

# Waiting Times and Length of Stay of Trauma Patients in a Botswana Referral Hospital Emergency Department

Keatlaretse Siamisang<sup>1,2\*</sup>, Kago Mokute<sup>1</sup>, Bonolo Bonnie Mhaladi<sup>2</sup>, John Thato Tlhakanelo<sup>1</sup>

<sup>1</sup>University of Botswana, Gaborone, Botswana

<sup>2</sup>Botswana Ministry of Health and Wellness, Gaborone, Botswana

Email: \*drksiamisang@gmail.com

**How to cite this paper:** Siamisang, K., Mokute, K., Mhaladi, B.B. and Tlhakanelo, J.T. (2022) Waiting Times and Length of Stay of Trauma Patients in a Botswana Referral Hospital Emergency Department. *Open Journal of Emergency Medicine*, 10, 54-65.

<https://doi.org/10.4236/ojem.2022.101005>

**Received:** January 2, 2022

**Accepted:** March 19, 2022

**Published:** March 22, 2022

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## Abstract

**Background:** Mortality and morbidity due to trauma are a significant public health challenge. There is paucity of data on the waiting times and length of stay (LOS) of trauma patients in emergency departments in Botswana. The aim of this study was to determine the Emergency Department (ED) waiting times and LOS of trauma patients at Princess Marina Hospital in Gaborone, Botswana. **Methods:** This was a retrospective medical records review of waiting times (time from triage to review by ED medical officer) and LOS (time from triage to disposition from the emergency department). The waiting times for the different assigned acuities were assessed against the South African Triage System (SATS) standards. All trauma patients seen from 19/11/2018 to 18/12/2018 were included in the study. Prolonged length of stay was defined as duration > 6 hours. Categorical data was summarized with frequencies while numeric data was summarized with medians and interquartile ranges. **Results:** A total of 187 trauma patients' files were analyzed. Of these, 72 (38.5%) were females. The median waiting time was 3.8 hours and the maximum was 19.2 hours. The median length of stay (LOS) was 8.8 hours with a maximum of 37.2 hours. Only 53 (28.3%) of the participants had a LOS of less than 6 hours. None of the emergent patients were seen immediately. Only 5 (4.0%) of the very urgent patients were seen within the target of 10 minutes. Finally, only 10 (20.4%) of urgent patients were seen within the target time of 1 hour. **Conclusion:** The waiting times and length of stay in Princess Marina Hospital were mostly above the recommended standards. Urgent interventions are needed to reduce waiting times and length of stay for trauma patients. More studies are needed to explore the sources of delay

and investigate possible solutions to this public health challenge.

## Keywords

Emergency Department, Waiting Times, Length of Stay, Trauma, Botswana

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## 1. Introduction

Mortality and morbidity due to trauma are a significant public health challenge. Trauma is said to account for 1 in 10 deaths annually worldwide with the vast majority of these occurring in low and middle-income countries (LMIC) [1]. This is because trauma patients in LMIC have worse outcomes than those in high-income countries [2]. Annually trauma causes about 6 million deaths [3]. Most of the trauma deaths occur before patients reach the hospital or in the emergency department. Effective and comprehensive emergency services can prevent most of the trauma mortality [2]. The quality of care at emergency departments is a critical determinant of mortality and morbidity [4]. In the emergency department, timeliness of service is measured mainly through waiting times and length of stay. The waiting time is defined as the time from triage to review by a doctor while length of stay is defined as time from arrival to disposition from the emergency department. These measures have been shown to affect patient outcomes and the rate of patients leaving the ED without being reviewed [5]. They also affect patients' satisfaction and public confidence in health facilities. Restoration of the public's confidence in the health system can improve health-seeking behavior thus improving the overall national health and wellness [5]. Estimation of waiting times and length of stay is imperative if this is to be achieved.

Botswana is an upper middle-income Southern African country with a population estimated to be 2,565,855 in 2021 [6]. Trauma is a significant cause of mortality and morbidity in the country. Princess Marina Hospital in Gaborone is essentially the trauma centre for Southern Botswana. It is the largest hospital in Botswana and it offers the most comprehensive services in the country [7]. It also serves as the primary and district hospital for greater Gaborone. The hospital emergency department adopted the South African Triage Scale (SATS) in 2012. This was modified to be more relevant to the local context [8]. SATS was initially developed in 2004 for use in South African emergency departments. It has since been validated and implemented in multiple African countries [9] [10]. The different acuity levels in SATS are color-coded. The most emergent patients are coded red and must be reviewed immediately; very urgent patients are coded orange and must be seen within 10 minutes; urgent patients are coded yellow and must be seen within 1 hour while routine patients are coded green and are to be seen within 4 hours [9] [11].

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emergency departments has not been studied. The aim of this study was therefore to determine the waiting times and length of stay of trauma patients at the Princess Marina Hospital Emergency Department.

## **2. Methods**

### **2.1. Study Design**

This was a retrospective medical records review of trauma patients waiting times and length of stay in the Princess Marina Hospital Emergency Department with a standard audit. The waiting times for the different assigned acuities were assessed against the South African Triage System (SATS) standards.

### **2.2. Study Site**

The study was done in a tertiary referral hospital in Gaborone, Botswana called Princess Marina Hospital (PMH). PMH is the largest hospital in Botswana with a catchment area covering the whole of the country. The hospital offers the most comprehensive services including emergency services [7]. Virtually patients from anywhere in Botswana can be referred to PMH Emergency Department. The emergency department has 21 treatment bays of which 3 are reserved for resuscitation or the most emergent patients. Patients are normally triaged by ED nurses according to a slightly modified version of SATS.

### **2.3. Study Population**

This study included all trauma patients seen in Princess Marina Hospital Emergency Department over a 1-month period (19/11/2018 to 18/12/2018). Sampling was exhaustive. Other studies in our setting have also used a 1-month follow up period [12] [13].

### **2.4. Data Collection**

Triage forms of all patients seen in the study period were retrieved from which trauma patients were selected. The triage forms are used to record the patients' medical data as well as the critical times in the patients' throughput. Time data routinely captured in these triage forms includes patient's registration time, triage time, time reviewed by emergency department doctor, time specialists doctors are called and times specialists doctors review the patient. Additional data extracted from the triage forms included demographic data and patients' assigned acuity level. Patients' day and time of presentation were used to determine shift of presentation and whether patients were seen on weekdays or weekends.

### **2.5. Standard**

The South African Triage Scale (SATS) has outlined specific standards for waiting times for different acuity levels. These were used to audit the Princess Marina Hospital Emergency Department performance.

## 2.6. Data Analysis

Data extracted from the triage forms were entered into Microsoft excel. After data cleaning and preparation, Statistical package for the social sciences (IBM SPSS version 27, 2020) software was used for data analysis. Waiting time (time from triage to review by ED medical officer), time from review by medical officer to disposition from the emergency department and emergency length of stay (time from triage to disposition from the emergency department) were calculated. Categorical data was summarized with frequencies and percentages while numeric data was presented with medians and interquartile ranges. Pearson's chi square test was used to compare different categorical data. The conventional p value of <0.05 was considered to demonstrate significant association between variables.

## 2.7. Ethical Issues and Protection of Human Subjects

Ethics approval was sought and obtained from the University of Botswana office of research and development and the Botswana Ministry Of Health And Wellness Human Research And Development (HRDC). This analysis only used routinely collected patient data with no additional interaction with the study participants. Data handling was done such that the participants' privacy was protected. Only routinely collected data was used for this study and there was no interaction with the patients. A waiver of consent was thus requested and granted by the ethical review boards.

## 3. Results

A total of 1052 files for patients seen from 19<sup>th</sup> November 2018 to 18<sup>th</sup> December 2018 were analyzed. Of these, 187 presented with a history of trauma. **Table 1** shows the characteristics of these patients. The median age was 27 years with an interquartile range of 10 to 36 years. Females accounted for 72 (38.5%) of the participants. In terms of assigned acuity at triage, 9 (4.8%) were emergent (red) patients, 124 (66.3%) were very urgent (orange) and 49 (26.2%) were urgent (yellow) patients. None of the trauma patients were assigned routine (green) acuity. Of the 187 trauma patients, 178 (95.2%) were alert at presentation. Only 1 patient (0.5%) was unresponsive. The rest were either responsive to voice or pain or had no documentation of mental status. In terms of mobility, 127 (67.9%) were ambulant while 43 (23.0%) were on a stretcher and 11 (5.9%) were on a wheelchair. Weekend presentations accounted for 71 (38.0%) while 52 (27.8%) of the patients were seen during night shift.

**Table 2** shows the overall waiting times and length of stay for trauma patients in the Princess Marina Hospital Emergency Department. The median medical officer waiting time (duration from triage to first review by medical officer) was 3.8 hours with IQR of 1.3 to 7.5 hours. The maximum medical officer waiting time was 19.2 hours. The median length of time from review by medical officer to disposition from the emergency department was 3.8 hours (IQR 1.8 - 6.0

hours) with a maximum of 23.7 hours. The median length of stay was 8.8 hours (IQR 5.4 - 12.0 hours) with a maximum of 37.2 hours. The waiting times and length of stay were then stratified according to whether the patients were seen on weekdays or weekends (**Table 3**). The median waiting times were longer on weekdays (5.1 hours) than weekends (3.6 hours). Similarly the maximum waiting times were longer on weekdays (19.2 hours) than weekends (15.1 hours). The median length of stay was similar for weekday and weekend reviews (8.9 hours). However the maximum length of stay was longer during weekdays (37.2 hours) than weekends (25.3 hours). None of the differences in the medians was statistically significant.

**Table 1.** Characteristics of trauma patients seen at Princess Marina Hospital (n = 187).

Variable	Frequency (%)
<b>Age median (IQR)</b>	27 (10 - 36)
<b>Sex</b>	
Female	72 (38.5)
Male	115 (61.5)
<b>Acuity (Triage Code)</b>	
Emergent (Red)	9 (4.8)
Very urgent (Orange)	124 (66.3)
Urgent (Yellow)	49 (26.2)
Routine (Green)	0 (0.0)
Not documented	5 (2.7)
<b>Mental status</b>	
Alert	178 (95.2)
Verbal response	2 (1.1)
Pain response	4 (2.1)
Unresponsive	1 (0.5)
Not documented	2 (1.1)
<b>Mobility</b>	
Ambulant	127 (67.9)
Stretcher	43 (23.0)
Wheelchair	11 (5.9)
Not documented	6 (3.2)
<b>Day of presentation</b>	
Weekday	116 (62.0)
Weekend	71 (38.0)
<b>Shift at presentation</b>	
Day shift	61 (32.6)
Evening	73 (39.0)
Night	52 (27.8)

**Table 2.** Waiting times and Length of stay in the Emergency Department.

Time (Hours)	Median (IQR)	Maximum
Medical officer waiting times (hours)	3.8 (1.3 - 7.5)	19.2
Length of time from MO review to disposition (hours)	3.8 (1.8 - 6.0)	23.7
Length of stay in ED (hours)	8.8 (5.4 - 12.0)	37.2

**Table 3.** Waiting times and Length of stay in the Emergency Department according to day of review.

Time (Hours)	Weekday	Weekend	p value
Medical officer waiting times, median (IQR)	5.1 (1.0 - 8.4)	3.6 (1.6 - 5.9)	0.25
Medical officer waiting times, maximum	19.2	15.1	
Medical officer review to disposition, median (IQR)	3.5 (1.5 - 5.5)	4.3 (2.6 - 6.8)	0.21
Length of stay in ED, median (IQR)	8.9 (5.2 - 12.6)	8.9 (5.5 - 11.8)	0.95
Length of stay, maximum	37.2	25.3	

The emergency department waiting times according to assigned acuity are displayed in **Table 4**. According to the SATS standards, emergent patients must be seen immediately. None of the red patients were seen within this target. The median waiting time was 1.4 hours (IQR 0.2 - 4.4 hours) and the maximum waiting time was 10.6 hours. Only 5 (4.0%) of orange patients were seen within 10 minutes. The orange patients had a median waiting time of 4.1 hours (IQR 1.4 - 7.3 hours) and a maximum waiting time of 19.2 hours. On the other hand, yellow patients had a median waiting time of 3.9 hours (IQR 1.5 - 8.2 hours) and a maximum waiting time of 15.1 hours. Only 10 (20.4%) of these patients were seen within the target time of 1 hour.

Prolonged length of stay [LOS] was defined as LOS > 6 hours. This is an internationally accepted standard [5]. **Table 5** shows associations of patients' characteristics with prolonged length of stay. Only 53 (28.3%) of the trauma patients in Princess Marina Hospital had an emergency LOS of less than 6 hours. The sex distribution was not statistically significantly different between patients with a normal length of stay and patients with prolonged length of stay. In contrast younger patients (<12 years) were significantly more frequent in the normal LOS than prolonged LOS category. There was no significant difference in the distribution of the other characteristics.

#### 4. Discussion

We report on the waiting times and length of stay of trauma patients in a Botswana referral facility over a one-month period. The waiting times and length of stay were long. The median waiting time was 3.8 hours with a maximum waiting time of 19.2 hours. The waiting times were above the SATS thresholds for all the triage categories. None of the emergent patients were seen immediately and only

4% of very urgent patients were seen within the target of 10 minutes. This is well below what was reported for emergency patients in the United Kingdom. In this study 52.4% of category 1 patients were seen immediately while 41.0% of category 2 patients were seen within 10 minutes. Category 1 and category 2 correspond to red and orange patients respectively [14]. Furthermore, in a cross sectional study of 364 hospitals in the United States, 30.5% of the emergency departments achieved the target waiting times for more than 90% of their patients [15]. The difference in performance between Princes Marina Hospital and these other settings is likely to be multifactorial.

**Table 4.** The Princess Marina Hospital emergency department performance against SATS standards.

Triage code (Acuity)	SATS standard (target)	Patient seen within target time, number (%)	Median Waiting Time, hours (IQR)	Maximum waiting time, hours
Emergent (Red)	Immediately	0 (0.0)	1.4 (0.2 - 4.4)	10.6
Very Urgent (Orange)	10 minutes	5 (4.0)	4.1 (1.4 - 7.3)	19.2
Urgent (Yellow)	1 hour	10 (20.4)	3.9 (1.5 - 8.2)	15.1

**Table 5.** Characteristics of patients with normal and prolonged length of stay (LOS).

Variable, number (%)	LOS < 6 Hours (n = 53)	LOS > 6 hours (n = 134)	p value
<b>Sex</b>			0.84
Female	21 (39.6)	51 (38.1)	
Male	32 (60.4)	83 (61.9)	
<b>Age (years)</b>			<0.001
<12	29 (54.7)	27 (20.1)	
12 or more	24 (45.3)	107 (79.9)	
<b>Day of Review</b>			0.71
Weekend	19 (35.8)	52 (38.8)	
Week day	34 (64.2)	82 (61.2)	
<b>Shift at presentation</b>			0.09
Daytime shifts	43 (81.1)	92 (68.7)	
Night shift	10 (18.9)	42 (31.3)	
<b>Mobility</b>			0.73
Ambulant	37 (69.8)	90 (67.2)	
Non-ambulant	16 (30.2)	44 (32.8)	
<b>Final Disposition</b>			0.19
Discharged home	36 (67.9)	77 (57.5)	
Not discharged	17 (32.1)	57 (42.5)	

The prolonged waiting times in our study are a significant barrier to healthcare access. Healthcare access is one of the pillars of the primary healthcare framework [16]. It is therefore imperative that innovative interventions are implemented to improve waiting times in Botswana hospitals. This would go a long way in helping the country achieve universal health coverage and reach the sustainable development goals. More studies are needed to explore causes of delays in emergency departments in Botswana. Shortage of healthcare workers may play a role in the long waiting times and prolonged length of stay. Previous studies in Botswana have demonstrated a shortage of healthcare workers [17] [18]. Other factors such as shortage of bed space, multiple laboratory and radiological investigations and review by multiple specialty teams have also been cited as causes of prolonged length of stay in the emergency department [19]. The results of this study are significant as trauma is a significant cause of morbidity and mortality in Botswana [2] [3]. Waiting times likely play an important role especially in the high mortality. A strong health system is necessary to improve outcomes of trauma patients and this cannot be achieved without improving access to healthcare services. Indeed service delivery is one of the building blocks of a robust health system [20].

The median time from review by ED doctor to disposition was also 3.8 hours but the maximum was 23.7 hours. This is the period during which all necessary investigations are done including laboratory tests and imaging. Specialist teams are also called to review most patients before they are admitted in the wards. Unfortunately this time could not be broken into its components because the data was not available. As an example, the times when the teams were called and when they reviewed the patients were not recorded for most patients. Elsewhere, these times have been well documented [21]. Future prospective studies should review these times to help identify the areas of delay. This would provide targets for interventions to reduce length of stay in the emergency department.

The median length of stay was 8.8 hours. The maximum length of stay was well over a day and half. Other studies in Africa have examined length of stay in the emergency department. In a South African study, the median waiting time was over 16 hours [21]. Prolonged waiting times are associated with worse patients' outcomes and worse patients' experience [16] [22]. A study in Canada found a significant association between prolonged length of stay and short-term mortality [23]. There is therefore an urgent need for interventions to reduce waiting times in Botswana emergency departments. This should include investment in research that examines factors and areas of delay and the effect of this delay on patients' outcomes.

An emergency department length of stay of less than 6 hours is widely considered to be an acceptable standard [5] [19]. Only about 28% of patients in our study had a length of stay within this target. In contrast, 60% of patients in a Netherlands emergency department had a length of stay of less than 6 hours [19]. In an Iranian study, only 10.2% of patients had a prolonged length of stay

in the emergency department. There was significantly higher proportion of children under 12 years of age among the patients with an acceptable length of stay. In fact patients with an acceptable length of stay were more likely to be under 12 years of age while patients with a prolonged length of stay were more likely to be above 12 years of age. The significant difference is probably due to the different procedures for admission of pediatric and adult patients in the Princess Marina Emergency Department. Adult patients normally have to be reviewed by the specialist team before they are accepted in the wards. On the other hand, emergency doctors can admit pediatric patients directly. This significant difference is consistent with our previous report [4].

## 5. Limitations

This study has some limitations. The study used routinely collected data and was retrospective. It was therefore inevitable that some triage forms would be missing. Furthermore, there was some missing data in the triage forms that limited analysis of potential areas of delay. Most triage forms did not have the time the specialist teams were called and when they actually reviewed the patients. These times were therefore not analyzed. Another limitation is a short observation period of 1 month. Possible temporal variations in waiting times and length of stay may not be well represented in the 1-month period. Despite these limitations, this study provides very useful insight into the waiting times and length of stay of trauma patients in Botswana. Future studies should build on this and assess the factors causing these delays in more detail.

## 6. Conclusion

The emergency waiting time and length of stay for trauma patients in Princess Marina Hospital were long. The median waiting time was 3.8 hours with a median length of stay of 8.8 hours. None of the emergent trauma patients were seen immediately while only 4% of very urgent patients were seen within 10 minutes as per the SATS standards. Less than a third of the patients had an acceptable length of stay of less than 6 hours. Urgent interventions are needed to reduce waiting times and length of stay for trauma patients. These should include training of staff on appropriate triaging and ensuring adequate staff complement of appropriate skills in the emergency department. Furthermore frequent audits of the structures, processes and outcomes (including waiting times and length of stay) should be implemented in the emergency department. More studies are needed to explore the sources of delay and investigate possible solutions to this public health challenge.

## Acknowledgements

We will like to thank the management of Princess Marina Hospital for their support and facilitation of this project. We also acknowledge the management and staff of the PMH ED. We also thank the following individuals who helped

with the collection of data: Sefularo Modukanele, Kevin Tshivhidzo, Pako Kgwarana, Ada Legesse, Tlhompho Bareetsi and Tsholofelo Seleta.

## Dissemination of Results

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

## Authors Contributions

Authors contributed as follow 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. KM reviewed the protocol, supervised data collection and critically reviewed the manuscript for intellectual content. BBM reviewed the protocol, collected data and critically reviewed the manuscript for intellectual content. JTT reviewed the protocol, supervised the data collection and critically revised the manuscript for intellectual content. All authors approved the version to be published, and agreed to be accountable for all aspects of the work.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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