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ORIGINAL ARTICLE

Injury patterns of patients presenting to a non-governmental hospital in Western Uganda

Heather A. Brown[a,*], Joshua Skaggs[a], Caroline Brady[a], Vincent Tumusiime[b], Austin S. White[c]

[a] University of South Carolina, Prisma Health Midlands, Department of Emergency Medicine, 14 Medical Park Dr. Suite 350, Columbia, SC 29203, USA
[b] Masindi Kitara Medical Center, Outpatient Department, Kijunjubwa Rd, Masindi, Uganda
[c] Morristown-Hamblen Healthcare System, Department of Emergency Medicine, 908 W 4th N St. Morristown, TN 37814, USA

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ABSTRACT

Introduction: Injury is a leading cause of morbidity and mortality globally and disproportionately affects low-income countries. While most injury data comes from tertiary care centers in urban settings, the purpose of this study was to describe the characteristics and severity of injury in rural Uganda and the associated treatment patterns and delays in care.

Methods: This is a retrospective cohort study of a trauma registry that was implemented at Masindi-Kitara Medical Center (MKMC), a rural hospital in Western Uganda. Demographic information, injury characteristics, modified Kampala Trauma Scores (M-KTS), and treatment modalities over a 12 month period were retrospectively collected from paper-based registry forms completed for all injury patients presenting to MKMC.

Results: A total of 350 patients were entered into the trauma registry. Most patients were male (71.2%) with a median age of 26.5 years. Motorcycle crashes were the most prevalent mechanism of injury (42.3%) with the majority being unhelmeted (83.3%). Soft tissue injury was the most common diagnosis (44.9%). Patients were frequently treated in the outpatient department and then discharged (54.8%). Patients requiring admission or transfer (M-KTS = 11.57 or 11.67) tended to have a lower M-KTS than discharged patients (M-KTS = 12.75). Analgesics (74.6%) and antibiotics (52.9%) were the most common treatments administered. For those patients requiring admission (29.4%), only one in-hospital death was documented. Thirty-nine percent of patients reported a delay in seeking care, most frequently due to lack of transportation (31.5%) with a median time of delay of 11 h.

Conclusion: Road traffic injuries were the leading cause of injury in Masindi, with a high proportion of injuries associated with unhelmeted motorcycle crashes. Future opportunities to prevent injury and improve care may be seen through improved prehospital care, enforcement of helmet laws, increased access to neurosurgical services, and enactment of hospital quality improvement measures.

African relevance

- Trauma registries are key to characterize injury patterns and improve trauma care.
- Most trauma data in Africa comes from trauma registries in large urban centres.
- Less is known about the demographics, injury patterns, or outcomes in rural Uganda.

Introduction

Injury is a significant cause of global mortality and frequently results in high levels of disability compared to other etiologies. Injury results in 4.6 million deaths annually and is responsible for 8.4% of the global mortality burden [1]. Low- and middle-income countries (LMICs) are disproportionately affected by injury, with > 90% of injuries occurring in these countries, meaning those countries with the least developed infrastructure and fewest resources often have the highest injury burden [2,3]. Road traffic injuries (RTIs) in particular account for a high burden of disease in LMICs, and result in nearly two times the death rate and three times the rate of disability-adjusted life years (DALYs) as similar injuries in high-income countries (HICs) [3]. This disparity in injury outcomes in LMICs compared to HICs results from a variety of factors including poor investment in preventative measures, underdeveloped or nonexistent prehospital care services, long transport times to an adequate medical facility, shortages of

* Corresponding author.
E-mail address: Heather.Brown2@prismahealth.org (H.A. Brown).

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medication and blood products, and lack of training in acute and emergency care for first line providers [4–7].

Uganda is classified by the World Bank as a low-income country [8]. As such, Uganda faces significant challenges in mitigating trauma-related morbidity and mortality. Injury is responsible for 13% of all deaths in Uganda and is the 9th leading cause of DALYs [9,10]. RTIs alone account for > 10,000 deaths annually in Uganda and is the country's tenth most common cause of death [10,11].

While there are country-specific estimates of injury burden, there is a lack of regionally available data, largely due to underdeveloped data systems to collect comprehensive injury statistics among health centers in most LMICs [12,13]. A crucial component of improving trauma care is the establishment of trauma registries, which capture the epidemiology of injury and the clinical care provided to the injured [14]. The burden of injury in Uganda is typically assessed through hospital-based trauma registries and the Uganda National Household Survey; however this likely underestimates the injury burden [15]. Injury data is also likely skewed as the bulk of data in this setting comes from referral centers in large cities and may misrepresent injury patterns in a country which is largely rurally-populated [16,17].

The goal of our study was to evaluate the injury patterns, severity, and outcomes of patients presenting to Masindi-Kitara Medical Center (MKMC), a small non-governmental organization (NGO) hospital located in a rural region of Uganda. The study and subsequent amendments were approved by the Prisma Health Institutional Review Board, The AIDS Support Organization (TASO) of Uganda's ethics committee, and the Uganda National Council of Science and Technology.

Methods

This study was conducted at MKMC, in Masindi, Uganda, a rural district 217 km northwest of the capital city of Kampala. MKMC was founded by the NGO OneWorld Health and functions as a self-sustaining hospital based on a sliding-scale, fee-for-service system. MKMC, along with Masindi Government Hospital, serves the 291,000 residents of Masindi District [18]. MKMC is a 35-bed hospital open 24 h with an outpatient clinic, laboratory, diagnostic x-ray and ultrasound suite, operating theater, and pediatric, adult, and maternity inpatient wards. CT and MRI are lacking in Masindi, requiring patients to travel to Kampala for these advanced imaging modalities.

This is a retrospective cohort study using a paper-based trauma registry initiated at MKMC in March of 2017. The trauma registry consists of paper forms designed specifically for MKMC (Appendix 1). Patients presenting to MKMC with a chief complaint of injury were included in the registry upon initial evaluation by the clinician (physician or clinical officer). All injured patients presenting to MKMC between March of 2017 and March of 2018 who were entered into the registry were included in the study. This time interval allowed for 12 consecutive months of data capture while additional staff support was available. Data points entered into the registry included date of injury and subsequent presentation; patient's age, sex, and district of residence; known pregnancy; the type of presentation (initial, follow-up, transfer); delays in seeking care and the rationale; mechanism, anatomical site, and intent of injury; injury severity as measured by the modified Kampala Trauma Score (M-KTS); treatments rendered; and diagnosis and disposition [18]. An additional variable of helmet use among motorcyclists was added to the registry form in May of 2017 as preliminary data showed a preponderance of motorcycle associated head injury.

The M-KTS was used in this study due to limited diagnostic capacity at MKMC. The M-KTS consists of four variables (patient age, systolic blood pressure, number of severe injuries, and basic neurologic status) which can predict mortality in trauma patients [19]. Using other trauma scoring systems like the Injury Severity Score would necessitate a specific diagnosis that often can only be captured using more advanced diagnostics, which are not available in this setting [15]. The M-KTS provides a context-appropriate, validated injury scoring system but limits comparison with other published registry data which may use alternative scoring systems [19].

Data was collected from the registry by two study investigators retrospectively at 9 months and again at 12 months. After the initial data collection was performed at 9 months, the decision was made to amend the study in order to add a retrospective chart review. This was performed at the 12 month conclusion of the study to capture patients not initially enrolled in the registry. Paper hospital admission records were retrospectively searched for patients with a primary diagnosis related to injury and included in the database. Any missing data points were also collected for all admitted registry patients, as trauma forms were often not updated after the initial encounter. Limited records were available for non-admitted patients and subsequently retrospective chart review was only feasible for inpatient records.

Data was transferred from the trauma registry into a spreadsheet using Microsoft Excel (Microsoft Corporation, Redmond, WA), de-identified and categorized. R package statistical software (R Core Team, Vienna, Austria) was used for data analysis. Means and standard deviations were evaluated for M-KTS and single variable frequencies and percentages were evaluated for injury categories. Cross-tabulation analysis was performed for demographics and injury characteristics, as well as for M-KTS with injury characteristics and disposition. M-KTS scores were not calculated and were excluded from analysis if a single variable component of the M-KTS was missing.

Results

An initial 320 patients were recorded in the trauma registry between March 1, 2017 to March 1, 2018 and an additional 30 patients were retrospectively identified and included in the final data analysis for a total sample size of 350. Of the 350 patients, 104 (32.5%) of the forms were missing at least one data variable. The majority of patients were male (Table 1), and the median age in years was 26.5 (IQR 18–36). Patients generally came to MKMC for the initial presentation of an injury (93%), while only 4% of patients transferred to MKMC from other health care facilities for injury care, with the remainder seen for injury follow-up after an initial presentation elsewhere. 138 patients (39.4%) reported a delay in care (defined as presentation > 1 h after injury). The average time of delay before arriving at MKMC was 11.0 h (IQR 2–24). In cases in which there was a delay in seeking care, the most common reason was due to difficulty obtaining transportation (Table 1).

RTIs comprised the most common mechanism of injury at 62.1% (Fig. 1). Motorcycle injury was the overall most common mechanism of injury, responsible for 42.3% of all injuries and 68.1% of injury due to RTI. Among cases where potential helmet use was documented, 83.3% of patients did not wear a helmet. Information about helmet use was available only for 37.2% of motorcycle injuries. Among unintentional

Table 1
Demographics and delays.

Patient age category	n (%)	Delays in seeking care	n (%)
Pediatric patients < 18 y/o	85 (24.4%)	Difficulty obtaining transportation	46 (31.5%)
Adult patients 18–65 y/o	250 (71.8%)	Injury deemed not severe	40 (27.3%)
Geriatric patients > 65 y/o	13 (3.7%)	Treated elsewhere first	34 (23.3%)
Patient sex		Long travel distance	11 (7.5%)
Male	247 (71.2%)	Financial concerns	7 (4.8%)
Female	100 (28.8%)		
Location of residence			
Masindi district	186 (60.4%)		
Masindi town	98 (31.8%)		
Surrounding districts	24 (7.8%)		

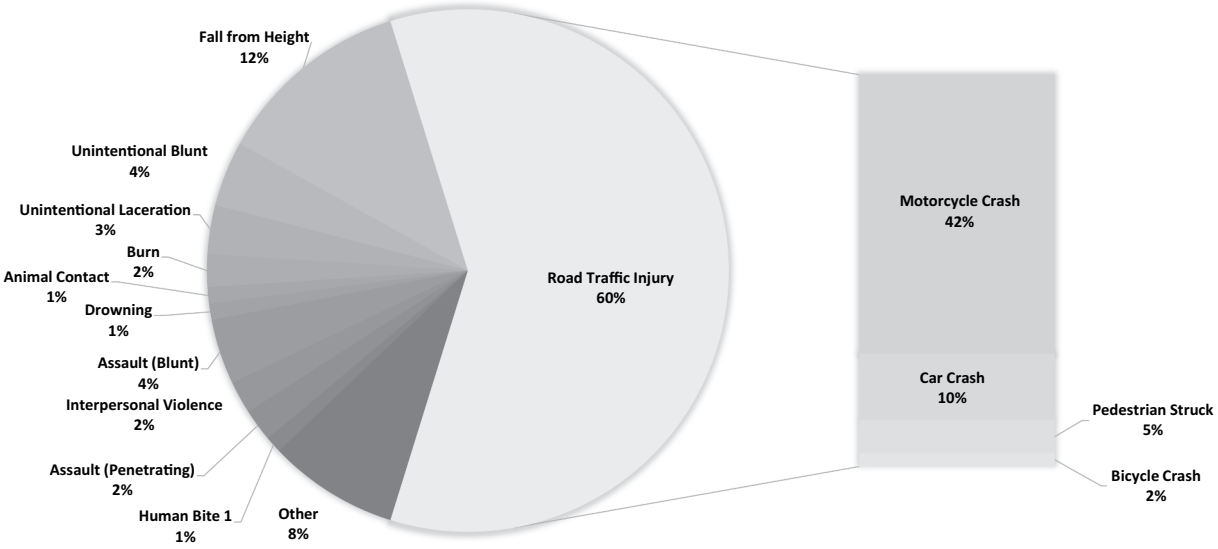

Fig. 1. Mechanism of injury.

injury not related to RTI, falls from height were most common at 12.0% of all cases. Most injuries were documented as unintentional (90.1%), with intentional injury comprising the remaining 9.9% of cases and was most commonly due to assault with a blunt object (44.1%). No injury presentations for self-harm were documented.

There were similar rates of RTIs in both men (63.1%) and women (60.6%). Among pregnant patients, RTIs accounted for 66.7% of all injury, with motorcycle crash being the most common mechanism. Intentional injury resulted in 15.2% of the injury burden among women overall and 13.3% of injuries among pregnant women, as compared to 7.9% of men. Intimate partner violence (IPV) accounted for 23.5% of all cases of intentional injury, with all victims being female.

The most frequent anatomical location of injury was the head (32.2% of all patients), followed by lower and upper extremities at 26.0% and 19.0% respectively. Among age groups, pediatric patients (< 18 years) had the highest proportion of head injury at 42.4%, while geriatric patients (> 65 years) sustained head injuries in only 15.4% of cases. Conversely, geriatric patients had higher proportions of lower extremity injury (46.2%) as compared to pediatric patients (15.3%). The greatest burden of injury for both adults and geriatric patients was due to RTI (68.3% and 69.2% respectively), while unintentional injury not related to RTI caused 52.4% of injury for pediatric patients.

All M-KTS scores with an incomplete component were excluded, with a total of 265 (75.7%) patients having a completed score. The mean M-KTS for all patients was 12.23 (SD 0.98). As lower M-KTS scores are associated with more severe injury, these values were cross-tabulated with mechanism of injury, diagnoses, and disposition. The mechanism of injury which resulted in the lowest aggregate M-KTS (12.12, SD 1.11) was RTI (Table 2). When correlating M-KTS with diagnosis, patients with abdominal trauma requiring operative management (10.75, SD 1.58) and patients with head injuries (11.41, SD 1.41) were found to have the lowest scores. Patients that required admission or transfer had lower scores than those discharged.

The most commonly documented treatment for injured patients was the administration of analgesia (74.6%), most commonly oral medications (Table 3). Of the 12 patients who went directly to the operating theater for surgical management of their injuries, exploratory laparotomy was the most common indication. Soft tissue injury (44.9%) was the most common final diagnosis, followed by fractures (19.5%, Table 4). Fractures were most commonly found in geriatric patients (54.5% of this population). Conversely a diagnosis of head injury was most frequently assigned to pediatric patients (13.2% in this age group). Symptomatic concussion represented the majority of diagnosed head injuries. When correlating the diagnosis with mechanism of injury, RTIs accounted for a substantial burden of injury across all diagnostic groups. This was particularly apparent among head injury, as 79.5% of these diagnoses were due to RTIs.

The majority of patients (54.8%) were treated for their injuries and subsequently discharged. One patient was documented to have died of their injuries after admission. Most transfers (45.1%) were to Masindi District Hospital for orthopedic treatment, as MKMC has limited orthopedic capabilities. Another 7.8% of transferred patients were sent to the Mulago National Referral Hospital in Kampala, most commonly for neurologic injuries.

Table 2
Modified Kampala Trauma Score.

	Mean (SD)
Mechanism of injury	
Unintentional injury (non-RTI)	12.39 (0.61)
Road traffic injury	12.12 (1.11)
Intentional injury	12.58 (0.58)
Primary diagnosis group	
Operative abdominal trauma	10.75 (1.58)
Fracture	11.65 (0.67)
Head injury	11.41 (1.45)
Musculoskeletal injury (non-fracture)	12.73 (0.52)
Soft tissue injury	12.54 (0.65)
Disposition	
Admitted	11.57 (1.06)
Discharged	12.75 (0.48)
Transferred	11.67 (0.98)

Table 3
Treatment.

Medication types	n (%)	Treatment interventions	n (%)
Analgesic medications	261 (74.6%)	Suture repair	48 (13.7%)
Antibiotic treatment	185 (52.9%)	Intravenous fluids	33 (9.4%)
Tetanus immunization	64 (18.3%)	Wound dressing or compress	22 (6.3%)
Steroids	48 (13.7%)	Splint or sling	18 (5.1%)
Mannitol	29 (8.3%)	Operative management	12 (3.4%)
Diazepam	27 (7.7%)	Blood products	4 (1.1%)

Table 4
Final diagnoses and dispositions.

Final diagnoses	n (%)		
Operative abdominal trauma	9 (2.8%)	Musculoskeletal (non-fracture)	42 (13.0%)
Intestinal perforation	1 (< 1%)	Amputation	1 (< 1%)
Penetrating abdominal trauma	2 (< 1%)	Dislocation	5 (1.5%)
Hemoperitoneum	1 (< 1%)	Muscle strain	6 (1.9%)
Splenic laceration	5 (1.5%)	Muscle spasm	28 (8.7%)
		Joint sprain	2 (< 1%)
Fracture	63 (19.5%)		
Dental	4 (1.2%)	Soft tissue	208 (64.4%)
Jaw	1 (< 1%)	Soft tissue injury	145 (44.9%)
Vertebral	1 (< 1%)	Cellulitis	2 (< 1%)
Clavicle	8 (2.5%)	Crush	3 (< 1%)
Humerus	13 (4.0%)	Burn	7 (2.2%)
Elbow	1 (< 1%)	Laceration	51 (15.8%)
Radius/Ulna	5 (1.5%)		
Hand	1 (< 1%)	Other	
Rib	3 (< 1%)	Blunt chest injury	13 (4.0%)
Pelvis	1 (< 1%)	Hemorrhagic shock	1 (< 1%)
Femur	3 (< 1%)	Spinal cord injury	1 (< 1%)
Knee	2 (< 1%)	Hemothorax	4 (1.2%)
Tibia/Fibula	14 (4.3%)	Near drowning	1 (< 1%)
Foot	2 (< 1%)	Ocular trauma	3 (< 1%)
Open	4 (1.2%)	Pain	17 (5.3%)
Head injury	46 (14.2%)		
Closed head injury	44 (13.6%)		
Open head injury	2 (< 1%)		
Disposition			
Admitted	95 (29.4%)		
Transferred	51 (15.8%)		
Discharged	177 (54.8%)		

Discussion

This study adds to the relatively sparse evidence describing demographics, epidemiology, and outcomes of injured patients cared for in African non-government hospitals outside of large urban centers. In keeping with previous studies performed in Uganda, road traffic injury, particularly motorcycle crashes, was responsible for the majority of injuries presenting to MKMC [20,21]. Approximately one-quarter of all patients were under 18 years old, demonstrating a high proportion of pediatric trauma. While RTI caused over two-thirds of all injury among adult and geriatric patients, unintentional injury (non RTI) was the most common mechanism among pediatric patients. As the legal driving age in Uganda is 18 years, this may account for the lower proportion of RTIs in this population. A relatively high proportion of injured patients were also pregnant, which is concerning as injuries are the leading non-obstetric cause of maternal death [22]. Women were almost twice as likely to sustain an intentional injury as men, and pregnancy was associated with similarly high levels of intentional injury. These findings suggest the need for targeted prevention and specialized treatment among these high risk populations.

Motorcycle crashes were the most common cause of injury, with head trauma accounting for the highest proportion of these injuries. These findings are consistent with the high proportion of motorcycle use as transportation in rural Uganda [23]. Helmet use was recorded for 37% of the 145 patients injured on motorcycles. In those cases in which helmet use was recorded, only 17% reported wearing a helmet. This low percentage of use appears consistent with national data, as mandatory helmet laws are infrequently enforced and often ignored [24].

A large proportion of injured patients (39.4%) experienced a significant delay in seeking care, with an average delay of 11 h. Compared to previously published trauma registry data from an urban center in Uganda, this is a significantly higher percentage [25]. Difficulty obtaining transportation was the most common barrier to seeking care, while financial concerns were actually the least common reason patients cited as causing a delay in care. Masindi is a largely rurally populated district which lacks any form of prehospital care or emergency medical services. Since the conclusion of this study, MKMC has created a pilot first responder program for commercial motorcycle taxi drivers to address this need.

We found a lower mean M-KTS associated with RTI as compared to other mechanisms of unintentional injury or intentional injury, underscoring the severity of RTI and the need for adequate trauma care for these patients. Even though head injury was the most common injury and was associated with more severe injury, any serious head trauma had to be transferred several hours away to Kampala due to a lack of regional neurological or neurosurgical capability. Offering these services in a more proximal geographical region or exploring innovative approaches such as telemedicine would be of significant value, especially considering the long distance and expense in transferring patients to Kampala.

Registry data raised concerns about the possible overuse of some medications in injured patients, particularly mannitol, antibiotics and steroids. Eight percent of patients with head injuries received mannitol; however, 21% of these patients were subsequently discharged the same day. Given that international guidelines recommend mannitol be used only in patients with progressive neurologic deterioration or signs of herniation, it is likely that many of these patients unnecessarily received mannitol [26]. Similarly, 14% of patients received steroids for injury, despite steroids rarely being indicated in injury [27]. In addition, 185 (53%) of patients received antibiotic treatment. However only 27% of patients in the registry actually met a high risk criteria which necessitated antibiotic prophylaxis (puncture wounds, crush injuries, grossly contaminated, open fracture, bite wounds, or wounds with at least 18 h delay to presentation) [28]. It is not clear how prevalent these practice patterns are in the Masindi region or Uganda as a whole, but it is reasonable to conclude that over-prescription of these types of medications is likely common in areas where clinicians have limited specialized training in emergency and trauma care.

Although a broad case definition of injury was used in order to include as many subjects as possible, it is likely that some patients with minor injuries were not recorded in the registry. The paper-based registry used in this study requires extra effort from providers to fill out the trauma registry forms, potentially underestimating the total number of injured patients. Retrospective review of admission records identified an additional 30 patients which suggests at least 30% of admitted injury patients were not included in the original registry. Assuming a similar percentage of discharged and transferred injury patients were not included in the registry, we estimate 96 total missing patients, which would align with our original anticipated n of 400 based on MKMC's census in previous years.

The inclusion of thirty patients discovered during retrospective review may have caused an overestimation in the number of admitted and more severely injured patients, given the same type of retrospective chart review was not able to be undertaken for non-admitted injury patients. In addition, patients that presented to MKMC after hours were more likely to be admitted, regardless of severity of injury. This frequently occurred when a clinician would not be available until morning but the patient, while stable, could benefit from a procedure or imaging study.

Data collected from a single center, non-governmental hospital may not be representative of injury patterns at other hospitals in the district. Given the frequent and often lengthy delays to presentation that many patients experience in this setting, it is also likely that injury patients are dying prior to reaching MKMC or other area healthcare facilities. These out of hospital deaths are an inherent limitation of most trauma registries and limit the utility of extrapolation of mortality data from trauma registries like the one presented here.

Of the trauma registry forms missing data variables, the systolic blood pressure (67 measurements) was most commonly excluded, and in 76.3% of these cases was not recorded in patients under 5 years old.

A limited availability of pediatric blood pressure cuffs played a role in this deficiency, and clinical staff may also have placed a lower priority on obtaining blood pressures in young children. Incomplete forms are not unique to this registry, as the most common challenge in implementing trauma registries in LMICs is related to data quality, especially incomplete or inaccurate records [29].

Conclusions

LMICs face a disproportionately high burden of disease due to injuries. Implementing a trauma registry and evaluating injury patterns presenting to a rural hospital in Masindi, Uganda, revealed that RTIs were the leading cause of trauma, with motorcycle crashes comprising the predominant mechanism of injury. A high proportion of pediatric and pregnant patients were affected by injury. Most delays in seeking care were significant with an average of 11 h and most delays were secondary to lack of transportation. Patients presenting with RTI and head injury had lower M-KTS scores and were more severely injured. These findings highlight the need for helmet use and enforcement, increased access to specialized neurosurgical services, and the demand for improved pre-hospital care and transport.

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Dissemination of results

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Authors' contribution

Authors contributed as follows 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: HB and JS contributed 35% each; and CB, VT and AW contributed 10% each. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of competing interest

The authors declare no conflict of interest.

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