Research Article

Evaluation of Patient Flow and Waiting Time for the First Physician Visit in an Overcrowded Emergency Department

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Abstract

Background: The velocity of providing services in health centers is crucial to reduce mortality and adverse outcomes.

Objectives: The present study aimed at determining the waiting time from entering the emergency department (ED) up to physician visiting based on congestion in the triple shift at Shahid Mohammadi Hospital in Bandar Abbas, Iran.

Methods: The current cross-sectional, analytical study was conducted in 2019 on 1285 subjects selected from three shifts. The data collection tools included demographic data and standard triage forms, as well as a timetable with a stopwatch. The time between patient arrival and physician visit was recorded. SPSS software version 21 was employed to analyze the data.

Results: The highest percentage of patients, 65.1% (n = 837), was non-traumatic, 38.98% (n = 501) referred during the evening shift, and 47.54% (n = 611) were related to the triage level 3. The maximum average waiting time from the beginning to the end of the triage was 4.46, and up to the physician, the visit was 12.8 minutes. Waiting time from entering ED up to physician first visit in terms of gender, refer to ED, and cause of referral statistically divulged a significant difference (P < 0.05). Estimation of the maximum congestion in the department was from 16:00 to 20:00, which showed a significant difference with other day times (P < 0.05).

Conclusions: The average waiting time for patients was higher than the global standard. The interventions based on the maximum congestion in ED can be effective in reducing patient waiting time.

Keywords: Waiting Time, Crowding, Emergency Department

1. Background

The emergency department (ED) has a sensitive position and provides multiple and complex care services in hospitals and health systems (1). It is highly important to appreciate what people expect from emergency departments (2). The law says that 98% of ED patients should be visited and then admitted or discharged within four hours of presentation to the ED (3). Triage systems are developed to speed up identifying critically ill patients in EDs (4). Employment of triage scales in EDs leads to a significant reduction in waiting time and improved patient satisfaction (5). Congestion of EDs changes the role of emergency medicine (EM), the problem existing in most countries (2). Policymakers and health researchers think that the patient waiting time is a major and important indicator for hospital quality performance (6). In addition, some studies identify the effect of high occupancy (above 90%) and access block as the causes of adverse patient outcomes, treatment delays, high mortality rates (20% - 30%), prolonged length of stay (LOS) of ambulatory patients, and hospital readmission (7, 8). Many studies show an inverse relationship between waiting time and patient satisfaction (9). The maturation of EM as a specialty coincides with a dramatic increase in ED visit rates in the

United States and worldwide (10). In Iran, waiting time in different parts of ED was not satisfactory (6). The key times of care delivery in ED is written in the form of studies known as timing studies. These key times include the time the patients enter until the beginning of the triage, the time which triage begins up to the end, and the time of admission until visiting the physician (11).

2. Objectives

The present study aimed at assessing the workflow and waiting time from entering the ED up to being visited by a physician based on the department congestion in all three work shifts.

3. Methods

3.1. Study Design

The current cross-sectional, analytical study was conducted at the ED of Shahid Mohammadi Hospital, Bandar Abbas, Iran, in 2019. Considering the malleability of patients referred during weekdays, sampling was performed consecutively in three shifts within two weeks, and 1285 subjects were selected.

3.2. Data Collection Method

To coordinate and resolve any ambiguity, the researcher held meetings with eight research colleagues responsible for recording the arrival time of patients up to being visited by the physician. The content of the sessions included the importance of the study, the need for careful work, time recording, and cognizance of the study process. After coordination with the ED managers of all three work shifts, the investigator continued to monitor the time. The researcher tried to determine the pick hours of ED according to the referral rate of patients during all the three work shifts with four-hour intervals from 8:00 to 8:00 in the next morning. Data collection tools were the demographic data, time registration (including the arrival time, start and end of triage time, visiting physician time) form, and emergency severity index for triage level determination. The ethical code (HUMS.REC.1396.34) was obtained from the Ethics Committee of the local university.

3.3. Statistical Analysis

Statistical analysis was performed using SPSS version 21. The study groups were compared using independent t, one-way ANOVA, the Mann-Whitney U, and Kruskal-Wallis tests. Multivariate linear regression was employed to predict the duration of patient stay in ED, based on demographic data of patients and other time and triage levels. P values less than 0.05 were considered as statistically significant.

4. Results

Among 1285 patients referred to ED during the evening shift, 775 (61.3%) were male, and 501 (39.7%) female. The most common reason for referral to ED in 837 (65.1%) subjects were the non-traumatic complications. Most of them, 611 (47.5%), were categorized as the triage level 3 (Table 1). The highest average waiting time for patients at the start of the triage was five minutes, from start to the end of the triage was 4.305 minutes, from arrival at ED to the end of triage was 5.7 minutes, and from admission to the emergency room to physician visit was 12.3 minutes during the

night shift. The statistical analyses showed a significant difference in patient arrival at ED up to the end of triage between the three different shifts (P < 0.05). However, the difference between the admission times to ED up to physician visits was not significant (P > 0.05) (Table 2). The maximum ED congestion was during the evening shift. The statistical analyses showed a significant difference between the three work shifts (P < 0.05), although the difference was not significant between the evening and night shifts (P > 0.05). The maximum number of the referrals to ED was during two four-hour periods of 16:00 to 20:00 and 20:00 to 24:00. The obtained results showed that the highest waiting time for patients from entering ED to the start of the triage (at level 1), from start to the end of triage (at level 4), from entering ED until the physician visit (at level 5) was not significant (P > 0.05, but this comparing were significant (P < 0.05) in other case (Tables 3 and 4). Using linear regression, the variables were transferred into a quasi-time equation to predict the time equation. The time variables of maximum overcrowding (three work shifts, daytime or night visitation), triage level, and holiday visits were nonstop and had no significant effect. Results obtained from the univariate logistic regression test indicated that variables including three work shifts, daytime or night visitation, triage level, and holiday visits had no significant effect on waiting time of patients during the maximum overcrowding period (16 pm to 24 midnight) in the ED (P > 0.05).

5. Discussion

Based on the findings of the study, the average patient waiting time from arrival at ED to physician visit was 14 minutes in the current study. Hashemi et al., reported the average waiting time from arrival in the first place to being visited by a physician as 8.1 ± 0.6 minutes (11). For 900 patients included in another study, the median waiting time interquartile range (IQR), from entry to the first visit by a physician was 8 (5-14) minutes (mean $\pm$ SD: 9.87 ± 7.55), 84 minutes to the first referral physician order in ED, and 100 minutes to the first clinical measure (4), consistent with the results of the present study. In a study conducted in Northern Nigeria (12), it was found that a total of 118 (31%) of the patients waited for less than an hour in the waiting room, while 371 (96.6%) spent less than 30 min with the doctor (12). The results of a study in Rwanda showed that the majority (42%) of the respondents considered 30 - 60 minutes as a reasonable time for waiting to be visited by a physician in an emergency center, and the majority perceived waiting for more than an hour as an indicative of the emergency center congestion (13). Chaou et al., re-

Table 1. The Basic and Demographic Information of Referrals to the Emergency Department

Demographic Variable	Frequency	Percentage
Gender		
Male	775	60.3
Female	510	39.7
Method of refer to the emergency department		
By ambulance	102	29.8
By self-wheel	1183	70.2
Reason for referral		
Traumatic	448	34.9
Non-traumatic	837	65.1
Triage level		
1	23	1.78
2	232	18.06
3	611	47.54
4	394	30.67
5	25	1.95
Work shift		
Morning	298	23.19
Afternoon	501	38.98
Night	486	37.82

ported the overall median LOS of 2.15 hours, with an IQR of 6.51 hours [14].

The results of a study in the United States showed that patients on-average waited 56 minutes for a visit by a physician, and 42% waited more than 60 minutes [15]. In this regard, according to CTAS (the Canadian Emergency Department Triage and Acuity Scale) guidelines, all patients referring to ED should be visited within 10 minutes. Also, arrival at ED, length of triage, and history-taking should not exceed 2 - 5 minutes [7].

In the current study, the waiting time from triage to physician visits varied across triage levels. The lowest average belonged to level 1 and the highest to level 5. While examining the waiting times in ED, in a heterogeneous sample of California hospitals, Lambe et al., estimated the average waiting time for physician visit at ED as 56 minutes, which was 20 minutes higher in the educational hospitals than non-educational ones, and was also 26.5 minutes higher in the state hospitals than the private ones [15].

Maleki et al., reported that the average time of admission to ED until physician visit in the five-level triage system was 8.92 minutes [16]. In the present study, the average waiting time from entering the ED to the start of

triage was 6.4 minutes. The probable cause of this difference can be the ED congestion due to patients' recurrence, lack of skill and experience, and inadequate training of staff. The waiting time for patients referring to ED is one of the indicators of hospital quality performance [17]. In the current study, the average waiting time from the start to the end of triage was seven minutes. In this regard, the Canadian Emergency Medicine Association emphasizes that only the information necessary to determine the level of triage should be collected [18]. In the current study, the average waiting time from entering the ED to the end of triage was eight minutes. Probably the reason for the long waiting time was that the study setting was the only public, specialty, and subspecialty hospital, and the majority of patients refer to this center. Other possible causes may be the anxiety of clients, lack of patient prioritization in the triage, and the shortage of experienced and efficient personnel. The shortage of staff and auxiliary staff, inappropriate use of emergency services, and inadequate physical space lead to significant problems, such as lowering patient safety and increasing expenditures [19, 20].

Therefore, the executive authorities of hospitals must specify especial areas for ambulatory and non-emergent patients in EDs by using strategies such as mobile care systems, walk-in clinics, and designating general practitioners for families [21].

The results of the current study showed that the maximum congestion of the patients was from 16:00 to 20:00, showing a significant difference in this term during all the work shifts ($P < 0.05$). Hertzum [22] reported that the average arrival varied from 0.85 at 06:00 to 7.25 at 11:00. Pairwise comparisons showed significantly fewer arrivals during the night (1:00 - 7:00) than any other time of the day, a significant hour-by-hour increase of arrivals in the morning (8:00 - 11:00), and a significant hour-by-hour decrease of arrivals from noon to midnight, except in the early afternoon and early evening [22]. The reason for this consistency can be the educational nature of the hospital and the emergency environment as the study setting in both studies.

Long waiting time results in undesirable services, reduced quality of care, adverse effects for patients with critical illnesses, and the increased number of patients leaving the hospital before receiving medical services. In this regard, Mataloni et al., reported that 8.9% of patients left ED before physician visits and 4.3% during treatment [23]. Studies in Australia, North America, Canada, the United Kingdom, and Hong Kong indicated that the most important reason for emergency escape is the prolongation of waiting time. On the other hand, it affects the on-time, fruitful, safe, and patient-axis care [24].

Table 2. Comparison of Waiting Time from Admittance to the Emergency Department to Doctor Visit According to the Triage Level

Waiting Time (Sec)	Triage Level, Mean (SD)				P Value
	Level 1 (N = 23)	Level 2 (N = 232)	Level 3 (N = 611)	Level 4 (N = 394)	
From emergency entry to the start of triage	231.4 (788)	190 (261)	156 (185)	137.3 (123.7)	0.1
From start to the end of triage	70 (48.8)	120.5 (50.7)	123 (39.7)	286 (39.3)	0.001
From emergency entry to the end of triage	131.4 (75)	294.5 (279)	267 (205)	236 (212)	0.001
From emergency entry to doctor visit	248.6 (119)	645 (392)	650 (360)	728 (400)	0.001

Table 3. Comparison of Waiting Time from Entering the Emergency Department to Doctor Visit by Work Shift

Waiting Time (Sec)	Shift Work, Mean (SD)			P Value
	Morning (N = 298)	Afternoon (N = 501)	Night (N = 486)	
From arrival at the emergency department to the start of triage	192 (300)	264 (360)	300 (540)	0.001
From start to the end of triage	228 (462)	120 (480)	258 (540)	0.001
From arrival at the emergency department to the end of triage	204 (180)	314 (156)	342 (420)	0.001
From arrival at the emergency department to doctor visit	502 (348)	600 (490)	720 (472)	0.05

Table 4. Comparison of Waiting Time for Admission from Arrival at the Emergency Department to Doctor Visit Based on Demographic Variables

Waiting Time (Sec)	Demographic Variable		Frequency (Percentage)	Mean (SD)	P Value
From arrival at the emergency department to the start of triage	Gender	Male	775 (60.3)	158 (197.2)	0.001
		Female	510 (39.7)	150 (215)	
	Refer to the emergency department	By ambulance	102 (29.8)	223 (464)	0.001
		By self-wheel	1183 (70.2)	149.5 (167)	
	Reason for referral	Traumatic	448 (34.4)	156 (175)	0.001
		Non-traumatic	837 (65.1)	181.3 (265)	
From start to the end of triage	Gender	Male	775 (60.3)	200 (232.7)	0.001
		Female	510 (39.7)	177.2 (247)	
	Refer to the emergency department	By ambulance	102 (29.8)	112.4 (100)	0.001
		By self-wheel	1183 (70.2)	196.7 (209.5)	
	Reason for referral	Traumatic	448 (34.9)	268.5 (315)	0.008
		Non-traumatic	837 (65.1)	132 (310)	
From arrival at the emergency department to the end of triage	Gender	Male	775 (60.3)	262 (251.6)	0.001
		Female	510 (39.7)	247 (171)	
	Refer to the emergency department	By ambulance	102 (29.8)	294.5 (322)	0.001
		By self-wheel	1183 (70.2)	253 (212.3)	
	Reason for referral	Traumatic	448 (34.9)	252.6 (196)	0.001
		Non-traumatic	837 (65.1)	289 (274)	
From arrival at the emergency department to doctor visit	Gender	Male	775 (60.3)	340.5 (392)	0.001
		Female	510 (39.7)	386 (463)	
	Refer to the emergency department	By ambulance	102 (29.8)	594.5 (557.6)	0.001
		By self-wheel	1183 (70.2)	340.5 (405)	
	Reason for referral	Traumatic	448 (34.9)	219 (395.5)	0.001
		Non-traumatic	837 (65.1)	604 (350.4)	

5.1. Conclusion

The results of the current study showed that the average waiting time was higher in comparison with the global standard. It is recommended that interventional studies be designed to reduce the waiting time in EDs, and then

the effect of such interventions be considered. Other studies be conducted to indicate that the distribution of staff in ED or triage room relative to the congestion and the number of visitors in each shift.

Supplementary Material

Supplementary material(s) is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

Footnotes

Conflict of Interests: The authors declared no conflicts of interest.

Ethical Approval: The study protocol was approved by the Ethics Committee of the local university (Ethical Code: HUMS.REC.1396.34).

Funding/Support: There was no financial support for the study.

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