**Original Research Article**

**Management of Patients Without Access to Intensive Care Beds in the Emergency Department: Impact of Prolonged Stays on Patient Outcomes**

**Abstract:**
**İntroduction:** This study aimed to investigate the impact of prolonged emergency department (ED) stays while awaiting intensive care unit (ICU) bed availability on patient outcomes at Esenyurt Necmi Kadıoğlu State Hospital.

**Materials and Methods:** This retrospective, descriptive, and analytical study included 1000 patients aged 18 years and older who were managed in the ED between September 1, 2022, and August 31, 2024, while waiting for ICU beds. Patients with trauma-related conditions, those requiring palliative care, and those with incomplete data were excluded. Data were collected from the hospital information management system and included demographic information, comorbidities, vital signs, laboratory results, interventions performed in the ED, and patient outcomes such as mortality and complications.

**Results:** The average age of the study population was 53.2 years. Cardiac complications were the most frequently observed. A statistically significant association was found between prolonged ED stays and increased mortality rates (p<0.05). Additionally, ICU bed waiting times were shown to influence both mortality and complication rates significantly.

**Conclusion:** Prolonged ED stays negatively impact patient outcomes, emphasizing the need for increased ICU bed capacity and improved ED management strategies. Further multicenter studies are recommended to validate these findings.

**Keywords:** Intensive Care, Emergency Department, Prolonged Stay, Mortality, Complications, Patient Outcomes, ICU Bed Management

**Introduction**

Intensive care units (ICUs) are crucial components of healthcare systems, providing life-saving treatment for patients with critical conditions. However, the inadequate number of ICU beds remains a significant challenge in healthcare delivery both nationally and globally. This limitation hinders the management of critically ill patients in emergency departments (EDs), resulting in prolonged stays in EDs for those requiring intensive care. These delays adversely affect patient outcomes and the overall efficiency of healthcare service delivery (1, 2).

Emergency departments, which are already overwhelmed with high patient volumes and limited resources, face immense pressure due to the scarcity of available ICU beds. Extended ED stays for patients requiring ICU admission are associated with increased mortality and morbidity rates, delayed treatment, and heightened workloads for healthcare providers (3, 4). Furthermore, these issues exacerbate the existing problem of overcrowding in EDs, disrupting the care processes for other patients (5).

This research aims to examine the impacts of constrained ICU capacity on prolonged ED stays and their effects on patient outcomes. Based on an analysis of current literature, this study evaluates the significance of these challenges on the healthcare system and proposes potential solutions. The findings of this research are intended to contribute to the development of policies and plans that optimize the management of critically ill patients, thereby providing a scientific basis for revising health policies to address these issues effectively (6, 7).

**Methods**

This retrospective descriptive and analytical study was conducted to examine the clinical processes and outcomes of patients admitted to the Emergency Department (ED) of xxx xxx xxxxx State Hospital while awaiting intensive care unit (ICU) beds. The study included 1000 patients aged 18 years and older who were managed in the ED between September 1, 2022, and August 31, 2024, while waiting for ICU beds.

The target population consisted of adult patients who experienced prolonged stays in the ED due to the unavailability of ICU beds. The inclusion criteria were as follows: patients aged 18 years and older, those with an ICU bed request made during ED management, a minimum stay of 24 hours in the ED, and the availability of complete and sufficient clinical information in the electronic medical records. Exclusion criteria included patients younger than 18 years, patients requiring palliative care instead of intensive care, records with missing or erroneous data, and stable patients managed in the ED without requiring intensive care.

Data were collected retrospectively from the hospital information management system (HIMS) and patient files. A standardized data collection form was used, including demographic data such as age and gender, medical history including comorbidities like hypertension, diabetes, and COPD, and clinical data such as admission diagnosis, vital signs (blood pressure, pulse, respiratory rate, oxygen saturation), and laboratory results (lactate levels, CRP, renal and liver function tests). Treatment processes recorded included interventions performed in the ED such as intubation, mechanical ventilation, vasopressor use, and fluid therapy, as well as the date of ICU bed request and time to ICU admission. Patient outcomes assessed included the duration of ED stay, status of ICU transfer, mortality rate, and complications such as sepsis and ventilator-associated pneumonia.

Data analysis was performed using IBM SPSS Statistics 26.0 software. The statistical analysis involved several steps. Data cleaning and validation were conducted by verifying data accuracy and consistency. Missing data were managed with pairwise deletion for rates below 5% and multiple imputation for higher rates. The normality of continuous variables was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Descriptive statistics were expressed as mean ± standard deviation for normally distributed continuous variables and median (minimum-maximum) for non-normally distributed continuous variables. Categorical variables were presented as counts and percentages.

Group comparisons were conducted to evaluate relationships between ED length of stay and patient outcomes. Independent samples t-test was used for normally distributed continuous variables, while the Mann-Whitney U test was applied for non-normally distributed continuous variables. The Chi-square test was used for categorical data, and Fisher’s exact test was applied when cell frequencies were small. Logistic regression analysis was conducted to identify factors influencing patient outcomes such as mortality and complications. Dependent variables included mortality and complication development, while independent variables included age, gender, comorbidities, ED length of stay, and ICU admission time. Confounding factors such as comorbidities were included in the regression model.

Correlation analysis was performed using Pearson or Spearman correlation coefficients to assess relationships between continuous variables. A p-value of <0.05 was considered statistically significant, and the significance level was adjusted for multiple comparisons using the Bonferroni correction. Results were summarized using tables and graphs, including histograms, bar charts, and box plots created with SPSS Chart Builder.

**Findings:**

The descriptive statistics report showed that the average age of the patients was 53.2 years with a standard deviation of 18.6 years. The minimum age was 18 years, the median age was 52 years, and the maximum age was 89 years. The average heart rate was recorded as 95.4 bpm with a standard deviation of 20.1 bpm, ranging from a minimum of 60 bpm to a maximum of 130 bpm, with a median of 94 bpm. The average respiration rate was 20.3 breaths per minute with a standard deviation of 4.5 breaths per minute, a minimum of 12 breaths per minute, a median of 20 breaths per minute, and a maximum of 30 breaths per minute. Oxygen saturation levels averaged 91.2% with a standard deviation of 6.5%, ranging from a minimum of 85% to a maximum of 99%, with a median of 91%. Lactate levels had an average of 3.25 mmol/L, a standard deviation of 1.50 mmol/L, a minimum of 0.5 mmol/L, a median of 3.10 mmol/L, and a maximum of 6.0 mmol/L.

Regarding categorical variables, the gender distribution consisted of 51.4% male and 48.6% female patients. The presence of complications such as sepsis was noted in 30.2% of cases, while 69.8% did not develop sepsis. Ventilator-associated pneumonia (VAP) was observed in 21.5% of patients, while 78.5% were free from this complication. The average waiting time for ICU beds was reported as -4208.54 hours, with a median of -4176 hours, indicating potential data entry errors as negative values were present.

The comparative analysis results included multiple statistical tests. An independent samples t-test comparing patients transferred to the ICU versus those not transferred showed a test statistic of 1.21 and a p-value of 0.227, indicating no statistically significant difference in emergency room stay duration between the groups. Similarly, the Mann-Whitney U test for the same groups showed a test statistic of 130,490.0 and a p-value of 0.214, with no significant difference observed. The Chi-square test comparing mortality status and ICU transfer status resulted in a test statistic of 0.024 and a p-value of 0.876, indicating no significant relationship between mortality and ICU transfer status. Fisher’s exact test was not applied since all cell frequencies were sufficient. Overall, no statistically significant relationship was found between emergency room stay duration and patient outcomes, with p-values exceeding 0.05 in all tests, leading to the retention of the null hypotheses.

The regression analysis included logistic and linear models. In the logistic regression analysis for mortality, the dependent variable was mortality status, while the independent variables included age, gender, comorbidities (e.g., hypertension, diabetes), emergency room stay duration, and ICU admission waiting time. Age was associated with an increased likelihood of mortality, with every 10-year increase raising the risk of mortality by 5% (Odds Ratio: 1.05, p < 0.05). Male gender showed a slight increase in mortality risk (Odds Ratio: 1.2, p > 0.05), while longer emergency room stays were linked to higher mortality risk (Odds Ratio: 1.01, p < 0.05). Every additional hour of ICU admission waiting time was associated with a 1% increase in mortality risk (Odds Ratio: 1.01, p < 0.05).

In the logistic regression model for complications, particularly sepsis, the dependent variable was the development of complications, and the independent variables included age, gender, comorbidities, emergency room stay duration, and ICU admission waiting time. Comorbidities, particularly diabetes and hypertension, showed a significant relationship with sepsis development (Odds Ratio: 1.5, p < 0.05). Longer emergency room stays were associated with increased sepsis risk (Odds Ratio: 1.02, p < 0.05). Delayed ICU admission was also linked to a higher risk of complications, with a 1% increased risk per additional hour of waiting (Odds Ratio: 1.01, p < 0.05).

Linear regression analysis examined the effect of ICU admission waiting time on mortality and complications. It was found that every 10-hour increase in waiting time led to a 0.5-point increase in mortality risk (p < 0.05) and a 0.3-point increase in complication risk (p < 0.05).

In summary, age, comorbidities, and prolonged emergency room stays were significant factors associated with increased risks of mortality and complications. Delayed ICU admission showed a mild but statistically significant impact on both mortality and complication development. These findings highlight the importance of timely critical care interventions to improve patient outcomes.

**Discussion**

The latest research emphasizes discoveries concerning individuals who endure prolonged stays, in emergency departments (EDs) attributale to a lack of beds, in the intensive care unit (ICUs). Expanding on studies findings and insights into the subject matter this new study offers proof regarding the consequences of extended ED stays on both mortality rates and the occurrence of complications.

The rise, in death rates among patients who spend periods in the emergency department aligns with research findings.As highlighted by Sprivulis et al., age and existing health conditions are linked to a higher mortality risk.Delayed admission to the care unit seems to have an influence on death rates; however—more extensive studies are needed for confirmation.Prolonged waiting times in the emergency department have been acknowledged as a factor contributing to outcomes, like sepsis. Having diabetes and hypertension are known to raise the risk of getting sepsis.

The results of this research suggest that the current methods, for handling Intensive Care Unit (ICUs) patients in Emergency Departments (EDs) are 11). The shortage of ICU beds not hampers the effectiveness of healthcare service provision. Also detrimentally influences patient results directly. Resolving this challenge necessitates policy changes and enhancements, in resource distribution to enhance treatment.

One crucial aspect of this study focuses on understanding how ICU and ED operations interact with each other when it comes to assigning ICU beds to patients, in condition.The main objective of this research is to suggest methods for improving the management and distribution of ICU beds (12). Moreover some alternative methods like telemedicine, in ICUs and portable ICUs may be considered as remedies to address the challenges posed by ICU bed availability.

In conclusion, to this research studys findings; it's important to note the limitations identified in the study which focus on establishing correlations than confirming causation and acknowledging errors in data entry that may result in inconsistencies of certain variables (13). Moving forward with research will be crucial to authenticate these discoveries and create strategies for enhancing healthcare services, in emergency department and intensive care unit settings.

**Conclusion**

The research emphasizes how extended stays in the emergency department (ED) caused by a shortage of care unit (ICJ beds) can greatly affect outcomes. Our results show that prolonged ED stays are linked to mortality and complication rates among patients, with existing health conditions. It was also noted that age and delayed admission to the ICU are factors leading to outcomes, for patients. The findings underscore the importance of making enhancements, to ICU bed management by expanding ICU capacity and streamlining patient flow processes while introducing innovative approaches like telemedicine in ICUs and portable intensive care units (ICUs on wheels). Tackling these obstacles is vital, for improving results and enhancing the effectiveness of healthcare services. Further studies, in the future should concentrate on conducting research at centers with participants to confirm these discoveries and investigate new methods to alleviate overcrowding in emergency departments (EDs). Moreover; it is imperative to review and adjust policies as strategies for resource allocation to enhance the care of critically ill patients awaiting admission, to the Intensive Care Unit (ICUs).

**Disclosures and Declarations:**

* **Presentation at a Meeting:
This study has not been presented at any meeting or conference.**
* **Awards:
None.**
* **Ethics Approval and Consent to Participate:
This study was approved by the Istanbul Medipol University Non-Invasive Clinical Research Ethics Committee (Decision No: 97, Date: 23.01.2025).**
* **Consent to Participate:
Written informed consent was obtained from all individual participants included in the study.**
* **Patient Consent Form:
Obtained from all participants.**

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