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The Causes of Long-Term Hospitalization of Patients in the Emergency Ward of Rouhani and Beheshti Hospital

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Abstract

Introduction: The length of stay in the emergency department (ED) starts from entering the unit and does not end until the patient is discharged home, admitted to the hospital or until transferred to another department or other treatment center. This period of time indicates the optimal management of beds in the ED. It is used as a performance index to evaluate the quality of care in the ED and the evidence shows that a stay in the ED of more than 6 hours is associated with an increase in mortality and morbidity. Therefore, the present study aims to investigate the causes of long-term stay (more than 12 hours) patients in the ED of Ayatollah Rouhani Babol educational and treatment center is designed.

Research method: This research was cross-sectional-retrospective. The study population consisted of all patients who referred to the ED of Rohani Babol Hospital in 2022. Sampling was done in the form of the entire census of the studied community. Data was collected using a checklist from Rouhani Hospital in Babol city. The collection tool was a pre-made checklist that included basic and demographic information of the patients. If a file did not have the desired information, or was incomplete, it was excluded from the study.

Results: This study was conducted on 400 patients who referred to the ED of Ayatollah Rouhani and Shahid Beheshti hospitals, who stayed in the emergency ward for more than 12 hours. In this study, the average duration of hospitalization until the assignment of the patient by the emergency medicine specialist was 57.8±82.6 minutes. The average time from entering to leaving the ED was 31.8 ± 21.8 hours for men and 33.8 ± 24.4 hours for women. The average time from entering to leaving the ED in patients with a history of hypertension was 38.9 ± 27.1 hours, with a history of diabetes 37.6 ± 27.3 hours, and with a history of heart disease 36.5 ± 24.3 hours. It was statistically significant (p=0.001), (p=0.007) and (p=0.040) respectively). The difference between the average time of entering and leaving the ED with the way the patient left the emergency ward was not statistically significant (p=0.636). However, a statistically significant difference was observed between the average time of entering and exiting the ED with the level of triage (p=0.004) and the type of disease (p=0.001). The results of the one-way analysis of variance test showed that the difference in the average duration of hospitalization in the emergency medicine service until leaving the emergency medicine service, the difference in the average duration of assignment by emergency medicine to the visit of the specialist assistant (p=0.814) and the difference in the average duration of required tests From the request to the answer to the test (p=0.454), no significant statistical difference was observed in the age groups. However, the difference in the average time between entering and leaving the ED in the age groups was found to be statistically significant (p=0.001).

Conclusion: The length of stay is influenced by various demographic and clinical factors. Therefore, it is possible to predict the length of stay by applying data mining techniques on hospital admission data. This work can be a suitable tool for planning and optimal allocation of hospital resources.

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Introduction

As the primary provider of health care services, hospitals play a vital role in the healthcare system (1). These institutions must be capable of meeting patient needs in the shortest possible time (2). Emergency departments (EDs) and emergency services are essential and critical components of hospitals, given their sensitive role in managing accidents and trauma (3). Furthermore, the ED is one of the most significant sections considered in hospital evaluations (4). The core mission of the ED is to provide the most appropriate care within the shortest timeframe. Patients presenting to the ED are often in a physiological crisis; therefore, timely intervention with the highest quality of care is both a fundamental patient right and a primary duty of the medical staff (5).

In recent decades, factors such as population growth, the prevalence of intentional and unintentional injuries, and substance abuse have led to increased patient density and overcrowding in emergency departments (6). Injuries are generally classified into two categories: intentional and unintentional. Unintentional injuries primarily include those resulting from road traffic accidents, poisoning, falls, and drowning. Intentional injuries include self-harm, such as suicide, or harm to others, including interpersonal violence and homicide. The rising incidence of various injuries is one of the most significant life-threatening risks globally, accounting for numerous deaths annually (7). Beyond the loss of health, the consequences of such incidents include costs related to medical care, treatment, and rehabilitation, as well as profound psychological impacts on individuals. Worldwide, accidents and trauma are recognized as the leading cause of ED visits (8).

In the context of the factors mentioned above, the Length of Stay (LOS) is a critical factor in emergency care (9). Nearly all daily hospital activities are mirrored within the ED, making it a microcosm of the hospital itself. Consequently, the ED is the only department that frequently faces the challenge of patient overcrowding (10). Time-motion analysis of patient workflow to determine LOS is the most effective and cost-efficient method for addressing hospital overcrowding (11). LOS is a widely used metric across nearly all aspects of quality assessment in emergency services. In the ED, LOS is defined as the time interval between a patient's arrival and their departure from the department (12). Prolonged LOS is associated with several adverse outcomes, including decreased patient satisfaction and care quality (13, 9), as well as increased mortality and morbidity for both admitted and discharged patients (13, 14).

Given the importance of estimating waiting times and LOS, these parameters serve as key indicators for evaluating the quality of healthcare services (15). Modern healthcare organizations believe that focusing on service quality is the key to organizational success (16). The first step in improving service quality is identifying the factors influencing service delivery and the duration required to control these factors (17). Prompt and optimal management of emergency patients significantly enhances public satisfaction (18). Since approximately 78% of hospital visits occur through the ED, every minute and even second is critical. Research indicates that 75–85% of deaths occur within the first 20 minutes following an incident, and most clinical outcomes progress or are mitigated within the first 10 minutes, when critical decisions are made.

Despite the significance of this issue, no such study has been conducted at Babol University of Medical Sciences. Investigating the causes of prolonged LOS in the ED and providing actionable solutions will significantly contribute to improving the quality of service delivery and, consequently, increasing patient satisfaction. Therefore, the present study was designed to investigate the causes of prolonged LOS (exceeding 12 hours) among patients in the emergency departments of Ayatollah Rohani and Shahid Beheshti Educational and Remedial Centers in Babol.

Methods

Study Design and Population

This cross-sectional study was conducted on 400 patients admitted to the emergency departments (EDs) of Shahid Beheshti and Ayatollah Rohani Hospitals in Babol in 2022-23. These hospitals serve as the primary referral centers for trauma and internal medicine in the region due to their diverse specialized and sub-specialized facilities. Inclusion criteria consisted of all patients with an ED length of stay (LOS) exceeding 12 hours. Exclusion criteria included incomplete medical records or cases where the final patient disposition was not documented.

Data Collection and Variables

A convenience sampling method was employed. Data were extracted from the Hospital Information System (HIS) and archived medical records using a researcher-developed checklist. The checklist comprised the following sections:

* Demographic variables: Age, Gender, place of residence (urban/rural), educational level (illiterate, below high school diploma, high school diploma and higher), and marital status (single/married).

* Clinical history and comorbidities: History of diabetes, cancer, hypertension, cardiovascular disease, respiratory disease, type of illness (internal vs. non-

internal), and history of hospitalization within the previous three months.

* Time-sensitive variables: Intervals between imaging and laboratory requests and the receipt of results (measured in minutes).

* Triage level: Classified into four levels upon arrival, with Level 1 indicating a higher degree of urgency compared to Level 4.

* Environmental and logistical variables: Time of arrival (recorded in minutes from the triage form, admission, and initial physician order), season, day of the week (weekday/weekend), shift (day/night), and mode of arrival (self-presentation, accompanied by others, or via ambulance).

* Outcomes and disposition: In-hospital mortality, causes of prolonged stay (e.g., lack of vacant inpatient beds, midnight arrival, lack of a guardian, complex medical status, or delayed disposition by other services), and discharge status (discharge, left against medical advice, or admission to a ward).

Table 1: Descriptive characteristics of emergency department patients with a length of stay >12 hours at Ayatollah Rohani and Shahid Beheshti Hospitals.

Variable	Level	Total Frequency	Ayatollah Rohani	Shahid Beheshti
Gender	Female	188 (47.0)	132 (70.2)	56 (29.8)
	Male	212 (53.0)	146 (68.9)	66 (31.1)
Age	≤20 years	19 (4.8)	7 (36.8)	12 (36.2
	21–40 years	79 (19.8)	40 (50.6)	39 (49.4)
	41–60 years	90 (22.5)	61 (61.8)	29 (32.2)
	61–80 years	157 (39.3)	128 (81.5)	29 (18.5)
	>80 years	55 (13.8)	42 (76.4)	13 (23.6)
Residence	Rural	166 (41.5)	119 (71.7)	47 (28.3)
	Urban	234 (58.5)	159 (67.9)	75 (32.1)
Season	Spring	67 (16.8)	51 (76.1)	16 (23.9)
	Summer	134 (33.5)	90 (67.2)	44 (32.8)
	Autumn	133 (33.3)	87 (65.4)	46 (34.6)
	Winter	66 (16.5)	50 (75.8)	16 (24.2)
Day of Week	Non-holiday	294 (73.5)	224 (76.2)	70 (23.8)
	Holiday	106 (26.5)	54 (50.9)	52 (49.1)
Shift	Morning/Evening	183 (45.8)	144 (78.7)	39 (21.3)
	Night	217 (54.3)	134 (61.8)	83 (38.2)
Arrival Mode	Private	203 (50.7)	164 (80.8)	39 (19.2)
	EMS	197 (49.3)	114 (57.9)	83 (42.1)
Triage Level	1	144 (36.0)	109 (75.7	35 (24.3)
	2	206 (51.5)	155 (75.2)	51 (24.8)
	3	50 (12.5)	14 (28.0)	36 (72.0)
History of Hypertension	No	242 (60.5	158 (65.3)	84 (34.7)
	Yes	158 (39.5)	120 (75.9)	38 (24.1)
History of Diabetes	No	285 (71.3)	195 (68.4)	90 (31.6)
	Yes	115 (28.7)	83 (72.2)	32 (27.8)
History of Cardiac Disease	No	286 (71.5)	192 (67.1)	94 (32.9)
	Yes	114 (28.5)	86 (75.4)	28 (24.6)
Type of Disease	Neurosurgery	33 (8.3)	15 (45.5)	18 (54.5)
	Cardiology	40 (10.0)	31 (77.5)	9 (22.5)
	Infectious	59 (14.8)	48 (81.4)	11 (18.6)
	Internal Medicine	203 (50.7)	170 (83.7)	33 (16.3)
	General Surgery	60 (15.0)	9 (15.0)	51 (85.0)
	Neurology	5 (1.3)	5 (100.0)	0 (0.0)
Outcome	Survived	338 (84.5)	236 (69.8)	102 (30.2)
	Deceased	62 (15.5)	42 (67.7)	20 (32.3)
Disposition Mode	Death	14 (3.5)	4 (28.6)	10 (71.4)
	Discharge (AMA)	11 (2.8)	7 (63.6)	4 (36.4)
	Routine Discharge	6 (1.5)	6 (100.0)	0 (0.0)
	Admission to Ward	322 (80.5)	229 (71.1)	93 (28.9)
	Admission to ICU	47 (11.8)	32 (68.1)	15 (31.9)

Statistical Analysis

Data were analyzed using SPSS software (Version 16.0). Quantitative variables were described using mean and standard deviation (SD), while qualitative variables were expressed as frequencies and percentages. The relationships between variables were assessed using the independent t-test, Chi-square test, and Analysis of Variance (ANOVA) with Post Hoc tests where appropriate. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study protocol was approved by the Ethics Committee of Babol University of Medical Sciences (Ethics Code: IR.MUBABOL.REC.1402.096). All principles of data confidentiality and the protection of patients' personal information were strictly maintained throughout the study.

Table 2: Descriptive clinical timeline during ED stay at Ayatollah Rohani and Shahid Beheshti Hospitals.

Variable	Total (Mean±SD)	Ayatollah Rouhani (Mean±SD)	Shahid Beheshti (Mean±SD)
Age (years)	58.3 ± 20.5	61.7 ± 18.3	50.6 ± 23.1
Admission to disposition (min)	57.8 ± 82.6	50.8 ± 79.8	73.6 ± 86.8
Disposition to consultation (min)	32.2 ± 30.8	29.5 ± 29.9	38.2 ± 31.9
Ward assignment by resident (min)	953.1 ± 941.2	1110.4 ± 1049.6	594.5 ± 461.4
Laboratory turnaround time (min)	305.0 ± 316.9	284.6 ± 257.1	351.3 ± 420.4
Imaging turnaround time (min)	528.5 ± 539.2	522.3 ± 545.2	542.7 ± 527.1
Total ED LOS (min)	1968.4 ± 1386.7	2340.1 ± 1465.0	1121.3 ± 622.3

Results

This study included 400 patients presenting to the emergency departments (EDs) of Ayatollah Rohani and Shahid Beheshti Hospitals with a length of stay (LOS) exceeding 12 hours. Of the participants, 212 (53%) were male. A total of 132 female patients (70.2%) and 146 male patients (68.9%) presented to Ayatollah Rohani Hospital, while the remaining patients were treated at Shahid Beheshti Hospital. The mean age of the study population was 58.3 ± 20.5 years. Age distribution was as follows: 19 patients (4.8%) aged ≤20 years, 79 (19.8%) aged 21–40 years, 90 (22.5%) aged 41–60 years, 157 (39.3%) aged 61–80 years, and 55 (13.8%) aged >80 years (Table 1).

Regarding residence, 234 patients (58.5%) lived in urban areas. Specifically, 119 rural patients (71.7%) and 159 urban patients (67.9%) presented to Ayatollah Rohani Hospital, with the remainder presenting to Shahid Beheshti Hospital. Seasonal distribution of visits was: Spring (n=67, 16.8%), Summer (n=134, 33.5%), Autumn (n=133, 33.3%), and Winter (n=66, 16.5%). Most patients (n=294, 73.5%) presented on non-holidays. Additionally, 207 patients (54.3%) presented during the night shift, while 183 (46.7%) presented during the morning or evening shifts. At Ayatollah Rohani Hospital, 224 patients (76.2%) presented on non-holidays and 54 (50.9%) on holidays; at Shahid Beheshti Hospital, these figures were 70 (57.4%) and 52 (42.6%), respectively (Table 1).

A total of 203 patients (50.7%) arrived via private transport, while the remainder were transported by Emergency Medical Services (EMS/115). Triage levels were distributed as: Level 1 (n=144, 36%), Level 2 (n=206, 51.5%), and Level 3 (n=50, 12.5%). Medical histories revealed hypertension in 242 patients (39.5%), diabetes in 115 (28.7%), cardiac disease in 114 (28.5%), cerebrovascular accident (CVA) in 39 (9.8%), and cancer in 98 (24.5%). Furthermore, 119 patients (29.5%) had a history of hospitalization within the previous three months. Admission causes by specialty were: neurosurgery (n=33, 8.3%), cardiology (n=40, 10%), infectious diseases (n=59, 14.8%), internal medicine (n=203, 50.7%), general surgery (n=60, 15%), and neurology (n=5, 1.3%) (Table 1).

Intubation was required for 94 patients (23.5%), and 58 (14.5%) required cardiopulmonary resuscitation (CPR). The overall in-hospital mortality rate was 15.5% (n=62), with 69.8% of deaths occurring at Ayatollah Rohani Hospital and 30.2% at Shahid Beheshti Hospital. Final patient disposition included transfer to a general ward (n=322, 80.5%), transfer to the ICU (n=47, 11.8%), discharge (n=6, 1.5%), leaving against medical advice (n=11, 2.8%), and death (n=14, 3.5%) (Table 1).

The mean time from admission to disposition by an emergency medicine specialist was 57.8 ± 82.6 minutes (Ayatollah Rohani: 50.8 ± 79.8 min; Shahid Beheshti: 73.6 ± 86.8 min). The mean time from emergency medicine disposition to specialty resident consultation was 32.2 ± 30.8 minutes (Ayatollah Rohani: 39.6 ± 30.0 min; Shahid Beheshti: 38.3 ± 31.9 min). Laboratory turnaround time (request to result) averaged 305 ± 317 minutes (Ayatollah Rohani: 284.7 ± 257.1 min; Shahid Beheshti: 351.3 ± 420.4 min). The average duration for imaging (request to completion of final study) was 528.6 ± 539.2 minutes (Ayatollah Rohani: 522.4 ± 545.3 min; Shahid Beheshti: 542.7 ± 527.1 min).

The mean time for ward assignment by a specialty resident was 953.1 ± 941.2 minutes; as shown in Table 2, this duration was approximately twice as long at Ayatollah Rohani Hospital compared to Shahid Beheshti Hospital. The overall mean ED LOS (arrival to departure) was 1968.3 ± 1386.7 minutes.

Mean ED LOS was 31.8 ± 21.8 hours for males and 33.8 ± 24.4 hours for females, with no significant statistical difference (p=0.394). However, significant differences in ED LOS were observed for patients with a history of hypertension (38.9 ± 27.1 hours, p=0.001), diabetes (37.6 ± 27.3 hours, p=0.007), and cardiac disease (36.5 ± 24.3 hours, p=0.040). Patients requiring isolation rooms had a significantly longer mean ED LOS of 44.0 ± 29.5 hours (p=0.001). Furthermore, statistically significant correlations were identified between ED LOS and admission to non-specialty wards (p=0.003) and isolation room requests (p=0.003).

Table 3: ED Length of Stay (LOS) categorized by patient characteristics.

Variable	Level	ED LOS (Minutes)	ED LOS (Hours)	P-value
Gender	Female	2030.1 ± 1467.6	33.8 ± 24.4	0.394
	Male	1912.6 ± 1311.8	31.8 ± 21.8	
Residence	Rural	1882.7 ± 1353.9	31.3 ± 22.5	0.299
	Urban	2029.1 ± 1409.2	33.8 ± 23.4	
Days of the Week	Non-holiday	2032.2 ± 1372.1	33.8 ± 22.8	0.125
	Holiday	1791.1 ± 1417.9	29.8 ± 23.6	
Time of Arrival	Day	2036.9 ± 1413.1	33.9 ± 23.5	0.365
	Night	1910.5 ± 1364.7	31.8 ± 22.7	
Arrival Mode	Private	1963.2 ± 1254.6	32.7 ± 20.9	0.941
	EMS	1973.6 ± 1514.1	32.8 ± 25.2	
Hypertension	No	1728.7 ± 1141.9	28.8 ± 19.0	0.001
	Yes	2335.4 ± 1631.3	38.9 ± 27.1	
Diabetes	No	1850.1 ± 1253.6	30.8 ± 20.8	0.007
	Yes	2261.3 ± 1641.2	37.6 ± 27.3	
Cardiac Disease	No	1878.3 ± 1348.1	31.3 ± 22.4	0.040
	Yes	2194.2 ± 1461.1	36.5 ± 24.3	
Lung Disease	No	1964.9 ± 1367.3	32.7 ± 22.7	0.871
	Yes	2006.1 ± 1609.8	33.4 ± 26.8	
CVA	No	1918.5 ± 1367.6	31.9 ± 22.7	0.029
	Yes	2429.4 ± 1493.4	40.4 ± 24.8	
Cancer	No	1968.1 ± 1439.7	32.8 ± 23.9	0.995
	Yes	1969.1 ± 1215.5	32.8 ± 20.2	
History of Hospitalization (Past 3 Months)	No	2042.7 ± 1407.5	34.0 ± 23.4	0.097
	Yes	1790.5 ± 1324.5	29.8 ± 22.1	
Mortality	Survived	1944.9 ± 1307.7	32.4 ± 21.7	0.431
	Deceased	2096.1 ± 1763.8	34.9 ± 29.3	
Intubation	No	2011.5 ± 1468.8	33.5 ± 24.4	0.262
	Yes	1827.7 ± 1071.9	30.4 ± 17.8	
Transfer Order to CPR Room	No	1988.3 ± 1351.6	33.1 ± 22.5	0.825
	Yes	1956.5 ± 1409.6	32.6 ± 23.4	
Resuscitation (CPR)	No	1966.6 ± 1419.7	32.7 ± 23.6	0.952
	Yes	1978.4 ± 1184.2	32.9 ± 19.7	
CT Scan Failure	No	1847.1 ± 1354.6	30.7 ± 22.5	0.108
	Yes	2070.6 ± 1408.2	34.5 ± 23.4	

The following results describe the relationship between the duration of stay—from admission to discharge—and various demographic and clinical variables among patients with a length of stay exceeding 12 hours at Ayatollah Rouhani and Shahid Beheshti hospitals in Babol.

Regarding the patient disposition from the emergency department, the longest mean duration of stay was observed in patients transferred to the neurology ward (31.1 ± 72.4 hours or 1867.0 ± 4346.0 minutes). Patients discharged to the internal medicine ward followed with a mean stay of 23.2 ± 35.4 hours (1396.1 ± 2126.2 minutes). Conversely, the shortest mean stay was recorded for patients who expired (2.15 ± 2.31 hours) and those transferred to the Intensive Care Unit (16.5 ± 30.1 hours). Statistical analysis indicated

that these differences in duration based on the mode of exit were not significant (p = 0.636).

In terms of seasonal variations, the highest mean duration of stay occurred during the autumn, reaching 26.2 ± 36.0 hours (1577.2 ± 2161.1 minutes), while the shortest duration was noted in the spring at 20.1 ± 33.1 hours (1206.4 ± 1989.7 minutes). These seasonal fluctuations in the length of stay did not reach statistical significance (p = 0.205).

Analysis of triage levels revealed a significant correlation with the duration of stay (p = 0.004). Patients categorized as Triage Level 1 experienced the longest mean stay at 26.1 ± 35.4 hours (1567.9 ± 2126.0 minutes), followed by Level 2 at 21.3 ± 33.3 hours (1279.9 ± 2000.4 minutes). The shortest stays were associated with Level 3 triage patients, averaging 18.2 ± 23.0 hours (1096.7 ± 1382.4 minutes).

Table 4. Association between time intervals and patient disposition among patients with prolonged emergency department stays (>12 hours) at Ayatollah Rouhani and Shahid Beheshti Hospitals.

Variable	ICU Admission	Ward Admission	Discharge	Discharge against medical advice	Death	P-value
Time from ED admission to ED service exit (minutes)	8.72 ± 5.88	3.57 ± 2.82	0.40 ± 9.97	4.30 ± 1.53	8.47 ± 1.84	0.517
Time from ED specialist decision to specialist resident visit (minutes)	29.7 ± 3.21	31.8 ± 2.31	5.8 ± 6.6	34.5 ± 4.25	57.5 ± 7.43	0.006
Time to ward assignment by specialist resident (minutes)	862.1 ± 4.837	958.1 ± 2.968	1250.0 ± 4.594	998.1 ± 4.1004	981.4 ± 8.759	0.898
Laboratory turnaround time (request to result) (minutes)	380.4 ± 6.464	296.7 ± 9.299	260.0 ± 3.90	250.9 ± 0.144	304.2 ± 1.231	0.507
Imaging turnaround time (request to completion) (minutes)	453.6 ± 3.302	544.8 ± 3.579	433.3 ± 8.415	456.3 ± 1.318	504.2 ± 6.364	0.808

* Data Presentation: Values are expressed as Mean ± Standard Deviation (SD).
* Abbreviations: ED, Emergency Department; ICU, Intensive Care Unit.

The type of illness was significantly associated with the duration of emergency department stay (p = 0.001). Infectious disease cases required the most extensive stays, averaging 30.0 ± 39.5 hours (1802.2 ± 2371.0 minutes). In contrast, patients in the general surgery category had the shortest mean duration of stay at 11.3 ± 18.9 hours (681.4 ± 1136.1 minutes). Other notable durations included cardiovascular cases at 14.5 ± 27.9 hours and neurosurgery cases at 14.7 ± 29.6 hours.

The total duration of stay from emergency department (ED) admission to discharge was analyzed for patients with stays exceeding 12 hours at Ayatollah Rouhani and Shahid Beheshti hospitals in Babol. For the total study population, the mean duration of stay was 1968.3 ± 1386.7 minutes, which corresponded to 32.8 ± 23.1 hours.

Statistical analysis revealed a significant difference in the length of stay between the two facilities (P = 0.001). At Ayatollah Rouhani Hospital, the mean duration from admission to discharge was 2340.1 ± 1464.9 minutes (39.0 ± 24.4 hours). In contrast, patients at Shahid Beheshti Hospital experienced a shorter mean duration of stay, recorded at 1121.2 ± 622.3 minutes (18.6 ± 10.3 hours).

The analysis of the relationship between patient disposition from the emergency department (ED) and triage levels among patients with a length of stay exceeding 12 hours revealed a statistically significant association (P = 0.009). Mortality was exclusively observed in the higher acuity triage levels, with 6 deaths (42.9%) occurring in triage level 1 and 8 deaths (57.1%) in triage level 2. Similarly, all 47 patients requiring intensive care unit (ICU) admission were classified within the first two triage levels, with 20 patients (42.6%) in level 1 and 27 patients (57.4%) in level 2.

Regarding inpatient ward transfers, the majority of the cohort was distributed across triage levels 1 through 3. Specifically, 112 patients (34.8%) were categorized as level 1, 161 patients (50.0%) as level 2, and 49 patients (15.2%) as level 3. Discharge against medical advice (personal consent) was reported for 4 patients (36.4%) in level 1, 6 patients (54.5%) in level 2, and 1 patient

(9.1%) in level 3. Routine discharge was limited to the highest acuity levels, involving 2 patients (33.3%) in triage level 1 and 4 patients (66.7%) in triage level 2.

The analysis of time-based process intervals relative to patient disposition revealed that the duration from the emergency medicine specialist's decision to the initial visit by a specialty resident was the only factor demonstrating a statistically significant difference across the various disposition groups (P = 0.006). Specifically, patients who ultimately died in the emergency department experienced the longest mean intervals for this specific metric compared to those admitted to wards or discharged. Conversely, other operational timeframes—including total ED length of stay, ward assignment duration by residents, and turnaround times for laboratory and imaging diagnostics—did not show significant statistical variation based on the patient's eventual mode of exit from the emergency department (P > 0.05).

The analysis of patient flow and outcomes for individuals with an emergency department (ED) stay exceeding 12 hours at Ayatollah Rouhani and Shahid Beheshti hospitals revealed distinct temporal patterns between survivors and non-survivors. The mean duration from ED admission to discharge was significantly longer in the non-surviving group (6.66 ± 3.38 hours) compared to those who survived (8.84 ± 3.61 hours; p = 0.043). When measured in hours, this discrepancy remained statistically significant, with mortality associated with a mean duration of 1.1 ± 0.6 hours from admission to exit from the emergency medicine service, contrasted with 4.1 ± 0.1 hours for survivors (p = 0.043).

Other clinical milestones did not demonstrate statistically significant associations with mortality. The interval between the emergency medicine department's final disposition and the subsequent visit by a specialty resident was 31.4 ± 30.1 minutes for survivors and 36.2 ± 34.1 minutes for non-survivors (p = 0.261). Similarly, the duration from the specialty resident's assessment to the final ward assignment showed no significant difference, recorded at 955.7 ± 925.7 minutes and 938.9 ± 1029.8 minutes for the respective groups (p = 0.898).

Diagnostic turnaround times were also comparable regardless of patient outcome. The mean time from laboratory test request to result availability was 299.2 ± 298.8 minutes for survivors and 336.7 ± 403.2 minutes for non-survivors (p = 0.392). Furthermore, the interval from imaging request to procedure completion did not differ significantly, with mean times of 533.9 ± 565.3 minutes in the surviving cohort and 499.3 ± 367.6 minutes in the mortality cohort (p = 0.643).

The analysis of clinical workflow intervals relative to patient age groups at Ayatollah Rouhani and Shahid Beheshti hospitals demonstrated significant age-related variations in several key performance indicators for patients with emergency department (ED) stays exceeding 12 hours. The duration from admission to the emergency medicine service until discharge from the service did not differ significantly across age groups, with mean times ranging from 54.1 ± 76.8 minutes in the 21–40 age group to 77.7 ± 60.4 minutes in patients over 80 years (p = 0.737). Similarly, the interval between the emergency medicine department's disposition and the initial evaluation by a specialty resident showed no statistically significant difference across the age cohorts, with mean values spanning from 30.3 ± 27.4 minutes to 35.8 ± 38.4 minutes (p = 0.814).

In contrast, several operational milestones exhibited high statistical significance regarding patient age. The time required for a specialty resident to determine the final ward assignment increased progressively with age, rising from 694.7 ± 398.6 minutes in patients aged 20 years and younger to 1269.6 ± 1157.4 minutes in those over 80 years (p < 0.001). Diagnostic imaging turnaround times—measured from request to completion—also varied significantly by age, with the longest mean duration observed in the youngest cohort (806.3 ± 724.1 minutes) compared to the 61–80 age group (469.0 ± 377.1 minutes; p < 0.001). Turnaround times for laboratory investigations did not follow this significant trend, with values ranging from 259.6 ± 184.7 minutes to 360.0 ± 483.9 minutes across all groups (p = 0.454).

The total length of stay (LOS) from ED entry to exit demonstrated a marked increase in older populations. Mean LOS rose significantly from 1365.2 ± 576.2 minutes (22.7 ± 9.6 hours) in the youngest cohort to 2258.0 ± 1620.3 minutes (37.6 ± 27.0 hours) in those aged 80 years and older (p < 0.001). Patients in the 61–80 age range also experienced prolonged stays, averaging 2239.4 ± 1461.6 minutes or 37.3 ± 24.3 hours. These findings indicate a strong positive correlation between advanced age and the total duration of the emergency department stay.

Discussion

The present study was conducted with the aim of investigating the causes of stays exceeding 12 hours in the emergency departments of Imam Khomeini and Shahid Beheshti Hospitals in Babol. The results of the current study indicated that the mean duration from entry to discharge from the emergency department (ED) was 31.8 ± 21.8 hours for men and 33.8 ± 24.4 hours for women. The difference in the meantime from entry to discharge between men and women was not statistically significant.

Findings by Chong et al. showed that patient mortality is not associated with the length of stay (LOS)

in the ED; however, an ED stay exceeding 8 hours is significantly associated with a longer total hospital stay, and the LOS in the ED was significantly longer for patients over 75 years of age (18). Conversely, Rose et al. concluded that the length of stay in the ED is associated with increased hospital mortality, highlighting the importance of swift action and patient disposition on clinical outcomes (19). These contradictory findings may be attributed to the sample size studied, the management systems of different hospital emergency departments, the number of human resources, and the quality of services and medical equipment, all of which lead to variations in LOS across different studies.

The results of the current study showed that the highest mean time from entry to discharge from the ED was reported in patients with a history of hypertension, while the lowest mean was related to patients with a history of heart disease. It was also found that patients requiring consultation experienced a longer stay compared to others. In this regard, the study by Casalino et al. indicated that specialized consultations were one of the reasons for prolonged stays in the ED. Other reasons examined in their study included arrival by ambulance, hematological examinations, intravenous treatment, unstable vital signs, specialized imaging such as X-rays, MRI/CT scans, and ultrasound, as well as admission to the surgical ward, which were consistent with the results of the current study (20). Similarly, the study by Belayneh et al. showed that patients requiring specialized consultation were hospitalized in the ED longer than others (21).

The results obtained from the present study showed a direct correlation between age and the time from entry to discharge from the ED. In other words, as age increased, the duration of stay in the ED also increased. However, the results of the study by Zamane et al. showed that patients in lower age groups and employed patients had, on average, longer hospital stays (22). Numerous previous studies align with the current findings, indicating that increasing age leads to a longer length of stay in the emergency department (23, 24). For instance, the results of a study by Vejdani et al. in Sabzevar showed that the age variable had a significant relationship with the number of hospitalization days, such that for every one-year increase in age, the length of stay increased by approximately one day on average (25).

In another study by Esmailian et al., which aimed to investigate the causes of long-term stays in the ED of a hospital in Tehran, findings stated that patient age and the time of arrival at the hospital influenced their length of stay in this department (26). Khazaei et al. stated that patient age and the reason for the ED visit were other factors influencing the duration of stay, meaning that patients in older age groups and children were among those who stayed more hours in the ED. The age conditions of these groups, their special sensitivities, and their need for specialized and extra-hospital consultations are among the factors affecting their stay in the ED (27). A 2021 study by Yang et al. showed that advanced age was one of the variables associated with a higher risk of prolonged LOS (23). Given that the phenomenon of aging can cause health problems, it leads to an increased disease burden and, parallelly, an increased frequency of hospitalizations (28). Many elderly individuals are hospitalized one or more times during their lives. Unfortunately, hospitalization for the elderly entails various problems; illness and hospitalization can place individuals in a critical situation regardless of their age. However, this is more pronounced in elderly individuals whose adaptation to hospitalization is lower, as they have less physical energy and a lower capacity to adapt to unfamiliar environments compared to younger individuals.

The results of the current study showed that the mean duration of stay in the ED was higher in women than in men, but this difference was not statistically significant. Consistent with our results, several previous studies showed that women, on average, stayed longer in the hospital than men (22). The study by Simkhada et al. in 2020 on the duration of ED stay in a tertiary care hospital in Nepal also showed that the mean stay for women was 3.25 hours, which was higher compared to 3.11 hours for men (29).

The current study revealed a statistically significant difference between the mean time from entry to discharge and the type of disease; specifically, the shortest stay was related to surgical diseases and the longest to neurological diseases. Consistent with these results, Jabbari et al. also showed that surgical patients spend less time in the ED due to the critical nature of their physical condition compared to other patients (30). Similarly, Ravangard et al. showed that patients hospitalized with neoplasms, endocrine, nutritional, and urogenital diseases stay longer in the hospital due to the need for multiple examinations, tests, and radiographs for diagnosis and treatment duration (31).

Furthermore, the results of this study showed no statistically significant correlation between the patient's mode of discharge, ICU admission orders, CPR transfer orders, admission to an unrelated ward, and vital status with the time from laboratory request to result or imaging request to completion regarding the LOS in the ED. No statistically significant difference was found between the mean duration of ED stay based on urban or rural residency. Similarly, Zamane et al. showed no significant difference between the variable of place of residence and the length of stay. Additionally, the current study found no significant relationship between

the season of visit or the hour of visit during the day/night with the length of stay (22).

Contrary to our results, Solakoglu et al. showed that patients who visited during the night shift experienced longer waiting times in the ED (32). Beczek et al. identified factors such as being female, having a higher triage level, arriving during the afternoon or night shifts, and being aged 56 to 80 as reasons for prolonged stays in the ED (33). Basir Ghafouri et al. also showed that the average waiting time for patients in the night shift was higher. They attributed this to the high volume of referrals during the afternoon and night shifts, the lower number of doctors and nurses compared to the morning shift, ED overcrowding, and the fatigue of the medical and nursing staff in these shifts (34). In 2012, Karaca et al. showed that the duration from admission to discharge in the ED was about 3 hours, with an increasing trend from 8:00 AM to noon, followed by a decreasing trend until midnight (35). Furthermore, Basir Ghafouri et al. showed a correlation between the days of the week and waiting times, with patients visiting during weekends staying approximately 58 minutes longer in the ED (34). They attributed this to the closure of private clinics on weekends and the subsequent increase in ED referrals (34). Schmulewitz et al. also stated that human resources and access to diagnostic and therapeutic services are significantly lower on weekends compared to other days (36). In a 2012 study by Wiler et al., the length of stay on holidays was estimated to be longer than on regular days (37), which contradicts the results of this study.

The results of the current study showed no statistical correlation between causes of prolonged stay and lack of vacant beds, midnight visits, complicated patients, or triage duration. However, Forster et al. demonstrated that hospital occupancy is strongly related to the length of stay in ED sections. Their findings suggested that factors like the lack of vacant beds in other hospital wards and the influence on visits and disposition by the senior resident on duty were less prominent in increasing LOS in the ED (38). A similar study by Karim et al. identified the time of hospital visit and a history of previous illness/hospitalization as influential factors (39).

The present study showed a significant difference between the time from entry to discharge from the ED with the triage level and type of disease. Specifically, the LOS for patients with Triage Level 1 was reported to be higher than Level 2, and Level 2 was higher than Level 3. Regarding the mean triage time, Baratloo et al. concluded that establishing emergency medicine teams in the ED can lead to more efficient triage (40). International studies have indicated that long waiting times and stays in the ED are the result of inefficiency in the workflow processes of entry, care delivery, and discharge. Thus, one of the main reasons for increased waiting times is the lack of triage implementation or patient prioritization based on clinical status (41). Consistent with the findings of the current study, Wessman et al. in Sweden showed that patients with an increased stay in the ED based on triage level had higher short-term mortality (9). Changes in vital signs and higher triage priority are closely related to short-term mortality (42). Therefore, it is predicted that patients with highly urgent symptoms and impaired vital parameters will have high mortality and longer stays in the ED (43). In fact, the primary goal of triage is not predicting short-term mortality, but the early identification of patients with higher disease severity. Patients with more severe conditions are assessed first by nurses; thus, triage priority is closely related to the stay in the ED. Additionally, the length of stay based on triage depends on patient-specific care, including blood sampling, diagnostic imaging, inpatient admission, and bed occupancy.

Conclusion

In this study, a significant relationship was observed between certain variables and the length of stay. Decisions regarding variables to reduce LOS rest with hospital planners and managers. They can take steps toward reducing LOS by implementing appropriate planning, such as increasing medical personnel and preparing necessary equipment in high-congestion departments, which will lead to the optimal productivity of hospital resources. Despite the high prevalence of ED admissions and the socio-economic consequences of prolonged hospitalization in Iran, limited studies have been conducted in this field. The results of this research can be considered by health managers to provide better programs for the prevention, treatment, and care of patients in the ED.

Research Limitations

Every research project faces limitations. The limitations of this study include the scattered nature of information in patient records, the retrospective design, lack of access to patients during the study, the inability of the researcher to take comprehensive clinical histories, and incomplete medical records.

Recommendations

* Conducting a multi-center study with similar objectives is recommended.

* Performing a similar study on patients undergoing a specific intervention is recommended.

* Conducting a systematic review on this topic is recommended.

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Authors Contributions

The authors contributed to the data analysis. Drafting, revising and approving the article, responsible for all aspects of this work.

Conflict of Interest

None

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