Delays in emergency department intervention for patients with traumatic brain injury in Uganda

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ABSTRACT

Background In Sub-Saharan African countries, the incidence of traumatic brain injury (TBI) is estimated to be many folds higher than the global average and outcome is hugely impacted by access to healthcare services and quality of care. We conducted an analysis of the TBI registry data to determine the disparities and delays in treatment for patients presenting at a tertiary care hospital in Uganda and to identify factors predictive of delayed treatment initiation.

Methods The study was conducted at the Mulago National Referral Hospital, Kampala. The study included all patients presenting to the emergency department (ED) with suspected or documented TBI. Early treatment was defined as first intervention within 4 hours of ED presentation—a cut-off determined using sensitivity analysis to injury severity. Descriptive statistics were generated and Pearson's χ^2 test was used to assess the sample distribution between treatment time categories. Univariable and multivariable logistic regression models with <0.05 level of significance were used to derive the associations between patient characteristics and early intervention for TBI.

Results Of 3944 patients, only 4.6% (n=182) received an intervention for TBI management within 1 hour of ED presentation, whereas 17.4% of patients (n=708) received some treatment within 4 hours of presentation. 19% of those with one or more serious injuries and 18% of those with moderate to severe head injury received care within 4 hours of arrival. Factors independently associated with early treatment included young age, severe head injury, and no known pre-existing conditions, whereas older or female patients had significantly less odds of receiving early treatment.

Discussion With the increasing number of patients with TBI, ensuring early and appropriate management must be a priority for Ugandan hospitals. Delay in initiation of treatment may impact survival and functional outcome. Gender-related and age-related disparities in care should receive attention and targeted interventions.

Level of evidence Prognostic and epidemiological study; level II evidence.

INTRODUCTION

Traumatic brain injury (TBI) is a leading cause of neurological disorders and disability globally, affecting as many as 69 million people annually and disproportionately burdening low-income and middle-income countries (LMICs).[1 2] In Sub-Saharan Africa (SSA) the incidence of TBI has recently been estimated to be as high as 801 per 100 000 person-years, several folds greater than the global rate. Beyond acute injury, TBI can result in severe long-term health sequelae, including life-long disability or death.[3 4] With greater urbanization of SSA countries and increasing risk factors for road traffic injuries, falls, and violent assaults, the magnitude and severity of TBIs as a public health problem are increasing, making early and appropriate management of suspected head injuries an important health system priority for the region.[5]

The cumulative incidence of TBI-related admissions at Mulago National Referral Hospital, Kampala has been estimated at 89 per 100 000 population per year, and mortality among the patients admitted with severe TBI was reported to be as high as 26%.[6] The leading cause is motorcycle-related road traffic injuries.[6 7] The outcome of TBI is hugely impacted by availability and access to healthcare services, timely implementation of TBI management guidelines, and overall quality of care.[8 9] Early diagnosis and treatment including appropriate surgical intervention can improve survival and may reduce hospital length of stay.[10] Suboptimal or delayed management of brain injuries increases the risk of death or permanent disability.[11] This is of particular concern in Uganda, where prehospital and in-hospital delays and non-adherence to standardized care contribute to hospital mortality as high as 45% to 75%.[12–14]

The health system in Uganda is financed by several sources including national government, private sector, households, and health development partners (external funding agencies). In the past 5 years, the health sector budget as a proportion of the national budget remained between 6% and 8%, which is far from the target of 15%.[15] Of the five East African countries, only Uganda is without national health insurance. Uganda abolished formal user fees in 2001 in all public health facilities to eliminate financial access barriers.[16] As reported recently, the proportion of government contribution dropped to 57% in 2019 to 2020 from 64% in 2015 to 2016, and per capita allocation for health increased from US$13 in 2015 to 2016 to US$17 in 2019 to 2020, which is still below the WHO recommendation of US$60 per capita.[15 17] Nonetheless, Ugandans have continued to experience high levels of out-of-pocket expenditure owing to indirect fees (such as transportation costs), additional fees to pay for radiology, medicines, and supplies, and illegal fees demanded ostensibly by medical staff for free services.[18 19] In this backdrop, there are potentially several factors influencing the healthcare service delivery and quality of care in Uganda.

Improved understanding of the timeliness of care for patients with TBI and the factors predictive of treatment time in a resource-constrained setting such as Uganda can help inform efforts to reduce delays, improve quality, and improve outcomes of TBI care. Recently, a dedicated TBI registry was implemented at the Mulago National Referral Hospital, Kampala to ensure an evidence-based approach toward quality improvement (QI).[20] Using the TBI registry data, this study was conducted to (1) investigate the time interval from emergency department (ED) presentation to TBI management interventions for patients presenting with TBI and (2) identify patient characteristics and injury factors predictive of early treatment initiation in a Ugandan context.

METHODS

The study was based on the Kampala internet-based Traumatic Brain Injury Registry (KiTBIR) data from the Mulago National Referral Hospital in Kampala, Uganda. KiTBIR was based on the core principles of hospital-based injury surveillance presented by Mitchell *et al*,[21] and customized specifically for Uganda through a collaboration between Mulago Hospital (MH), Makerere University, and Johns Hopkins Bloomberg School of Public Health.

Study setting and participants

MH is the largest tertiary care hospital in Uganda, located in the country's capital Kampala. It is the only public tertiary care neurosurgical center and houses five neurosurgeons. MH has 1500 beds and admits 130 000 to 140 000 patients per year.[6] All patients received in the ED are triaged, after which primary assessment and resuscitation, further investigations, and consultations are sought.

Patients of any age and gender presenting to the ED with either suspected or documented TBI during a 15-month period in 2016 to 2017 were included in the study. Loss of consciousness after the injury was not a requirement for inclusion, and patients with all levels of severity of head injury presenting to ED were included. Data were collected on patient and clinical characteristics, including age, sex, education level, injury circumstances, cause and mechanism of injury, prehospital assessment, investigations, and treatment in the ED. The Glasgow Coma Scale (GCS) and the Kampala Trauma Score (KTS) were calculated.[22–24] Patients found to have other reasons for altered consciousness (ie, meningitis, stroke, and drugs or alcohol intake with no associated injury) were excluded from the study. Enrolled patients were followed until their discharge from the ED.

Oral informed consent was obtained from all adult patients, assent from all patients between 13 and 17 years of age, and permission from parents or guardians for all patients less than 13 years of age.

Outcome measures

The primary outcome of interest was defined as *the time from presentation at the ED to treatment initiation*, measured as the time of first intervention delivery. ED interventions included both general measures such as supplemental oxygen, intravenous fluids, analgesics, and tetanus prophylaxis, and head injury management including head elevation, post-traumatic seizure prophylaxis, mannitol, hypertonic saline, advanced airway management, antibiotics, surgical toilet, and wound repair. Early treatment was defined as first intervention delivery within 4 hours of ED presentation, a cut-off for dichotomization of treatment time tested using sensitivity analysis to injury

severity.[25] This consisted of testing the robustness of the observed association between GCS and treatment time across alternative thresholds for defining early treatment as an outcome ranging from 4±2 hours after patient assessment. To analyze the impact of age we used a linear spline mode where appropriate knots were obtained using a smoothed Locally Weighted Scatterplot Smoothing (LOWESS) plot for the relationship between early treatment as a dichotomous outcome variable and age of the patient. Three knots were identified, and these were used to construct linear splines that were included in subsequent logistic regression analyses: 18 years, 40 years, and 60 years.[26 27] GCS score reflecting injury severity was converted into ordinal categories of mild (13–15), moderate (9–12), and severe (<9). KTS was similarly analyzed as categories of mild (9–15), moderate (7–8), and severe (4–6).[23]

Data analysis

Descriptive statistics and tabulations were generated for patient clinical and demographic characteristics, prehospital care data, injury characteristics, and ED treatment times. Pearson's χ^2 test was used to assess the sample distribution between treatment time categories.[28] Univariable logistic regression models were followed by multivariable logistic regression models with <0.05 level of significance to derive the associations between patient and injury characteristics and early intervention for TBI, and backward stepwise selection was used by removing terms with p≥0.050001 and adding those with p<0.05 for derivation of the final model.[29] Confounding and effect modification by referral status on the relationship between injury severity and odds of early intervention were tested using significance of interaction terms combining GCS injury severity category and referral status. Statistical analyses were completed using Stata V.15 I/C package.[30] We did not use imputation for any of the missing data in this study. Instead, we used pairwise deletion (analyzing all cases in which the variables of interest were present) to maximize the power of each analysis. Detailed checklist of items reported in this paper is provided in the Supplemental file 1 (Strobe Statement)

RESULTS
Patient characteristics

From May 2016 to July 2017, 4735 patients were eligible for enrollment, and of these 3944 (83.3%) were enrolled, excluding those who did not fulfill the inclusion criteria or provide consent/assent. As shown in table 1, majority of patients with TBI were male (n=3339; 84.7%) and most were aged 19 to 40 years (n=2662; 67.5%). Nearly half of all patients with TBI resided in rural areas, and approximately two-thirds of the patients were family breadwinners. The most common modes of arrival were by police vehicles (n=1337; 33.9%), private vehicles (n=1146; 29.1%), and ambulances (n=1057; 26.8%). Only 4.6% of 3944 patients (n=182) received an intervention for TBI management within 1 hour of ED presentation, whereas 17.4% of patients (n=708) received some treatment within 4 hours of presentation.

There were no statistical differences between mean age, sex distribution, or distribution of any other patient demographics between the early and delayed treatment time groups except for mode of arrival to the ED and breadwinner status. A slightly higher percentage of patients with early TBI treatment were brought by private vehicles compared with patients with delayed treatment (31.8% vs. 28.5%), whereas the percentage of patients brought by police vehicles and ambulances was lower among the early treatment group compared with the late treatment

Table 1 Patient demographic characteristics by treatment time (N=3944)

	Treated within 4 hours of presentation (n=704)	Treatment delayed >4 hours (n=3240)	P value
Age in years, mean±SD	28.0±13.8	28.6±14.3	0.299
Age group in years, n (%)			
0–18 (n=724)	136 (19.3)	588 (18.1)	0.360
19–40 (n=2662)	483 (68.6)	2179 (67.2)	
41–60 (n=423)	65 (9.2)	358 (11.0)	
>60 (n=135)	20 (2.8)	115 (3.5)	
Sex, n (%)			
Male (n=3339)	610 (86.6)	2729 (84.2)	0.106
Female (n=605)	94 (13.4)	511 (15.8)	
Area of residence, n (%)			
Urban (n=1993)	365 (51.8)	1628 (50.2)	0.464
Rural (n=1946)	339 (48.2)	1607 (49.6)	
Breadwinner, n (%)			
No (n=1486)	290 (41.2)	1196 (36.9)	0.040
Yes (n=2423)	410 (58.2)	2013 (62.1)	
Mode of arrival, n (%)			
Private vehicle (n=1146)	224 (31.8)	922 (28.5)	0.033
Boda boda (n=318)	49 (7.0)	269 (8.3)	
Ambulance (n=1057)	186 (24.4)	871 (26.9)	
Police vehicle (n=1337)	224 (31.8)	1113 (34.4)	
Walk-in (n=33)	8 (1.1)	25 (0.8)	
Other (n=31)	11 (1.6)	20 (0.6)	
Referred, n (%)			
No (n=1711)	295 (41.9)	1416 (43.7)	0.406
Yes (n=2223)	406 (57.7)	1817 (56.1)	
Cause of TBI, n (%)			
RTI (n=2322)	421 (59.8)	1901 (58.7)	0.303
Falls (n=288)	61 (8.7)	227 (7.0)	
Intentional injuries (n=1133)	188 (26.7)	945 (29.2)	
Others (n=201)	34 (4.8)	167 (5.2)	

RTI, Road Traffic Injuries; TBI, traumatic brain injury.

Table 2 Patient clinical characteristics by treatment time (N=3944)

	Treated within 4 hours of presentation (n=704)	Treatment delayed >4 hours (n=3240)	P value
Type of head injury, n (%)			
Open wound with underlying fracture (n=1432)	249 (35.4)	1183 (36.5)	0.674
Close (n=2483)	445 (63.2)	2038 (62.9)	
Number of serious injuries, n (%)			
0 (n=800)	134 (19.0)	666 (20.6)	0.615
1 (n=3033)	551 (78.3)	2482 (76.6)	
≥2 (n=108)	18 (2.6)	90 (2.8)	
GCS category, n (%)			
Mild (n=2428)	416 (59.1)	2012 (62.1)	0.099
Moderate (n=871)	154 (21.9)	717 (22.1)	
Severe (n=645)	134 (19.0)	511 (15.8)	
KTS category, n (%)			
Mild (n=3361)	612 (87.1)	2749 (84.9)	0.318
Moderate (n=393)	60 (8.5)	333 (10.3)	
Severe (n=187)	31 (4.7)	156 (4.8)	
Loss of consciousness, n (%)			
No (n=1185)	197 (28.0)	988 (30.5)	0.188
Yes (n=2759)	507 (72.0)	2252 (69.5)	
Suspected alcohol use, n (%)			
No (n=2685)	484 (68.8)	2201 (68.0)	0.412
Yes (n=1188)	212 (30.1)	976 (30.2)	
Unknown (n=68)	8 (1.1)	60 (1.9)	
Suspected drug use, n (%)			
No (n=3512)	627 (89.1)	2885 (89.0)	0.703
Yes (n=338)	63 (9.0)	275 (8.5)	
Unknown (n=94)	14 (2.0)	80 (2.5)	
Pre-existing condition			
No (n=3382)	597 (84.9)	2785 (86.0)	0.054
Yes (n=375)	61 (8.7)	315 (9.7)	
Unknown (n=186)	45 (6.4)	141 (4.4)	

GCS, Glasgow Coma Scale; KTS, Kampala Trauma Score.

group. Breadwinners represented a slightly smaller proportion of the early treatment group (58.2%) compared with the delayed treatment group (62.1%). More than half of all patients with TBI (n=2223; 56.4%) were interhospital referrals. The most common causes of TBIs were Road Traffic Injuries (RTIs, accounting for 58.9% of all cases (n=2322), followed by assault and self-harm (n=1133; 28.7%).

Clinical characteristics

Table 2 demonstrates the clinical characteristics of the study subjects. Majority of cases were closed head injuries (n=2483; 63.0%), and most (n=3033; 76.9%) of the study subjects suffered from one or more serious injuries involving the head and neck or other organ systems. Most patients had no known

pre-existing medical condition (n=3382; 85.6%). The distribution of overall injury severity among patients with TBI was more heavily weighted toward mild categories for both the GCS (61.5% mild GCS, 22.1% moderate GCS, and 16.4% severe GCS) as well as KTS, where lower score meant severe injury (85.2% mild KTS category, 10.0% moderate KTS category, and 4.7% severe KTS category). A large majority of TBI cases involved loss of consciousness (n=2759; 70.0%), about 30% involved suspected alcohol use (n=1188; 30.1%), and less than one-tenth involved suspected drug use (n=338; 8.6%). Comparing all patients treated for TBI within 4 hours of presentation with those with longer delays in ED interventions, there was no statistically significant difference in distribution across injury severity categories or any other clinical patient or injury characteristics.

Multivariable logistic regression

Univariable and multivariable logistic regression models were used to identify factors predictive of receiving at least one TBI management intervention at 4 hours or less after presenting to the ED (table 3). Independent of any other variables, being severely injured according to GCS category was associated with

Table 3 Results of logistic regression analysis of patient and clinical characteristics as predictors of early treatment (N=3944)

	Unadjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Age, per year				
0–18	0.99 (0.97 to 1.02)	0.539	1.00 (0.97 to 1.02)	0.751
19–40	1.01 (0.99 to 1.02)	0.406	**1.02 (1.00 to 1.03)**	**0.038**
41–60	**0.97 (0.95 to 1.00)**	**0.047**	**0.97 (0.95 to 1.00)**	**0.028**
Above 60	1.02 (0.98 to 1.06)	0.359	1.02 (0.98 to 1.06)	0.431
Sex				
Male	Ref		Ref	
Female	0.82 (0.65 to 1.04)	0.107	**0.75 (0.59 to 0.97)**	**0.030**
Area of residence				
Urban	Ref			
Rural	0.94 (0.80 to 1.11)	0.464		
Breadwinner				
No	Ref		Ref	
Yes	**0.84 (0.71 to 0.99)**	**0.040**	**0.72 (0.58 to 0.89)**	**0.003**
Mode of arrival				
Private vehicle	Ref		Ref	
Boda boda	0.75 (0.54 to 1.05)	0.095	0.76 (0.54 to 1.06)	0.105
Ambulance	0.88 (0.71 to 1.09)	0.240	0.86 (0.69 to 1.07)	0.166
Police vehicle	0.83 (0.68 to 1.02)	0.071	0.83 (0.68 to 1.02)	0.075
Walk-in	1.32 (0.59 to 2.96)	0.505	1.31 (0.58 to 2.96)	0.514
Other	**2.26 (1.07 to 4.79)**	**0.033**	**2.30 (1.08 to 4.88)**	**0.030**
Referred				
No	Ref			
Yes	1.07 (0.91 to 1.27)	0.406		
Cause of TBI				
RTI	Ref			
Falls	1.21 (0.90 to 1.64)	0.209		
Intentional injuries	0.90 (0.74 to 1.08)	0.266		
Others	0.92 (0.63 to 1.45)	0.667		
Type of head injury				
Open	Ref			
Close	1.04 (0.87 to 1.23)	0.674		
Number of serious injuries, n				
0	Ref			
1	1.10 (0.90 to 1.36)	0.352		
≥2	0.99 (0.58 to 1.70)	0.983		
GCS category				
Mild	Ref			
Moderate	1.04 (0.85 to 1.27)	0.714	1.04 (0.85 to 1.28)	0.706
Severe	**1.27 (1.02 to 1.58)**	**0.032**	**1.25 (1.00 to 1.56)**	**0.047**
KTS category				
Mild	Ref			
Moderate	0.81 (0.61 to 1.08)	0.151		
Severe	0.89 (0.60 to 1.33)	0.573		
Loss of consciousness				
No	Ref			
Yes	1.13 (0.94 to 1.35)	0.188		
Suspected alcohol use				
No	Ref			
Yes	0.99 (0.83 to 1.18)	0.892		
Unknown	0.61 (0.29 to 1.28)	0.188		
Suspected drug use				

Table 3 Continued

	Unadjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
No	Ref			
Yes	1.05 (0.79 to 1.40)	0.719		
Unknown	0.81 (0.45 to 1.43)	0.460		
Pre-existing condition				
No	Ref		Ref	
Yes	0.91 (0.68 to 1.21)	0.503	0.91 (0.68 to 1.22)	0.520
Unknown	**1.49 (1.05 to 2.11)**	**0.025**	**1.46 (1.03 to 2.08)**	**0.032**

Bold values: p <0.05; statistically significant

GCS, Glasgow Coma Scale; KTS, Kampala Trauma Score; Ref, reference; RTI, Road Traffic Injury; TBI, traumatic brain injury.

26% greater odds of treatment within 4 hours of presentation compared with patients with mild GCS (unadjusted OR 1.27; 95% CI 1.02 to 1.58). The observed association between severe GCS and odds of early treatment remained statistically significant even after adjustment for age in years, sex, breadwinner status, mode of arrival, and presence of pre-existing conditions in the multivariable logistic model (adjusted OR 1.25; 95% CI 1.00 to 1.56).

In contrast, although not statistically significant, more severe injury per KTS category was paradoxically associated with reduced odds of early treatment, whether comparing moderate with mild KTS (unadjusted OR 0.81; 95% CI 0.61 to 1.08) or comparing severe with mild KTS (unadjusted OR 0.89; 95% CI 0.60 to 1.33). Interaction terms combining GCS injury severity category and referral status were found to be statistically insignificant in both univariate and multivariate models. After adjustment, an increase in age by 1 year among patients between 19 and 40 years old was associated with a 2% increase in odds of early treatment (adjusted OR 1.02; 95% CI 1.00 to 1.03), whereas an increase in age by 1 year among patients between 41 and 60 years old was associated with a 3% decrease in odds of early treatment (adjusted OR 0.97; 95% CI 0.95 to 1.00).

Being the family's breadwinner was associated with significantly lower odds of TBI treatment within 4 hours of ED presentation, both independent of other variables (unadjusted OR 0.84; 95% CI 0.71 to 0.99) and after adjusting for other covariates in the model (adjusted OR 0.72; 95% CI 0.58 to 0.89). Although sex was not a significant predictor of treatment time before adjustment, in the multivariable model, the odds of early treatment were 25% lower for women as compared with men of the same age in years, breadwinner status, GCS injury severity category, and pre-existing condition status (adjusted OR 0.75; 95% CI 0.59 to 0.97). It was also noticed that patients with unknown pre-existing conditions are more likely to receive care as opposed to those who had known comorbidities.

DISCUSSION

This is one of the few studies from Uganda to address the quality of hospital-based TBI care with reference to prompt ED diagnosis and management in patients with different demographics, injury patterns, and severity. Logistic regression analysis estimated the unadjusted and adjusted odds of receiving early care (within 4 hours of ED arrival) in patients presenting with TBI. The following observations are worthy of special attention. ED delays in assessment and treatment of patients with TBI were very common. Less than 5% of patients were documented to have received care within an hour of arrival. Only 19% of those with one or more serious injuries and 18% of those with moderate to severe TBI received care within 4 hours of arrival.

This delay happened even with history of loss of consciousness, open head injury, or unfavorable KTS. Female patients are significantly less likely to receive early care regardless of TBI severity, cause of TBI, and other factors. Young patients with TBI (age 19–40 years) are more likely to get prompt treatment as compared with other age groups.

These findings suggest that older patients with age between 41 and 60 years, female patients, and those who were not breadwinners of their household had statistically significant lesser odds of receiving treatment within a 4-hour window. These factors could be proxies for low financial means, sociocultural environment, as well as allocation of resources to those who have severe head injury or younger age group affording a better prognosis. This finding might be disquieting but is not new; less aggressive TBI management has been documented in hospitalized patients with advanced age and that low management intensity was associated with an increased risk of 30-day mortality.[31] It is also observed that for an equivalent severity of intracranial injury, older patients may have a higher presenting GCS score than in the young.[32] This, combined with different management practices such as review by the most senior doctor, early neuroimaging, and early transfer to a center with acute neurosurgical facilities, may contribute to the observed differences in mortality between younger and older patients as reported in other studies.[33–35]

One of the most noticeable findings is gender difference in receiving prompt attention in ED. Many studies have confirmed a female survival advantage in trauma attributed to estrogen and progestin effect; however, disparities have been observed in access to trauma care, triage to trauma center, and prehospital care.[36–39] In other studies, it is also reported that women are less likely to receive appropriate analgesia, selected life-supporting treatments, and more likely to die after critical illnesses than men, despite similar severity of illness at the time of admission.[40 41] Gender-based differences in trauma care delivery are still not well studied in LMICs and this is an important area of research to be explored to reduce such inequities.

Despite these speculations about prognosis, socioeconomic, and cultural factors in allocation of resources, this study presents an indisputable evidence on delay in treatment for trauma patients with or without TBI. Even though the guidelines suggest that the assessment and interventions of a patient with suspected TBI should start as early as the first 15 minutes of arrival, our sensitivity analysis based on the data revealed a cut-off of 4 hours, which is unacceptable in any evidence-based clinical standards.[8 9] This study again highlights the lack of early ED resuscitation and management of patients with TBI in one of the largest public sector referral hospitals of Uganda, which seems to impact both high-risk and low-risk patients. Our previous study from the same setting demonstrated that this delay could

be responsible for the poor outcome of many initially low-risk patients with TBI, whose GCS worsens in ED due to delays in assessment and resuscitation.[7] Kuo *et al*[42] also demonstrated that failure to receive surgery, high dependency unit admission, ventilator support requirement, and prehospital delay by more than 4 hours could significantly impact TBI outcomes apart from injury severity.

Delay in initiation of treatment for patients with trauma and TBI is one of the factors that could potentially impact survival and functional outcome. Implementing and adhering to TBI management guidelines, which include recognition of high-risk patients and supportive interventions to prevent physiological deterioration and secondary injuries, could potentially improve outcomes. Other researchers have emphasized the importance of early warning clinical signs such as hypoxia, change in heart rate or blood pressure, and age >50 years that may guide ED physicians and neurosurgeons in prioritizing care for patients at the highest risk of mortality.[43] TBI outcome prediction models such as the International Mission on Prognosis and Analysis of Clinical Trials also take CT classification, intracranial hemorrhage, and laboratory results into account.[44] However in LMICs, ED overcrowding of large tertiary care hospitals, lack of trained personnel, and non-standardized treatment have been documented previously as contributory factors toward suboptimal ED and inpatient trauma care. System-based changes with strong institutional support are needed to overcome such barriers.[45–47]

Recognition of early warning signs, inadequate or delayed resuscitation, and disparities in care could be positively impacted by standardized clinical protocols, triage guideline implementation, targeted education, and sensitization of the ED clinicians and staff toward improving the quality of care by change in practice.[48] Organizational leadership is required to facilitate training, regular forums for dissemination of best practices and clinical practice protocols, injury data management, development of pilot QI projects, and advocacy for quality trauma care.[49] Finally, indepth studies to understand the barriers to optimal care would also help in identifying opportunities for targeted policies and successful implementation of these interventions.

Limitations

This study does not address the underlying causes of suboptimal ED management of patients with TBI. In this study, any medical treatment was considered a positive outcome, although some life-saving measures such as airway protection clinically carry more weight than other interventions. This analysis was not designed for outcome prediction; hence, CT scan findings and other prognostic variables were not considered. Additionally, it was recognized that a large proportion of patients were initially treated elsewhere before being transferred to Mulago. However, this was accounted for and no significant difference was observed in the two groups at the level of analysis. Although the state of emergency care is generally suboptimal in urban tertiary care centers in SSA, caution must be applied in generalizing the specific findings to other settings.

CONCLUSION

With the increasing importance of TBI as a public health problem, ensuring early and appropriate management must be a priority for Ugandan hospitals. Other than injury severity, delay in initiation of treatment for patients with TBI is reflective of suboptimal trauma care that may impact outcomes such as death or residual disability. Gender-related and age-related disparities in care should receive attention and interventions targeted

to improve clinical practice must be initiated. Indepth studies to understand the barriers to providing care will help identify opportunities for targeted interventions and successful implementation of QI initiatives.

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