYBÜ yatışı olan hasta çalışmaya dahil edildi. Hastaların ortalama yaşı 4.3 yıl (dağılım: 1 ay – 17.8 yıl), ortalama ÇYBÜ yatış süresi 92 gün olarak saptandı (dağılım: 30–920 gün). En sık başvuru nedeni solunum yetersizliği idi (%68.9). Hastaların %71.6'sında altta yatan kronik hastalık mevcuttu. Bu hastalıkların en yaygın olanları santral sinir sistemi hastalıkları (%30.2) ve kronik solunum sistemi hastalıklarıydı (%23). Toplamda 214 hastaya (%65.2) trakeostomi işlemi uygulanırken, 72 hastada (%22) gastrostomi açılması gerekli olmuştur. Tüm hastalar (%100) mekanik ventilasyon desteği aldı. Mortalite, toplam 34 hastada (%14.8) gözlendi; bu ölümlerin 21'i (%13.4) kardiyak nedenlere, 13'ü (%1.4) ise beyin ölümüne bağlıydı. Trakeostomi uygulanan hastalarda, ÇYBÜ'de kalış süresi çoğunlukla hastanın klinik durumundan bağımsız, klinik dışı nedenlerle uzamıştı.

Sonuç: Sosyal nedenlerle ÇYBÜ'ne kabul edilen hastalarda, yatış süresi anlamlı düzeyde daha uzun bulunmuş; bu hastalarda trakeostomi uygulama oranı, kronik ventilasyon desteği ihtiyacı ve altta yatan kronik hastalık prevalansı daha yüksek saptanmıştır. COVID-19 pandemisi sonrası süreçte, sosyal nedenli yoğun bakım kabul oranlarında artış saptanmıştır. Yoğun bakım kaynaklarını belirgin şekilde tüketen bu hasta grubuna yönelik alternatif bakım modellerinin geliştirilmesi, ÇYBÜ üzerindeki yükün azaltılmasına katkı sağlayabilir.

Anahtar Sözcükler: Çocuk yoğun bakım ünitesi; epidemiyoloji; kalış süresi; kronik hastalıklar; sağlık kaynakları.