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Research Article

Mortality-associated factors in the pediatric intensive care setting: a retrospective review of 519 patients in Çanakkale, Türkiye

Pediatrik yoğun bakım ortamında mortalite ile ilişkili faktörler: Çanakkale, Türkiye'de 519 hastanın retrospektif incelemesi

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Abstract

Introduction: The Pediatric Intensive Care Unit plays a vital role in the management and continuous monitoring of life-threatening conditions affecting multiple organ systems. In recent years, the demand for pediatric intensive care services in our country has increased significantly. However, patient survival is influenced not only by bed availability but also by the quality of care provided. Therefore, identifying and analyzing mortality predictors is of critical importance for improving the quality of care in Pediatric Intensive Care Units (PICUs). This study aims to evaluate the clinical characteristics of patients admitted to the Pediatric Intensive Care Unit of Çanakkale Onsekiz Mart University Hospital and to identify the variables associated with survival outcomes.

Methods: In this retrospective cross-sectional study, the medical records of 519 patients admitted to the PICU of Çanakkale Onsekiz Mart University Hospital between May 1, 2019, and December 31, 2022, were reviewed. Collected data included demographic characteristics, admission diagnoses, length of stay in the ICU, need for invasive procedures, complications developed during hospitalization, and clinical scoring systems such as the Glasgow Coma Scale (GCS), Pediatric Risk of Mortality III (PRISM III), Pediatric Index of Mortality 2 (PIM2), and Pediatric Logistic Organ Dysfunction-2 (PELOD-2). Statistical analyses were conducted using appropriate tests, and factors associated with mortality were evaluated through logistic regression analysis.

Results: Among the 519 patients included in the study, 55.3% were male, and the median age was 55 months. The most frequent reasons for hospitalization were infectious diseases (31.2%), neurological disorders (15.1%), and intoxications (10.6%). Additionally, 27.0% of the patients had at least one chronic condition. Notably, the rate of intoxication was particularly high in the 97–216-month age group (69.4%). There was a statistically significant association between mortality and all the evaluated scoring systems, namely PRISM III, PIM2, PELOD-2, and the GCS ($p = 0.001$). Logistic regression analysis identified previous intensive care unit admission [OR: 4.697–6.898], the need for mechanical ventilation [OR: 0.151–0.094], and the development of nosocomial infection [OR: 2.474] as independent predictors of mortality ($p = 0.021$).

Conclusion: Survival outcomes in pediatric intensive care are influenced not only by diagnostic and therapeutic interventions but also by factors such as hospital-acquired infections, the need for mechanical ventilation, and prior intensive care unit admissions. Clinical scoring systems such as PRISM III, PIM2, and PELOD-2 offer valuable prognostic insight and contribute to clinical decision-making. The findings of this study provide important data for the assessment and enhancement of current pediatric intensive care practices. Therefore, the regular analysis of factors influencing mortality represents a critical step toward improving the quality of care delivered in PICUs.

Keywords: prognosis, child, glasgow coma scale, pediatric intensive care units, clinical decision making

Öz

Giriş: Çocuk Yoğun Bakım Ünitesi (ÇYBÜ), çoklu organ sistemlerini etkileyen yaşamı tehdit eden durumların yönetimi ve sürekli takibinde hayati bir rol oynamaktadır. Son yıllarda ülkemizde pediatrik yoğun bakım hizmetlerine olan ihtiyaç belirgin şekilde artış göstermektedir. Ancak hasta sağkalımı, yalnızca yoğun bakım yatak kapasitesine değil, aynı zamanda sunulan sağlık hizmetinin kalitesine de bağlıdır. Bu nedenle, Çocuk Yoğun Bakım Üniteleri'nde (ÇYBÜ) bakım kalitesinin iyileştirilmesi açısından mortalite belirleyicilerinin tanımlanması ve analiz edilmesi büyük önem taşımaktadır. Bu çalışmanın amacı, Çanakkale Onsekiz Mart Üniversitesi Hastanesi ÇYBÜ'ne yatırılan hastaların klinik özelliklerini değerlendirmek ve sağkalım sonuçlarıyla ilişkili değişkenleri belirlemektir.

Yöntem: Bu retrospektif kesitsel çalışmada, 1 Mayıs 2019 ile 31 Aralık 2022 tarihleri arasında Çanakkale Onsekiz Mart Üniversitesi Hastanesi ÇYBÜ'ne yatırılan 519 hastanın tıbbi kayıtları incelendi. Toplanan veriler demografik özellikler, yatış tanıları, yoğun bakım ünitesinde kalış süresi, invaziv prosedürlere duyulan ihtiyaç, hastanede yatış sırasında gelişen komplikasyonlar ve Glasgow Koma Skalası (GKS), Pediatrik Mortalite Riski III (PRISM III), Pediatrik Mortalite İndeksi 2 (PIM2) ve Pediatrik Lojistik Organ Disfonksiyonu-2 (PELOD-2) gibi klinik puanlama sistemlerini içeriyordu. Uygun testler kullanılarak istatistiksel analizler yapıldı ve mortalite ile ilişkili faktörler lojistik regresyon analizi ile değerlendirildi.

Bulgular: Çalışmaya dahil edilen 519 hastanın %55,3'ü erkekti ve ortanca yaş 55 aydı. Hastaneye yatışın en sık görülen nedenleri bulaşıcı hastalıklar (%31,2), nörolojik bozukluklar (%15,1) ve zehirlenmelerdi (%10,6). Ek olarak, hastaların %27,0'ında en az bir kronik rahatsızlık vardı. Özellikle, zehirlenme oranı 97-216 aylık yaş grubunda (%69,4) özellikle yüksekti. Mortalite ile değerlendirilen tüm puanlama sistemleri, yani PRISM III, PIM2, PELOD-2 ve Glasgow Koma Ölçeği (GKS) arasında istatistiksel olarak anlamlı bir ilişki vardı ($p = 0,001$). Lojistik regresyon analizi, daha önce yoğun bakım ünitesine yatış [OR: 4,697–6,898], mekanik ventilasyon ihtiyacı [OR: 0,151–0,094] ve hastane enfeksiyonu gelişimini [OR: 2,474] mortalitenin bağımsız öngörücüleri olarak tanımladı ($p = 0,021$).

Sonuç: Pediatrik yoğun bakımda sağkalım sonuçları yalnızca tanı ve tedavi müdahalelerinden değil, aynı zamanda hastane kaynaklı enfeksiyonlar, mekanik ventilasyon ihtiyacı ve daha önce yoğun bakım ünitesine yatış gibi faktörlerden de etkilenir. PRISM III, PIM2 ve PELOD-2 gibi klinik puanlama sistemleri değerli prognostik öngörüler sunar ve klinik karar almaya katkıda bulunur. Bu çalışmanın bulguları, mevcut pediatrik yoğun bakım uygulamalarının değerlendirilmesi ve iyileştirilmesi için önemli veriler sağlar. Bu nedenle, mortaliteyi etkileyen faktörlerin düzenli analizi, ÇYBÜ'lerde sunulan bakım kalitesini iyileştirmeye yönelik kritik bir adımdır.

Anahtar kelimeler: çocuk, prognoz, glasgow koma skoru, pediatrik yoğun bakım üniteleri, klinik karar verme süreci

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Key Points

1. PRISM III, PIM2, and PELOD-2 scores demonstrated a statistically significant association with mortality, supporting their utility as reliable prognostic indicators in pediatric intensive care settings.
2. History of previous PICU admission, requirements for mechanical ventilation, and the occurrence of hospital-acquired infections were identified as significant factors associated with increased mortality.
3. Logistic regression analysis confirmed that these variables independently influenced mortality outcomes, highlighting their clinical relevance in risk stratification and management

Introduction

Pediatric intensive care has emerged as a critical area of advancement in child health with the evolution of modern medicine. Since the establishment of the first PICU in Gothenburg, Sweden, in 1955, the field has undergone rapid and widespread development on a global scale [1]. PICU plays a critical role in the management of children with life-threatening conditions requiring advanced monitoring and therapeutic interventions due to multi-organ system involvement. Enhancing survival rates in these settings relies not only on the expansion of PICU capacity but, more importantly, on the continuous improvement of care quality. The effectiveness of intensive care services is influenced by several key factors, including patient volume, the ratio of experienced healthcare professionals per unit, adherence to appropriate admission criteria, the clinical complexity of patients, presence of comorbidities, and the use of invasive interventions. A multidisciplinary approach, the integration of advanced medical technologies, and the active participation of healthcare providers with specialized training in pediatric critical care substantially contribute to improved clinical outcomes and increased survival rates [2]. The demand for PICU is steadily increasing in Türkiye. The survival rates of children admitted to these units—particularly those with severe illnesses or traumatic injuries—have significantly improved due to advances in monitoring technologies and therapeutic interventions [3]. Nevertheless, when pediatric intensive care services are not delivered effectively and with adequate quality, a notable rise in mortality rates may be observed. This highlights that the existence of PICU infrastructure alone is insufficient; instead, the provision of accessible, high-quality, and sustainable care is crucial for improving patient outcomes. Current research in pediatric intensive care emphasizes the importance of analyzing patient data from PICU settings. Such analyses are fundamental not only for evaluating existing clinical practices but also for informing the development of future healthcare policies [4–6]. In this context, the present study aims to assess the clinical characteristics and outcomes of pediatric patients admitted to the PICU at our institution and to identify the key factors influencing survival.

Methods

This retrospective study was conducted through the review of medical records of patients admitted to the PICU at our institution. Data extracted includes demographic and clinical parameters such as age, sex, source of hospital admission, history of previous PICU admission, Glasgow Coma Scale (GCS) score at admission, duration of stay in the PICU, and discharge outcomes. Severity of illness was assessed using standardized scoring systems applied at the time of admission: Pediatric Risk of Mortality III (PRISM III), Pediatric Index of Mortality 2 (PIM2), and Pediatric Logistic Organ Dysfunction-2 (PELOD-2).

Indications for PICU admission were classified into the following categories: respiratory system disorders; infectious diseases (e.g., pneumonia, sepsis, meningitis/encephalitis); neurological, cardiovascular, metabolic, and endocrine disorders; hematological and oncological diseases; gastrointestinal and nephrological pathologies; intoxications; scorpion and snake bites; traumatic injuries (e.g., motor vehicle accidents, falls from height, drowning, foreign body aspiration, penetrating trauma); and postoperative monitoring.

A total of 571 patient records were initially screened. Of these, 52 cases were excluded due to incomplete or missing data. The final study cohort consisted of 519 patients with complete and analyzable datasets.

Ethical approval, informed consent and permissions

This retrospective observational study included 519 patients who were admitted to the PICU at Çanakkale Onsekiz Mart University Health Practice and Research Hospital between May 1, 2019, and December 31, 2022. Ethical approval was obtained from the Institutional Review Board of the university (Approval Date: March 26, 2024; Decision No: 2023/02-14). All data were collected from the hospital's electronic medical record system.

Statistical Analysis

A multivariable logistic regression analysis was conducted to identify factors that may be associated with mortality. All statistical analyses were performed using a standard statistical software package. Continuous variables were reported as mean ± standard deviation (SD) for normally distributed data or as median (minimum–maximum) for non-normally distributed data. Categorical variables were expressed as frequencies and percentages (%). The normality of continuous data was assessed using the Kolmogorov–Smirnov and Shapiro–Wilk tests. Age, PRISM score, PIM score, and PICU length of stay did not follow a normal distribution ($p < 0.001$); therefore, non-parametric methods were employed for group comparisons involving these variables. Comparisons between groups were conducted using the independent samples t-test for normally distributed variables and the Mann–Whitney U test for non-normally distributed variables. Categorical data were analyzed using the Pearson Chi-square test or Fisher's exact test. Univariate analyses were initially performed to identify variables associated with mortality. Statistically significant variables were included in multivariate logistic regression analysis and their effects on mortality were evaluated. A two-tailed p-value of < 0.05 was considered statistically significant in all analyses.

Results

A total of 519 patients were included in the study, of whom 287 (55.3%) were male and 232 (44.7%) were female. The median age was 55 months (range: 1–216 months). Age group distribution was as follows: 47.0% were between 1–48 months, 16.3% between 49–96 months, and 36.7% between 97–216 months (Figure 1).

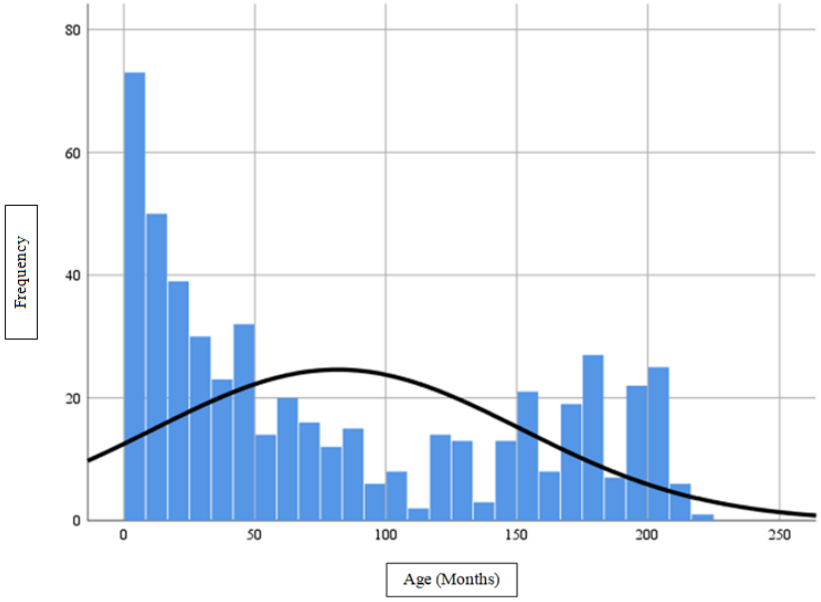

Figure 1. Histogram of age distribution of the sample

When diagnostic categories were evaluated (Table 1), the most common reason for PICU admission was infectious diseases (31.2%), followed by neurological disorders (15.1%), intoxications (10.6%), respiratory diseases (9.8%), metabolic and endocrine disorders (7.1%), and traumatic injuries (6.4%). Among infectious diseases, pneumonia (23.7%) was the most prevalent, followed by meningitis/encephalitis (4.4%) and sepsis (3.1%). Other diagnostic groups included hematologic-oncologic conditions (4.9%), cardiovascular diseases (4.1%), postoperative monitoring (4.2%), nephrological disorders (2.5%), and gastrointestinal pathologies (2.5%). The rate of hospitalisation due to scorpion and snake stings was 1.1%.

Table 1. Distribution of diagnostic groups and age ranges of patients.

	n	%
Respiratory system pathologies	69	9.8 %
Infection	220	
- **Pneumonia**	167	23.7 %
- **Sepsis**	22	3.1 %
- **Meningitis-Encephalitis**	31	4.4 %
Neurological system pathologies	107	15.1 %
Cardiovascular system pathologies	29	4.1 %
Metabolic and endocrine system pathologies	50	7.1 %
Hematological and oncological pathologies	35	4.9 %
Gastrointestinal system pathologies	18	2.5 %
Nephrological system pathologies	18	2.5 %
Intoxication	75	10.6%
Scorpion-Snake poisoning	88	1.1%
Accidents	45	
- **Traffic accident**	16	2.2%
- **Falling from height**	14	1.9%
- **Drowning in water**	8	1.1%
- **Foreign body aspiration**	5	0.7%
- **Penetrating body injury**	2	0.2%
Post-operative follow-up	30	4.2 %

When diagnostic distribution was examined across age groups (Table 2), pneumonia was the most frequent diagnosis among patients aged 1–48 months and 49–96 months, while intoxication was predominant (69.4%) in the 97–216 month age group. Additionally, trauma- and poisoning-related admissions were largely concentrated in this older age group. A history of one or more chronic diseases was present in 27.0% of the patients (n = 143).

Table 2. Distribution of diagnoses by age groups.

		1-48 months	49-96 months	97-216 months
	n	n%	n%	n%
Respiratory system pathologies	69	41 (59.4%)	18 (26.1%)	10 (14.5%)
Infection	220			
- **Pneumonia**	167	107(64.1%)	28 (16.8%)	32 (19.2%)
- **Sepsis**	22	14 (63.6%)	3 (13.6%)	5 (22.7%)
- **Meningitis-Encephalitis**	31	13 (41.9%)	9 (29.0%)	9 (29.0%)
Neurological system pathologies	107	59 (55.1%)	18 (16.8%)	30 (28.0%)
Cardiovascular system pathologies	29	14 (48.3%)	1 (3.4%)	14 (48.3%)
Metabolic and endocrine system pathologies	50	16 (32.0%)	5 (10.0%)	29 (58.0%)
Hematological and oncological pathologies	35	16 (45.7%)	7 (20.0%)	12 (34.3%)
Gastrointestinal system pathologies	18	9 (50.0%)	5 (27.8%)	4 (22.2%)
Nephrological system pathologies	18	6 (33.3%)	2 (11.1%)	10 (55.6%)
Intoxication	75	17 (22.6%)	6 (8.0%)	52 (69.4%)
Scorpion-Snake poisoning	8	1(12.5%)	2 (25.0%)	5 (62.5%)
Accidents	45			
- **Traffic accident**	16	4 (25.0%)	2 (12.5%)	10 (62.5%)
- **Falling from height**	14	7(50.0%)	5 (35.7%)	2 (14.3%)
- **Drowning in water**	8	4(50.0%)	0 (0.0%)	4 (50.0%)
- **Foreign body aspiration**	5	4(80.0%)	1 (20.0%)	0 (0.0%)
- **Penetrating body injury**	2	0(0.0%)	0 (0.0%)	2 (100.0%)
Post-operative follow-up	30	12 (40.0%)	5 (16.7%)	13 (43.3%)

The distribution of continuous variables was assessed using the Kolmogorov–Smirnov and Shapiro–Wilk tests (Table 3). All key continuous variables—including age, PRISM III, PIM2 scores, and length of PICU stay—were found to deviate from a normal distribution ($p < 0.001$).

Table 3. Distribution Tests for Continuous Variables (Kolmogorov–Smirnov and Shapiro–WilkTests)

	Kolmogorov-Smirnov			Shapiro-Wilk		
	statistics	df	Sig.	statistics	df	Sig.
Age (months)	0.157	519	0.000	0.872	519	0.000
PRISM score	0.205	446	0.000	0.781	446	0.000
PIM score	0.296	446	0.000	0.621	446	0.000
Length of stay in intensive care (Days)	0.384	519	0.000	0.277	519	0.000

PRISM score: Pediatric Risk of Mortality score. **PIM score:** Pediatric Index of Mortality score

The Kolmogorov–Smirnov and Shapiro–Wilk tests were used to assess the distribution characteristics of continuous variables. A p-value of < 0.05 indicates a statistically significant deviation from a normal distribution.

When mortality-related scoring systems were compared between survivors and non-survivors (Table 4), statistically significant differences were observed. The mean GCS score was 13.91 ± 2.58 in survivors and 8.41 ± 3.80 in non-survivors ($p < 0.001$). Mean PRISM III scores were 3.70 ± 4.14 for survivors and 13.24 ± 10.53 for non-survivors ($p < 0.001$). PIM2 scores were 7.62 ± 8.58 in survivors versus 35.43 ± 27.22 in non-survivors ($p < 0.001$). Similarly, the PELOD-2 scores were significantly higher in non-survivors (14.24 ± 16.02) compared to survivors (1.33 ± 3.84, $p < 0.001$). These findings indicate a strong association between all scoring systems and mortality.

Table 4. Distribution of Mortality-Related Scores (GCS, PRISM III, PIM2, PELOD-2)

		n	Average	SD	t	df	Sig.(2-tailed)
GCS	Survivors	486	13.91	2.587	9.534	506	0.000
	Non-Survivors	22	8.41	3.800			
PRISM3 Score	Survivors	425	3.70	4.138	-9.234	444	0.000
	Non-Survivors	21	13.24	10.530			
PIM2 Score	Survivors	425	7.6154	8.57727	-12.226	445	0.000
	Non-Survivors	21	35.4286	27.22236			
PELOD2 Score	Survivors	425	1.325	3.8393	-11.402	443	0.000
	Non-Survivors	21	14.238	16.0216			
PELOD-2: Estimated Mortality	Survivors	425	0.545	4.3932	-11.504	439	0.000
	Non-Survivors	21	25.714	41.1931			

GCS: Glasgow Coma Scale. **PRISM:** Pediatric Risk of Mortality. **PIM2:** Pediatric Index of Mortality 2. **PELOD-2**: Pediatric Logistic Organ Dysfunction 2. Comparisons between survivor and non-survivor groups were conducted using the independent samples t-test. A p-value of < 0.05 was considered statistically significant.

The initial -2 Log Likelihood value in logistic regression analysis was 324.311, which improved to 213.072 following model refinement, indicating a significant improvement in the model (Table 5).

Table 5. Logistic Regression Analysis Results (-2 Log Likelihood at Baseline and Post-Estimation)

		Chi-square test	df	Sig.
Step 1	Step	111.238	5	.000
	Block	111.238	5	.000
	Model	111.238	5	.000

The logistic regression model was evaluated using the −2 Log Likelihood statistic, the Chi-square test for overall model significance, and the Hosmer–Lemeshow goodness-of-fit test to assess model calibration. A reduction in the −2 Log Likelihood value indicates an improvement in model fit, while a non-significant Hosmer–Lemeshow test result ($p > 0.05$) suggests that the model adequately fits the observed data.

Model explanatory power was acceptable, with Cox & Snell $R^2 = 0.193$ and Nagelkerke $R^2 = 0.415$ (Table 6). The Hosmer–Lemeshow goodness-of-fit test showed that the model was well calibrated ($p = 0.563$).

Table 6. Model Explanatory Power (Cox & Snell R^2, Nagelkerke R^2)

Step	-2 Log likelihood	Cox&Snell R Square	Nagelkerke R Square	Hosmer-Lemeshow Test Sig.
1	213.072[a]	.193	.415	.563

The R^2 values obtained from the logistic regression analysis—specifically Cox & Snell R^2 and Nagelkerke R^2—were used to evaluate the explanatory power of the model. These statistics estimate the proportion of variance in the dependent variable that can be explained by the independent variables included in the model.

Multivariate logistic regression analysis identified three independent predictors of mortality (Table 7): a history of previous PICU admission [Exp(B): 4.697–6.898], the need for mechanical ventilation [Exp(B): 0.151–0.094], and the development of nosocomial infection [Exp(B): 2.474], all of which were statistically significant ($p = 0.021$).

Table 7. Multivariate logistic regression analysis of ındependent predictors of mortality

	B	S.E.	Wald	df	Sig.	Exp(B)
The patient has a history of previous hospitalization	1.547	.399	15.044	1	.000	4.697
There is a history of more than one PICU hospitalization	1.931	.576	11.254	1	.001	6.898
Need for mechanical ventilation			30.611	2	.000	
yes	-1.888	.680	7.702	1	.006	.151
no	-2.359	.437	29.109	1	.000	.094
Nosocomial Infection	.906	.458	3.904	1	.048	2.474
Constant	-1.585	.303	27.383	1	.000	.205

Mortality was defined as the dependent variable in this analysis. Independent variables that demonstrated statistical significance in univariate analysis were entered into the multivariate logistic regression model to identify those independently associated with mortality. A p-value of < 0.05 was considered indicative of statistical significance.

Discussion

This study highlights the significant impact of clinical variables such as age, sex, underlying chronic conditions, and prior PICU admission on patient outcomes in the PICU. In particular, a history of chronic illness or previous PICU admission was associated with increased mortality. Additionally, the PRISM III, PIM2, and PELOD-2 scoring systems demonstrated substantial prognostic value in predicting mortality, underscoring their utility in clinical risk stratification in the pediatric critical care setting.

Of the 519 patients included, 55.3% were male and 44.7% were female. The most represented age group was 1–48 months (47.2%, n = 245), followed by the 97–216 months group (36.4%) and the 49–96 months group (16.4%). These findings confirm that the highest PICU admission rates occur in infancy and early childhood, consistent with patterns reported in the literature. For instance, a study by Ülgen et al. [7] involving 454 patients reported a similar sex distribution (54.6% male, 45.4% female) and a median age of 24 months, which parallels our findings.
The observation that male children were more frequently admitted to the PICU in both our study and that of Ülgen et al. may suggest a sex-related predisposition to critical illness or healthcare-seeking behavior, warranting further investigation. The consistency of these demographic trends emphasizes the need for pediatric intensive care resources and protocols tailored to the needs of younger children, especially during the early developmental stages.

Ülgen et al. [7] reported a PICU readmission rate of 15.7% among patients with underlying chronic conditions, a finding that was statistically significant ($p < 0.001$). In our cohort, the mortality rate was notably higher among patients with a history of prior PICU admission (2.5%) compared to those without such a history (1.7%). Taken together, these findings suggest that children with chronic comorbidities or previous PICU admissions constitute a high-risk group for both readmission and mortality.

Further subgroup analysis revealed a significant disparity in outcomes based on ICU admission history. Among patients with prior PICU admissions, 22.3% survived and 2.5% succumbed, whereas among those without prior admission, the survival and mortality rates were 61.2% and 1.7%, respectively. These data reinforce the prognostic relevance of previous ICU exposure as an independent predictor of poor outcomes.

Children with chronic conditions and those requiring prolonged or complex care represent a substantial proportion of PICU admissions. Consistent with our findings, Konca et al. [8] reported a chronic disease prevalence of 25.5% among PICU patients, while Öz et al. [9] found an even higher prevalence at 41.1%. Both studies identified neurologic disorders as the most common comorbidities in this population. These observations underscore the need for individualized management strategies and enhanced monitoring protocols for these particularly vulnerable pediatric patients.

In our study, the leading cause of PICU admission in the 1–48 month age group was pneumonia (31.1%), followed by the same diagnosis in the 49–96 month group (23.7%). In contrast, intoxication represented the most frequent reason for admission in the 97–216 month age group, accounting for 21.5% of cases. These findings underscore the variation in pediatric intensive care indications across age groups, reflecting differences in clinical presentation and vulnerability during developmental stages. Overall, notable proportions of admissions were attributed to respiratory diseases (9.8%), neurological disorders (15.1%), and infections (23.7%), with severe infections such as pneumonia, sepsis, and meningitis/encephalitis being particularly prominent.

Analysis of the association between PICU length of stay and mortality revealed that surviving patients had a mean ICU stay of 5.64 days (median: 2 days), whereas non-surviving patients exhibited a significantly longer mean duration of 50.55 days (median: 7.5 days). This stark contrast indicates that prolonged ICU stays are closely linked to increased morbidity and mortality.

These findings, supported by existing literature, provide meaningful insights into the epidemiological and clinical characteristics of PICU populations in our context. They highlight the increased hospitalization frequency among younger children and affirm that underlying comorbidities or prior ICU admissions serve as negative prognostic indicators.

Additionally, our analysis demonstrated that the PRISM III, PIM2, and PELOD-2 scoring systems were significantly associated with mortality in PICU patients. These results are consistent with the study by Ülgen et al. [7], which reported higher PRISM, PELOD, and PIM scores among non-survivors. In our cohort, the mean PRISM III score for non-survivors was 13.24, compared to 3.70 among survivors. Similarly, PIM2 and PELOD-2 scores also showed statistically significant differences ($p < 0.001$), reinforcing the prognostic validity of these scoring systems. Moreover, the GCS emerged as an independent factor associated with survival, further underscoring its clinical relevance in outcome prediction.

In our study, the mean GCS score among deceased patients was 8.41, compared to 13.91 among survivors — a difference that was statistically significant. This finding suggests that GCS serves as a valuable prognostic marker in assessing neurological status and predicting mortality in critically ill pediatric patients.

A study by Zinter et al. [10] focusing on pediatric oncology patients reported that this subgroup accounted for 4.2% of all PICU admissions, with a notably elevated mortality rate of 11.4%. The study also identified the type of malignancy and PRISM III score as significant predictors of mortality. In contrast, our study did not include any patients with oncologic diagnoses, a limitation clearly acknowledged in our discussion. This discrepancy underscores how variations in patient populations—particularly in the presence of complex, high-risk conditions such as cancer—can markedly influence intensive care outcomes.

Furthermore, our analysis revealed that both the duration of mechanical ventilation and length of stay in the PICU were significantly longer in non-surviving patients ($p < 0.001$ and $p = 0.002$, respectively). These findings are consistent with those reported by Ülgen et al. [7], who observed

prolonged mechanical ventilation and hospitalization times in patients with fatal outcomes in a tertiary care setting. Collectively, these results suggest that extended ventilator dependency and prolonged ICU stay are indicative of greater illness severity and are associated with an unfavorable prognosis.

Furthermore, our analysis demonstrated that PRISM III, PIM2, and PELOD-2 scores were significantly higher among deceased patients compared to survivors ($p < 0.001$ for all), whereas GCS scores were significantly lower in the deceased group ($p < 0.001$). These findings reinforce the prognostic value of these scoring systems in predicting mortality risk among PICU patients.

These results are consistent with those reported by Ülgen et al. [7], who similarly observed significantly elevated PRISM, PELOD, and PIM scores in patients with fatal outcomes ($p < 0.001$). Their study also noted a notably higher mortality rate (39.4%; $p < 0.001$) in children with hematologic and oncologic conditions, likely due to immunosuppression associated with both the underlying diseases and aggressive therapeutic regimens, which predispose patients to life-threatening infections.

In parallel with these findings, our study identified significant associations between mortality and several clinical variables, including a history of recurrent hospitalizations, prolonged mechanical ventilation, and hospital-acquired infections. These observations highlight the critical importance of combining clinical parameters with validated scoring systems to effectively stratify risk and guide clinical decision-making in PICUs. Implementing such integrative approaches may facilitate early identification of high-risk patients and enable the development of individualized treatment strategies aimed at improving clinical outcomes.

Limitations

This study has several noteworthy limitations. First, its retrospective design introduces inherent biases, including the potential for missing or incomplete data, as clinical information was extracted from the hospital's existing automation system. This may have affected the accuracy and comprehensiveness of the dataset.

Second, as a single-center study, the generalizability of the findings is limited.

Third, the study was conducted during a period when the hospital served as a designated COVID-19 treatment center. This context may have altered the characteristics of the patient population, affected admission patterns, and influenced care delivery, potentially introducing confounding factors.

Finally, the analysis focused on basic demographic and clinical variables such as age, sex, diagnosis, and comorbidities. Important individual-level factors — such as genetic predispositions, socioeconomic conditions, and environmental influences — were not assessed. These unmeasured variables may also significantly impact outcomes in pediatric intensive care and warrant inclusion in future studies.

Strengths

This study possesses several notable strengths. First and foremost, the inclusion of a large patient cohort significantly enhances the statistical power of the analyses and supports the generalizability of the findings to similar healthcare settings.

The utilization of standardized prognostic scoring systems, including PRISM III, PIM2, and PELOD-2, allowed for an objective, quantifiable, and reproducible evaluation of mortality risk. These tools provided a robust and systematic framework for assessing disease severity and clinical outcomes.

Importantly, this study is among the first to systematically examine the characteristics and outcomes of critically ill pediatric patients in the region. As such, it provides original and region-specific insights that can inform improvements in pediatric critical care services and contribute to the development of localized health policies.

Moreover, as one of the few comprehensive studies addressing the clinical profile and outcomes of PICU patients at the national level, the findings offer valuable comparative data that are relevant both locally and internationally.

Finally, the application of multivariate logistic regression analysis enabled the concurrent evaluation of multiple risk factors affecting mortality. This analytical approach allowed for a more nuanced understanding of the interplay between clinical variables and improved the ability to identify independent predictors of adverse outcomes — thereby supporting more precise, evidence-based decision-making in pediatric intensive care settings.

Conclusion

This study offers valuable insights into the clinical characteristics, mortality risk factors, and outcomes of 519 pediatric patients treated in the PICU of Çanakkale Onsekiz Mart University Hospital. As the first comprehensive analysis of critically ill children in this region, it represents a significant step toward assessing the performance of local pediatric intensive care services and identifying regional healthcare needs.

The use of widely accepted prognostic scoring systems — PRISM III, PIM2, and PELOD-2 — enabled a standardized and objective evaluation of mortality-associated factors. Through multivariate logistic regression analysis, the study identified previous ICU admissions, need for mechanical ventilation, and hospital-acquired infections as independent predictors of mortality. These findings underscore the importance of early intervention, vigilant monitoring, and targeted therapeutic strategies in reducing mortality rates in pediatric intensive care.

In summary, this study not only provides an evaluation of PICU performance in a specific institutional context but also lays a robust foundation for future research. The data presented here contribute meaningfully to the development and refinement of pediatric critical care protocols and may inform health service planning at both national and international levels.

Recommendations for Future Research

Given the single-center and retrospective nature of this study, the generalizability of the findings to other geographic regions and healthcare settings is inherently limited. Therefore, future multicenter and prospective studies are essential to enhance the confirmability, external validity, and broader applicability of these results.

Long-term outcomes of children discharged from PICUs, including neurodevelopment, general health, and psychosocial well-being, remain poorly understood. Longitudinal follow-up studies addressing these areas would provide critical insights into the lasting effects of intensive care experiences and inform post-discharge care planning.

Research focused on evaluating the effectiveness of targeted clinical interventions aimed at reducing PICU mortality is also warranted. Investigations into strategies such as enhanced infection control protocols, early weaning from mechanical ventilation, and personalized treatment plans could yield actionable data for optimizing patient outcomes.

Lastly, the integration of advanced technologies, including artificial intelligence (AI) and machine learning (ML), into pediatric intensive care warrants exploration. Studies assessing the feasibility and accuracy of AI/ML-based models for mortality prediction could contribute to the development of more precise and responsive clinical decision support systems. Incorporating such innovations into routine monitoring and care processes may significantly improve the quality, efficiency, and outcomes of pediatric critical care.

Conflict of Interest: The authors declare that they have no known financial or personal relationships that could have appeared to influence the work reported in this study.

Author Contributions		**Author Initials**
SCD	Study Conception and Design	FB, TAB
AD	Acquisition of Data	TAB, FB
AID	Analysis and Interpretation of Data	FB, TAB
DM	Drafting of Manuscript	FB, TAB
CR	Critical Revision	FB, TAB

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