

Emergency Department Waiting Times and Determinants of Prolonged Length of Stay in a Botswana Referral Hospital

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Abstract

Introduction: Emergency medicine is a critical component of quality public health service. In fact length of stay and waiting times in the Emergency department are key indicators of quality. The aim of this study was to determine waiting times and determinants of prolonged length of stay (LOS) in the Princess Marina Hospital Emergency Department. **Methods:** This was a retrospective observational study. It was done at Princess Marina, a referral hospital in Gaborone, Botswana. Triage forms of patients who presented between 19/11/2018 and 18/12/2018 were reviewed. Data from patient files was used to determine time duration from triage to being reviewed by a doctor, time duration from review by emergency doctor to patients' disposition and the time duration from patient's triage to disposition (length of stay). Prolonged length of stay was defined as duration > 6 hours. **Results:** A total of 1052 files representing patients seen over a 1-month period were reviewed. 72.5% of the patients had a prolonged length of stay. The median emergency doctor waiting time was 4.5 hours (IQR 1.6 - 8.3 hours) and the maximum was 27.1 hours. The median length of stay in the emergency department was 9.6 hours (IQR 5.8 - 14.6 hours) and the maximum was 45.9 hours. Patient's age (AOR 1.01), mental status (AOR 0.61), admission to internal medicine service (AOR 5.12) and pediatrics admissions (AOR 0.11) were significant predictors of prolonged length of stay in the emergency department. **Conclusion:** Princess Marina Hospital emergency department waiting times and length of stay are long. Age, normal mental status and internal medicine admission were independent predictors of prolonged stay (>6 hours). Admission to the pediatrics service was associated with shorter length of stay. There is a need for interventions to address the long waiting times and length of stay. Interventions should particularly focus on the identified predictors.

Keywords

Emergency Department, Waiting Times, Prolonged Length of Stay, Determinants

1. Background

For many years, emergency medicine has been recognized as a critical component of quality public health service [1]. The World Health Organization (WHO) recognizes emergency care not only as an essential component of universal health care but also as vital in achieving the Sustainable Development Goals (SDGs) [2]. Ensuring healthy lives and promoting wellbeing for all at all ages by 2030 is the target of the third SDG [3]. Emergency care plays a significant role in all the components of this goal by among others prompt treatment of acute childhood illnesses, efficient treatment of obstetric emergencies and management of acute exacerbation and complications of non-communicable diseases [2] [3]. A significant proportion of death and disability in low and middle-income countries can be prevented by comprehensive and effective emergency systems [4].

Provision of quality emergency services is hampered by delays in the emergency department (ED). In fact emergency length of stay (LOS) is a key indicator of quality of care of health facilities and health departments [5]. It can therefore be used for performance monitoring and improvement of service. Prolonged stay causes overcrowding that causes further delays resulting in a vicious cycle. Prolonged waiting times not only reduce quality of care but also increase adverse events including more frequent complications and mortality [1] [6]. Hospitals and health departments strive to reduce prolonged stay and overcrowding in emergency departments. This is a difficult task when there is no evidence to guide targeted efforts and public health interventions. Emergency departments are the main hospital entry points for critical and stable patients. Clients can access the services at any time without need for appointment or referral. They may also be the only readily available and accessible means of medical care for patients. The departments therefore occupy a crucial position in the medical care continuum [7]. Improving the performance of emergency departments should be a public health priority since the demand for emergency care is increasing annually across the globe and Botswana is no exception [8]. To this end there is need for locally relevant and up-to-date evidence to guide the country on keeping up with the demand for this vital service. Currently, there are no studies on waiting times and determinants of length of stay in Botswana.

The aim of this study was to determine waiting times and determinants of prolonged length of stay (LOS) in the Princess Marina Hospital Emergency Department.

2. Methods

2.1. Study Design

This was a retrospective observational study of the patients waiting times and length of stay in the emergency department.

2.2. Study Site

The study was done at Princess Marina Hospital in Gaborone, the capital city of Botswana: one of the three referral hospitals in the country. It is the busiest and largest hospital in the country with a capacity of 567 beds and an average of 750 inpatients. The hospital covers all critical patients from Greater Gaborone and from the referring hospitals around the country [9]. There is a designated triage room and 13 beds including 2 resuscitation beds and 1 isolation bed. About 70 patients are seen daily in the department. As of January 2019, there were 3 emergency physicians, 10 medical officers and 25 nurses working in the department.

2.3. Study Population

All triage forms of patients who presented to the Princess Marina hospital during a 1-month period (19/11/2018 to 18/12/2018) were reviewed. No patients who went through the accident and emergency were excluded. The trial period of 1 month is comparable to similar studies in the region [10] [11].

2.4. Data Collection

Routinely collected data was extracted from patients' triage forms and entered into Microsoft excel. The following times were documented:

- Patient's registration time
- Time of triage
- Time reviewed by emergency department doctor
- Time of disposition (Time the patient left the Emergency department)

From these times, the following durations were calculated:

- Time from triage until review by emergency doctor (waiting time)
- Time duration from review by medical officer to disposition
- Time duration from triage to disposition (length of stay)

The following additional information was collected

- Patient's acuity scale (South African Triage System (SATS) color code)
- Specialty called and specialty that reviewed patient
- History of trauma
- Mobility status

Day and shift of Emergency department visit were also noted as were demographic information and initial assessment provided on the patients' triage forms.

2.5. Data Analysis

A data extraction sheet was used for all collected data. The data was entered into

Microsoft excel. After data cleaning and preparation, EpiInfo version 7.1, 2019 was used for data analysis. Categorical data was summarized with frequencies and percentages while numeric data was summarized with medians and inter-quartile ranges. Pearson's Chi-square test or Fisher's exact test were used to determine significant differences in categorical variables while Mann-Whitney's test was used for continuous data. Bivariate and multiple logistic regression analysis were used to determine factors associated with prolonged length of stay. Prolonged length of stay was defined as duration greater than 6 hours. Multiple logistic regression was also used to identify factors associated with an Emergency department length of stay > 12 hours. A p value of 0.25 was used as a cut-off point to recruit variables from the bivariate model into the multiple regression models. A p value of <0.05 was considered significant in the multivariate model. Variables with significant missing data were excluded from the analysis. For other variables, missing data is presented as not documented.

2.6. Ethical Issues and Protection of Human Subjects

Ethics approval was sought and obtained from The University of Botswana Ethics review board and the Ministry of Health Human Research and Development Committee. Permission was also sought and obtained from the Princess Marina management. This study only used routinely collected patient data. The participants were not subjected to any additional procedures or activities that may harm or cause them any discomfort or inconvenience. Patients clinical and laboratory data was presented in a way that could not compromise their privacy or confidentiality.

3. Results

Of the 1052 files analyzed, 763 (72.5%) had prolonged length of stay according to the definition. This group of patients had a median age of 32 years while the patients with acceptable length of stay had a median age of 24 years. There were more females than males in both groups accounting for 59.5% and 52.9% in the prolonged and acceptable length of stay groups respectively. 36.7% of study participants had a LOS of >12 hours. **Table 1** shows the characteristics of patients with Emergency Department length of stay > 6 hours (prolonged length of stay) and patients with length of stay of 6 hours or less. The median waiting time for review by a medical officer was 4.5 hours while the median length of stay in the Emergency department was 9.6 hours. The maximum length of stay was 45.9 hours (**Table 2**).

Variables that were significantly associated with prolonged length of stay in the univariate analysis were patient's age, acuity of presentation, patient's mental status, mobility, emergency shift at presentation, admission to internal medicine service, admission to gynecology service and admission to pediatrics service (**Table 3**). Increasing age (AOR 1.015), lower mental status (AOR 0.615), not being admitted to Internal Medicine service (AOR 0.344) and admission to

Table 1. Characteristics of patients with acceptable and prolonged Length of Stay.

Variable n (%)	LOS < 6 hours n = 289 (27.5%)	LOS > 6 HOURS n = 763 (72.5%)	P value
Age, median (IQR)	24 (7 - 37)	32 (24 - 44)	0.001
Sex			0.05
Female	153 (52.9)	454 (59.5)	
Male	136 (47.1)	309 (40.5)	
Acuity (triage) code			0.01
Not documented	10 (5.9)	16 (2.1)	
Green (Routine)	0 (0)	2 (0.3)	
Yellow (Urgent)	61 (21.1)	125 (16.4)	
Orange (Very urgent)	191 (66.1)	580 (76.0)	
Red (Emergency)	27 (9.3)	40 (5.2)	
Mobility			<0.001
Ambulant	175 (60.6)	527 (69.1)	
Wheelchair	7 (2.4)	43 (5.6)	
Stretcher	61 (21.1)	172 (22.5)	
Not applicable	46 (15.9)	21 (2.7)	
Day of presentation			0.11
Weekday	208 (72.0)	587 (76.9)	
Weekend	81 (28.0)	176 (23.1)	
Shift at presentation			0.02
Day	242 (83.7)	585(76.7)	
Night	47 (16.2)	178 (23.3)	
History of Trauma	53 (18.3)	134 (17.6)	0.67
Disposition			0.72
Discharged	125 (43.3)	319 (41.8)	
Not discharged	164 (56.8)	444 (58.2)	

Table 2. Waiting times and Length Of Stay (LOS) in the emergency department.

Time (Hours)	Median (IQR)	Range
Medical officer waiting times	4.45 (1.62 - 8.30)	0.00 - 27.08
Length of time from MO review to disposition	3.90 (1.80 - 7.32)	0.00 - 34.18
Length of stay in ED	9.60 (5.83 - 14.61)	0.75 - 45.92

Table 3. Predictors of prolonged length of stay (univariate model).

Variable	Unadjusted OR	95% CI	P value
Age	1.0279	1.0194 - 1.0365	<0.005
Sex (male/female)	0.7692	0.5840 - 1.0131	0.062
Acuity (emergency/non-emergency)	0.5367	0.3228 - 0.8921	0.016
History of trauma (yes/no)	0.9115	0.6402 - 1.2977	0.607

Continued

Mental status (Not Alert/ Alert)	0.4748	0.2849 - 0.7915	0.004
Patient disposition (not discharged/Discharged)	1.0610	0.8070 - 1.3948	0.672
Mobility (non-ambulant/ambulant)	0.6874	0.5188 - 0.9109	0.009
Day of presentation (Weekend/weekday)	0.7704	0.5652 - 1.0501	0.098
Day Shift (Yes/No)	0.7164	0.5444 - 0.9429	0.017
Night shift (Yes/No)	1.5606	1.0914 - 2.2317	0.015
Medicine admission (No/Yes)	0.2803	0.1637 - 0.4799	<0.005
Gynaecology Admission (Yes/No)	0.6535	0.4422 - 0.9660	0.033
Orthopaedics Admission (No/Yes)	1.4321	0.7685 - 2.6687	0.258
Surgery Admission (Yes/No)	1.5257	0.9041 - 2.5747	0.114
Paediatric Admission (Yes/No)	0.0502	0.0224 - 0.1128	<0.005

pediatrics service (AOR 0.11) remained statistically significantly associated with prolonged length of stay in the multivariate logistic regression model (**Table 4**). Age (AOR 1.01), Mental status, mobility, day of presentation and shift, admission to medical and pediatrics services were independent predictors of length of stay greater than 12 hours (**Table 5**).

4. Discussion

This study was the first formal objective measure of the timeliness of Emergency Department (ED) services in Botswana. Previous studies have focused on determining the validity and reliability of formal triage scales [12] [13] [14]. This measurement is imperative as waiting times and length of stay impact access to healthcare and therefore can affect the country's achievement of universal health coverage [15].

The times from triage to medical officer review and from medical officer review to disposition were both long and were comparable. The median waiting time from triage to review by medical officer was 4.45 hours with a maximum waiting time of 27.08 hours. The waiting times are much longer than reported elsewhere [16] [17]. Shorter waiting times were reported in two South African studies. In a Cape Town referral hospital, the median waiting time was 4.1 hours and 2.4 hours before and after introduction of the Cape triage score respectively [18]. A review of data from 52 Western Cape facilities revealed an overall mean waiting time of 2.1 hours [5]. The relatively poor performance of Princess Marina Hospital ED may be due to an overwhelmed system. The ED covers greater Gaborone and referrals from the rest of the country. Medical officers on duty often struggle to keep up with the ever-increasing patient load. The median length of time from review by medical officers to disposition from the Emergency Department was 3.9 hours with a maximum of 34.18 hours. This is the time when most investigations are done and when referrals are made to various specialties. ED medical officers also make decisions about discharge or referral

Table 4. Predictors of prolonged length of stay (Multivariate model).

Variable	Adjusted OR	95% CI	P value
Age	1.0149	1.0058 - 1.0240	<0.005
Sex (male/female)	0.8940	0.6423 - 1.2443	0.507
Acuity (emergency/non-emergency)	0.7019	0.3702 - 1.3311	0.278
Mental status (Not Alert/Alert)	0.6148	0.3260 - 1.1596	0.003
Mobility (non-ambulant/ambulant)	0.8137	0.5766 - 1.1485	0.241
Day of presentation (Weekend/weekday)	0.8047	0.5714 - 1.1333	0.214
Day Shift (Yes/No)	0.7336	0.5238 - 1.0274	0.072
Night shift (Yes/No)	1.4034	0.9091 - 2.1666	0.126
Internal Medicine admission (No/Yes)	0.3444	0.1936 - 0.6128	<0.005
Gynaecology Admission (Yes/No)	0.7902	0.5051 - 1.2363	0.303
Orthopaedics Admission (No/Yes)	1.3213	0.6775 - 2.5771	0.414
Surgery Admission (Yes/No)	1.7217	0.9739 - 3.0437	0.098
Paediatric Admission (Yes/No)	0.1101	0.0455 - 0.2655	<0.005

Table 5. Predictors of emergency length of stay greater than 12 hours.

Variable	Adjusted OR	95% CI	P value
Age	1.0111	1.0031 - 1.0191	0.006
Sex (male/female)	0.9805	0.7245 - 1.3271	0.899
Acuity (emergency/non-emergency)	0.6183	0.3152 - 1.2129	0.162
Mental status (Not Alert/ Alert)	0.3013	0.1354 - 0.6704	0.003
Mobility (non-ambulant/ambulant)	0.6389	0.4641 - 0.8795	0.006
Day of presentation (Weekend/weekday)	0.7022	0.5075 - 0.9716	0.032
Day Shift (Yes/No)	0.5400	0.3965 - 0.7354	<0.005
Night shift (Yes/No)	1.2294	0.8622 - 1.7529	0.2540
Medicine admission (No/Yes)	0.3617	0.2402 - 0.5446	<0.005
Gynaecology Admission (Yes/No)	0.6999	0.4656 - 1.0132	0.058
Orthopaedics Admission (No/Yes)	0.6999	0.3623 - 1.3523	0.288
Surgery Admission (Yes/No)	1.5062	0.9269 - 2.4475	0.098
Paediatric Admission (Yes/No)	0.2371	0.0694 - 0.8101	<0.021

for further management. The Princess Marina Hospital ED triage form provides for ED medical officers to document when they call other departments for further review and management, what specialty they call and when the specialized teams review patients. Unfortunately, this was poorly documented and therefore was not analyzed. Delayed consultations after referral, multiple referrals, conflicts between ED staff and consultants and multiple investigations have been cited as causes of this delay [19] [20] [21].

Prolonged Length of stay (LOS) is not only an independent predictor of mortality and poor outcomes but is also a cause of ED overcrowding [16] [17] [22] [23]. Overcrowding in turn causes stress and burnout among ED healthcare providers and is a major cause of patients' dissatisfaction. Emergency department length of stay greater than 6 hours is widely considered as prolonged [19] [21] [22] [24]. In other settings, LOS of <4 hours is considered acceptable [23]. The waiting times and the length of stay in the Princess Marina Emergency department were long. LOS was >6 hours for 72.5% of patients. The median LOS was 9.6 hours with a maximum of 45.9 hours. This was much higher than in an Iranian study where only 10.2% of patients had prolonged LOS [19]. In a Netherlands hospital 80% of patients had an ED LOS of <4 hours [23]. Researchers in Switzerland reported a significantly lower median LOS of 4.82 hours in a University hospital [25]. Horwitz *et al.* reported a median ED LOS of 4.3 hours for admitted patients and 2.3 hours for discharged patients across 364 American hospitals [16]. Studies on length of stay in our setting are scarce. The Princess Marina Hospital ED department still performed poorly even when 12 hours was used as a cutoff for prolonged LOS. Only 64.35% of patients left the ED within 12 hours of their triage.

Increasing age, normal mental status and admission to internal Medicine service were associated with prolonged LOS. Admission to pediatric service was associated with lower odds of prolonged length of stay. Older age has been associated with prolonged LOS in a previous study. It was associated with a 5% increase in the odds of prolonged LOS in an Iranian hospital [19]. Other significant predictors of prolonged LOS in the study were, lack of insurance support and high number of ordered clinical tests. Unfortunately, data on these factors was not documented in the Princess Marina Hospital ED triage forms. In Saudi Arabia, laboratory time, patient admission to observation, patient admission to trauma, and critical care management and consultation time were significant predictors of prolonged hospital stay [26].

Patients with lower mental status are likely to be more critical and require intensive care. These patients tend to have expedited review and admission. Admission to internal Medicine may be associated with more investigations that could prolong LOS. The prolonged LOS could also be explained by a higher number of internal medicine admissions. Generally, in the Princess Marina Hospital ED, patients can only be admitted after the ward team has reviewed them. Documentation of time of referral and time of review would reveal if the delays were mainly before or after referral to internal medicine service. ED doctors can use their discretion to admit pediatric patients directly without approval of a ward doctor. It is therefore not surprising that these patients had shorter LOS compared to other patients. In addition to the factors described above, 2 other factors were independently associated with an LOS of >12 hours. Presentation during day shift was associated with a 46% reduction in the odds of LOS > 12 hours. Similarly weekend presentations were associated with a 30% reduction in odds of prolonged LOS.

Measures to address the long waiting times and length of stay are required including adequate, skilled and experienced staff. Interventions should focus on the identified predictors of prolonged length of stay. The hospital management should consider allowing ED doctors to use their discretion to admit patients directly to the wards. This is already done for admission to pediatric service which was associated with shorter length of stay. This reduction in length of stay has been associated with less adverse events. Staying in the ED for less than 2 hours reduced the odds of mortality by 79% compared to LOS > 6 hours in a Canadian study [27]. Future studies should break down the time from review by ED medical officers to disposition. This would help isolate the sources of delay. In addition, documentation in the ED should be reinforced to allow more detailed analysis of waiting times.

5. Limitations

This was a retrospective study using triage form duplicates kept in the Emergency Department. Inevitably, there were missing forms and missing data. Due to system downtime, many patients did not have a registration time. The triage time was therefore used as arrival time for all patients. This could underestimate the length of stay and actual patient times. However, triage is usually done very soon after arrival and is sometimes done even before registration. Time of triage is therefore a reasonable estimate of the patient's arrival time in the Emergency department.

Due to inconsistent documentation, the time from review by medical officer to disposition could not be broken down into smaller time durations *i.e.* time to referral of patient, time from referral to review by specialty, time from review by specialty admission/discharge and time from admission/discharge to actual departure from the ED. A closer look at these durations would have been critical in identifying areas for action by the hospital management and Ministry of Health. There is a need to reinforce consistent documentation by ED and other hospital staff, especially between the times patients are seen by ED medical officers, to the time they leave the ED. Future studies should include analysis of these times.

6. Conclusion

Princess Marina Hospital emergency department waiting times and length of stay are long. Younger age, normal mental status and internal medicine admission were independent predictors of prolonged stay (>6 hours). Admission to pediatrics service was associated with shorter LOS. The documentation of patients' throughput in the ED is suboptimal and needs enforcement.

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Dissemination of Results

The results of this study were shared with the hospital management at the management meeting.

Authors Contributions

Authors contributed to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content. KS designed and drafted the protocol, led the data collection, data analysis and drafted the manuscript. JTT reviewed the protocol, supervised the data collection and critically revised the manuscript for intellectual content. BBM reviewed the protocol, collected data and critically reviewed the manuscript. All authors approved the version to be published, and agreed to be accountable for all aspects of the work.

Conflicts of Interest

The authors declared no conflicts of interest.

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