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Original Article

Predictors of prolonged adult hospitalization in the tertiary care hospital emergency department of Saudi Arabia

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ABSTRACT

The Length of Stay (LOS) in the Emergency Department (ED) is considered as an indicator of performance across many nations. Therefore, we aimed to investigate the predictors of increased LOS in a sample of adult patients, admitted to an ED of a major tertiary care hospital in the KSA. A cross-sectional study was conducted from January 2017 to March 2018 in the ED of King Abdullah Bin Abdulaziz University Hospital, Riyadh, KSA. The medical records of all patients (11513) who were admitted to ED were extracted and analyzed using STATA version 16.

In multivariable analysis, after adjusting for other covariates, the LOS was 70 minutes higher in patients discharged against medical advice (DAMA) versus those with no DAMA. Similarly, in patients presenting to emergent and urgent triage, the expected LOS was 221 minutes and 88 minutes higher as compared to non-ER patients. The expected LOS was 13 minutes higher among > 40 years old females compared to males of the same age group. There is a need to explore organizational hospital-related factors that might be related to significant patient-related predictors identified in this study. Future studies should aim to explore the underlying causes of gender differences related to the extended length of stay in Saudi Arabia.

Keywords: Predictors, Length of stay, Emergency department, Adults, Saudi Arabia

Introduction

Emergency medicine, known as an integral part of public health service, has rapidly advanced since its inception around four decades ago [1, 2]. As the services provided by EDs increase and patient management becomes more complex, patients tend to stay longer in EDs; as a result, it becomes more crowded [3]. The EDs crowding has gained considerable consideration in recent years across many nations [4]. It represents the disproportion between the recognized needs for emergency services and the existing resources in the ED and hospital [5]. Besides, ED crowding has been considered a chronic health challenge across the globe [6], which may lead to dysfunctional and curtailed emergency activities [7]. There is evidence in the literature that ED crowding can lead to severe adverse effects, including increased complications, long waiting times, and increased deaths of patients [8-10].

Furthermore, increased ED LOS has caused adverse consequences such as increased complication and mortality rate

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and decreased satisfaction [11, 12]. A myriad of studies has also revealed that extended LOS in ED is not only a cause but also a result of its crowding creating a vicious cycle [8, 13]. The studies in the developed countries have demonstrated that the flow of patients in EDs and treatment times, including LOS, are affected by several multifaceted factors like staffing, triage interventions, and hospital occupancy rates [14-17]. LOS is a marker of overcrowding and a crucial measure of ED throughput [18]. Reduction in LOS can reduce healthcare costs and optimize resource consumption [19, 20]. Planning of interventions to reduce LOS in the hospital requires understanding the individual and organizational factors that may affect LOS and identifying subgroups of patients with longer LOS [21, 22]. These interventions are equally important for both developed and developing countries with rising populations and changing demographics to address the issue of an increasing number of admissions effectively [23, 24].

For example, in Saudi Arabia, the increasing population has led to an increase in the number of admissions to EDs [25]. As a result, performance improvement in EDs has been a critical challenge. Although the factors that contribute to prolonged ED length of stay have been analyzed in numerous studies, most data are derived from the databases in the developed countries such as the United States and China [26, 27]. These results might not reflect the conditions in countries with different health systems such as Saudi Arabia. So, elucidating the factors associated with ED LOS is valuable in the reduction of crowding and improvement of the quality of care in a country having a different health system and population demographics. Hence, this study aimed to investigate the predictors of increased LOS in adult patients admitted to the ED of a tertiary care hospital in the KSA.

Materials and Methods

Study design

We conducted a cross-sectional study from 2017 to 2018 in Saudi Arabia.

Settings

Data of all patients admitted to the ED of King Abdullah Bin Abdulaziz University Hospital (KAAUH) in Riyadh, KSA, starting from January 2017 to March 2018 were included in the study. The KAAUH is the landmark of Princess Nourah bint Abdulrahman University, and one of its distinguished accomplishments. The ED of the KAAUH provides medical care to all employees, university staff, and their families as well as university students (approximately 70,000). The emergency department and the emergency medical services (EMS) have been cornerstones in providing the ED services to PNU: the department has 4 sections, the adult, pediatric, disaster medicine, and EMS section comprising of 35 beds. It is the main governmental hospital and is funded by the Ministry of Education. The hospital is composed of 300 beds including 7 departments. 320 residents, 113 consultants, and registered nurses provide healthcare to patients with any disease type.

The Scope of the Emergency Medicine Department (ED) provides comprehensive Emergency services to all patients referred to the ward 24 hours a day. This ward accepts all emergency patients for treatment. ED of the KAAUH manages nearly 47 cases/day and around 3500 cases/month. It is composed of Acute Care, Triage, and Resuscitation units. Patients are triaged based on a 5-level triage system (Canadian Triage and Acuity Scale), ensuring that they are evaluated and sorted according to severity. All patients who are eligible and meet the scope of service of KAAUH will be seen in the Emergency Department unless it is CTAS 2 to 5. All patients with CTAS 1, or with life or limb-threatening conditions (Trauma, Toxicology, Burn, etc.), regardless of their eligibility status, will receive only the stabilization management in the resuscitation unit of the ED, and then they will be transferred straight to KAAUH for further management. ED staff are specialized emergency healthcare providers with advanced experience and qualifications.

Data collection

We used the medical records of the patients admitted to the ED. Data was collected for 11513 patients admitted to the adult ED. As per hospital policies and rules of the ED, all related data about the patient's complaints documented in the Health Information Management System-TrakCare. This consists of gender, age at the time of admission, triage category, bed, time and date of discharge, and discharge classification. The data were extracted and entered into Microsoft Office Excel for further analysis. The sampled population was also used in a previously published study [28].

Statistical analysis

The data were analyzed using STATA software version 16. Median (IQR) was reported for the length of hospital stay and its relationship with different variables and assessed by the Mann-Whitney U test. Adjusted and unadjusted beta coefficients with 95% CI were reported using linear regression modeling. All plausible confounders and interactions were measured. The significance level was set at a p-value <0.05.

Results and Discussion

The descriptive characterisitics of the study participants were reported in our similar research article published in 2019 [28]. **Table 1** shows the length of hospital stay (LOS) and the demographic and Emergency department (ED) related factors. The overall median (IQR) LOS of patients was 70 (87). The median LOS was significantly higher (77 (114) minutes) in patients >40 years of age as compared to ≤ 40 years (68 (81) minutes) ($p=0.000$). We observed that median LOS was significantly higher among females (74 (90) minutes) versus males (60 (78) minutes) ($p<0.001$). Median (IQR) LOS among

patients who were discharged against medical advice (DAMA) was significantly higher (172 (170) minutes) versus their counterpart (69 (87)) (p <0.001). Moreover, median (IQR) LOS in patients presenting to emergent triage was significantly higher (270 (238) minutes) followed by urgent (134 (128) minutes), less urgent (63 (67) minutes), non-urgent (44 (44) minutes), and lowest in non-ER patients (38 (39) minutes) (p <0.001).

Table 1. Length of Hospital Stay (LOS) and the Demographic and Emergency Department (ED) Related Factors

Variables (Number of Patients)	Length of Hospital Stay (in minutes) Median (IQR)	p-value
Age		
≤40 years (8497)	68(81)	0.000*
>40 years (3008)	77(114)	
Gender		
Females (7821)	74 (90)	0.000*
Males (3293)	60 (78)	
Discharge Classification		
Discharge against medical advice (59)	172(170)	
Admission to the hospital (497)	149(208)	
Home (5357)	64(76)	0.000*
Discharged with outpatient appointment (55)	103(203)	
Transfer to another healthcare facility (30)	309(455)	
Discharge against Medical Advice		
Yes (59)	172(170)	0.000*
No (5939)	69(87)	
Triage Category		
Emergent (56)	270 (238)	
Urgent (2628)	134(128)	0.000*
Less urgent (6676)	63(67)	
Non-urgent (1521)	44(44)	
Non-ER patient (22)	38(39)	

*significant at p <0.05 by Mann Whitney U test/Kruskal Wallis test.

Table 2 shows multivariable and univariate analyses to assess the relationship between the length of hospital stay and demographic and Emergency Department (ED) related factors.

On univariate analysis **(Table 2)**, the expected LOS was 23 minutes higher among older patients (>40 years) versus the younger patients (≤ 40 years). Similarly, the expected LOS among females was 11.04 minutes higher as compared to males. For patients who were discharged against medical advice (DAMA) the expected LOS was 97 minutes higher as compared to their counterparts. Moreover, patients at emergent and urgent triage had higher expected LOS of 208 and 111 minutes, respectively as compared to non-ER patients.

On multivariable analysis **(Table 2)**, after adjusting for the other covariates the expected LOS was 70 minutes higher among patients with DAMA versus those with no DAMA. Similarly, in patients presenting to emergent and urgent triage, the expected LOS was 221 and 88 minutes higher as compared to non-ER patients. A significant relationship was found between gender and age in the study. The expected LOS was 13 minutes higher among >40-year-old females versus >40-year-old males.

Table 2. Multivariable and Univariate Analysis to Assess the Relationship of Length of Hospital Stay with Demographic and Emergency Department (ED) related Factors

	2a.Univariate Analysis		2b.Multivariate Analysis	
Variables	**Unadjusted Beta coefficient (SE)**	**95% Confidence Interval (CI)**	**Adjusted Beta Coefficient (SE)**	**95% Confidence Interval (CI)**
Age (in years)	1.006(0.007)	0.87,1.15 *	-	-
Age				
≤40 years (ref)	-	-	-	-
>40 years	23.03(2.01)	19.08,26.99*	15.14(4.81)	5.69,24.58**
Gender				
Males(ref)	-	-	-	-
Females	11.04 (1.97)	7.15,14.92*	-1.97 (3.14)	-8.14,4.19
Discharge against Medical Advice				
Yes	97.23 (12.63)	72.46,122.00*	70.45(11.75)	47.43,93.48**
No (ref)	-	-	-	-

Triage Category				
Emergent	207.81(22.06)	164.56 ,251.05*	221.07 (29.82)	162.61,279.543**
Urgent	111.39(18.76)	74.60,148.19*	88.13(25.54)	38.06,138.20**
Less urgent	33.95(18.72)	-2.74,70.65	11.20(25.46)	-38.72,61.13
Non-urgent	5.78(18.82)	-31.12,42.68	-19.76(25.61)	-69.97,30.45
Non-ER patient (ref)	-	-	-	-
Age*Gender				
>40 years and female	-	-	12.72 (5.76)	1.42,24.01**
>40years and male (ref)			-	-

*significant at p <0.25 by Univariate Linear Regression Analysis

** Significant at p <0.05 by Multivariable Linear Regression Analysis

Our study demonstrated that those adult patients who were discharged against medical advice, those who were admitted for emergent and urgent care, and those who were older females had a long stay in the ED as compared to their counterparts. This means that factors such as older aged females, those who left the hospital against the medical advice of the physician or health care provider, and those who were admitted for some urgent or emergent care were associated with long stay in the ED in Saudi Arabia.

Our study findings regarding most of these factors are consistent with previous research conducted across the world [29-31]. Among them, triage category or triage level was most frequently mentioned to be associated with LOS, even in EDs with different triage systems in different studies [29]. Older age is another factor that is associated with increasing ED LOS in different countries [29-31]. Our results also indicate the greater clinical acuity and complexity of older patients, and our findings are concordant with other studies [32]. This finding can be explained that older adults have lesser immunity and multimorbidity; therefore, they take more time to recover or become stable before being shifted to the next level of care or discharged from the hospital. Besides, it has been previously reported that older patients have conditions that are more acute and require more emergency resources and more biological and x-ray tests than younger patients, thus requiring longer stay in ED [33-35]. Another explanation for this finding might be related to problems in communication, with more time being required to obtain a complete history and perform the physical examination among older patients when compared to younger patients [3]. Another explanation might be the effect of more complex diseases existing among elders as confirmed by other studies [3, 32, 36, 37].

Likewise, the study found that patients who were categorized as requiring emergent and urgent care at the triage level had a longer stay than those who needed less emergent care. This might be explained by the fact that the adult patients coming to the ED with urgent and emergent care might require more holistic care with the consultation of medical team members from different disciplines. This decision of providing care takes a longer time than usual; therefore, causing the prolonged length of stay for these types of patients. This finding is confirmed by a study conducted in Canada where patients in intermediate triage with urgent and emergent care usually had the longest ED lengths of stay and the longest waiting times for physician and nurse assessment [18]. These triage categories require more imaging and laboratory utilization and also consultation rate thus ending up with longer stays [18].

Concerning DAMA as a factor for a prolonged stay in ED, we found that those who left against the medical advice of health care providers had an extended length of stay in the ED in our study. This is a very interesting and unique finding and lacks support from the literature. One possible explanation is that these patients might not have recovered properly during their previous hospital stay and end up having more complicated conditions with re-admission to ED. This re-admission with a more complicated condition, in turn, might result in prolonged LOS in the ED. For example, studies have revealed that DAMA can have adverse effects along with prolonging the length of stay. More specifically, the DAMA outcomes for patients can be aggravating even up to the point of death, or the entailing side effects that cannot be treated in a long time and render the therapeutic outcome unsatisfactory. Moreover, the re-admission of patients due to their severe conditions imposes additional costs on the healthcare system, which can be observed and discussed [38, 39]. Thus, failure to complete hospitalization can lead to disease relapse, re-admission, and increased length of stay and medical costs for the patient [38, 39].

Strengths and limitations

One of the main strengths of this study is that it is the first one performed in the KSA evaluating the factors related to prolonged LOS in the emergency department among adult patients. Since this tertiary care level, hospital caters to people with diverse demographics, the results can be generalized to the ED of all tertiary care hospitals in the KSA. In addition, this is the first study of its kind that provided new insights into the predictors of ED-LOS especially among adults in Saudi Arabia.

However, our study has certain caveats. Since data were collected from the medical records at the hospital, some information was missed. Moreover, we did not have information on some demographic factors like education, occupation, or socioeconomic status, case complexity, course of illness, and comorbidities, and a number of patients with different levels of morbidities could predict the LOS as well. We also did not assess the organizational factors such as shortage of staff, availability of vacant beds and diagnostic tools, equipment, and overcrowding that could affect the length of stay and DAMA rate in the ED. Besides, we could not conduct prospective follow-up of patients

admitted to the ED to determine the outcomes of those with prolonged LOS, and also their distribution by discharge time. Thus, these limitations can be objectives for further studies.

Conclusion

To recapitulate, our study found that older aged females, those who were discharged against medical advice, those who were categorized as requiring emergent and urgent care were found to be the predictors of prolonged stay among adults in the emergency department of Saudi Arabia. There is a need to explore organizational hospital-related factors in the future like crowding in the ED, which might be related to other predictors. The emergency department needs to be extended in terms of providing more quick and comprehensive services to reduce the length of stay. Also, the public should be educated about the consequences of discharge against medical advice. Continued health education is required at the community level, combined with an improvement in the socio-economic conditions of the population, and may further reduce DAMA and length of stay in the emergency department. Future studies should assess the sociodemographic and hospital-related factors that can contribute to LOS in the EDs among adults.

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