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Abbreviated paper

Cross-sectional survey of treatments and outcomes among injured adult patients in Kigali, Rwanda

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ABSTRACT

Introduction: Traumatic injuries and their resulting mortality and disability impose a disproportionate burden on sub-Saharan countries like Rwanda. An important facet of addressing injury burdens is to comprehend injury patterns and aetiologies of trauma. This study is a cross-sectional analysis of injuries, treatments and outcomes at the University Teaching Hospital-Kigali (CHUK).

Methods: A random sample of Emergency Centre (EC) injury patients presenting during August 2015 through July 2016 was accrued. Patients were excluded if they had non-traumatic illness. Data included demographics, clinical presentation, injury type(s), mechanism of injury, and EC disposition. Descriptive statics were utilised to explore characteristics of the population.

Results: A random sample of 786 trauma patients met inclusion criteria and were analysed. The median age was 28 (IQR 6–50) years and 69.4% were male. Of all trauma patients 49.4% presented secondary to road traffic injuries (RTIs), 23.9% due to falls, 10.9% due to penetrating trauma. Craniofacial trauma was the most frequent traumatic injury location at 36.3%. Lower limb trauma and upper limb trauma constituted 35.8% and 27.1% of all injuries. Admission was required in 68.2% of cases, 23.3% were admitted to the orthopaedic service with the second highest admission to the surgical service (19.2%). Of those admitted to the hospital, the median LOS was 6 days (IQR 3–14), in the subset of patients requiring operative intervention, the median LOS was also 6 days (IQR 3–16). Death occurred in 5.5% of admitted patients in the hospital.

Conclusion: The traumatic injury burden is borne more proportionally by young males in Kigali, Rwanda. Blunt trauma accounts for a majority of trauma patient presentations; of these RTIs constitute nearly half the injury mechanisms. These findings suggest that this population has substantial injury burdens and prevention and care interventions focused in this demographic group could provide positive impacts in the study setting.

African relevance

- One of the key steps to addressing injury related burdens is understanding gaps in healthcare delivery for these patients.
- Higher admissions among younger, male patients indicates substantial trauma burden among economically productive members.
- Improving the capture of key interventions and patient demographic metrics in a standardized trauma registry is critical.

Introduction

Huge gaps in trauma capacity in low- and middle-income countries (LMICs) result in a tremendous loss of life and a substantial reduction in the quality of life of trauma survivors [1]. The healthcare system in Rwanda, a World Bank categorized LMIC in Sub-Saharan Africa, is affected by the burden of injuries due to both high morbidity and mortality rates [2]. Blunt injury remains the most common mechanism of injury in sub-Saharan countries such as Rwanda, with the leading

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cause being road traffic injuries (RTIs) specifically affecting young males [3]. Prior research from the University Teaching Hospital-Kigali (CHUK) has demonstrated that the burden of traumatic injuries is nearly equivalent to other emergent presentations with each composing approximately 50% of emergency care arrivals [4].

There exists limited injury data in the form of trauma registries from LMICs [5] where uncovering injury characteristics, health resource needs and outcomes, would be of the utmost benefit. An important initial facet to addressing injury related health burdens is to understand the patterns and aetiologies of injury, this study is a cross-sectional survey of injuries, treatments, and outcomes at CHUK, the primary trauma receiving center in Rwanda.

Methods

This study is a pre-specified secondary analysis of a retrospective chart review that was conducted at CHUK in Kigali, Rwanda. CHUK is an urban, tertiary-care teaching hospital that is the primary trauma receiving center in Kigali providing comprehensive care for adult, paediatric, and pregnant patients with acute injuries. For the retrospective chart review which examined the impact of emergency medicine training on mortality, patients were eligible for inclusion if they arrived at the CHUK Emergency Centre (EC) during the study period from August 2015 through July 2016 and had identifiable medical records and EC record documentation for the encounter of interest. All trauma patients seeking care with documentation of emergency care during the specified study period were included in this secondary analysis; patients arriving for non-traumatic illness were not included in this secondary analysis. Research activities were approved by the CHUK Ethics Committee and the Lifespan (Rhode Island Hospital) Institutional Review Board.

A validated data acquisition approach was used to query the hospital database to identify a random sample of EC trauma patients presenting for care [4,6]. A multipoint composite index was generated from the electronic hospital database and used to identify all EC cases during each month of the accruement period. All cases were subsequently coded with a unique identification number and were sampled at random until a sufficient number of records meeting inclusion criteria were identified (range: 130–160 records per month). Trained personnel utilised a standardised data collection instrument to review archived paper hospital records and abstracted data for entry into a secure, password-protected web-based electronic data management application, REDCap™. Cases were identified for inclusion primarily by a Rwandan research physician with a second reviewer adjudicating for consensus in case of uncertainties. Collected data included demographics, clinical presentation, injury type (s), mechanism of injury (MOI), surgical interventions, length of stay (LOS), and EC disposition. Descriptive statics were utilised to explore characteristics of the population. STATA version 15.0 (StataCorp; College Station, USA). Categorical variables were described using frequencies with associated percentages, while continuous variables were summarised using median values with interquartile ranges (IQR).

Results

The database query generated 22,117 unique encounters between August 2015 and July 2016, of which 4620 cases were randomly selected and screened. 2963 cases did not have identifiable medical records or lacked proper documentation. Of the 1657 EC cases, 786 trauma patients were analysed. The median age of trauma patients was 28 (IQR: 6–50) years and the majority of patients, 69.4%, were male (Table 1). Patients <15 years of age accounted for nearly one-fifth of the trauma patients at 21.6% and patients >65 years of age accounted for 5.1% of the trauma encounters. A majority of patients, 86.1% of the study patients had a GCS of 13–15, and 4.6% of trauma patients had GCS of below 8 (Table 1).

Table 1
UTH-K EC trauma population characteristics (n = 786).

Age (years)	
Overall, median IQR	28 (6–50)
0–5 years	56 (7.2%)
6–15 years	120 (15.4%)
16–45 years	461 (58.7%)
46–65 years	105 (13.4%)
>65 years	40 (5.4%)
Gender	
Male	544 (69.4%)
Female	240 (30.6%)
Vital signs, median (IQR)	
Heart rate	87 (75–102)
Respiratory rate	20 (18–20)
Systolic blood pressure	122 (110–134)
Glasgow Coma Score	
3–8	24 (3.1%)
9–12	48 (6.1%)
13–15	447 (56.9%)
Unknown	267 (33.9%)
Mechanism of Injury	
Road Traffic injury	388 (49.4%)
Fall	188 (23.9%)
Penetrating trauma	86 (10.9%)
Burns	38 (4.8%)
Blunt trauma	18 (2.3%)

Road traffic injuries (RTIs) constituted 49.4% of traumatic injury aetiology and were the most common MOI followed by falls (23.9%) and penetrating trauma (10.9%) (Table 1). The most frequent types of injuries were fractures (46.2%) followed by contusion/bruising (10.1%), and dislocation (5.1%). Among trauma patients, resuscitation with EC blood product transfusions was utilised for 3.9% of patients and 31.4% were resuscitated with crystalloid transfusions (Table 2).

The LOS in the ED for admitted and discharged trauma patients was one (IQR 0–2) and one (IQR 0–2) days, respectively (Table 2). Among our study population 53.6% required hospital admission, with 43.7% admitted to an orthopaedic service and 36.0% to another surgical service (Table 3). Among admitted patients, 36.6% required intubation during their hospital course and 9.3% ICU admission during their inpatient care period. Of those admitted to the hospital, the median LOS was six days (IQR 3–14), in the subset of patients requiring operative

Table 2
UTH-K ED Utilisation and Outcomes (N = 786).

Fluid resuscitation	
Blood products	31 (3.9%)
Crystalloid	247 (31.4%)
No IV fluids or blood products	463 (58.9%)
Imaging performed	582 (74.1%)
Laboratory testing	458 (58.4%)
Specialty consultations	548 (69.8%)
Acute care surgery	181 (33.1%)
Neurosurgery	110 (22.1%)
Orthopaedics	243 (44.4%)
EC interventions	
Cervical spine immobilisation	79 (10.1%)
Splinting and traction	197 (25.1%)
Haemorrhage control	104 (13.2%)
Thoracostomy	20 (2.5%)
Local wound care	218 (27.7%)
EC length of stay in days, median (IQR)	
Admitted trauma patients	1 (IQR 0–2)
Discharged trauma patients	1 (IQR 0–2)
EC disposition	
Died in the hospital	20 (2.54%)
Admitted to hospital	421 (53.6%)
Discharged from hospital	178 (22.6%)

Table 3
UTH-K inpatient utilisation ($N = 421$).

Admission wards	
Orthopaedics	183 (43.7%)
Surgery	151 (36.0%)
Neurosurgery	59 (14.1%)
Intensive Care Unit	19 (4.5%)
Hospital intervention	
Open reduction	99 (23.5%)
Closed reduction with external fixation	57 (13.5%)
Wound debridement	48 (11.4%)
Craniotomy	35 (8.31%)
Laparotomy	24 (5.70%)
Hospital length of stay in days, median (IQR)	
All admitted patients	6 days (IQR 3–14)
Requiring operative management	6 days (IQR 3–16)
Inpatient disposition	
Died in hospital	23 (5.5%)
Transferred to a different health center	39 (9.2%)
Discharged	357 (84.8%)

intervention, the median LOS was also six days (IQR 3–16). Death occurred in 5.5% of admitted patients in the hospital, 9.3% were transferred to another facility and 84.8% were discharged home.

Discussion

Clinical data detailing the epidemiology, care and outcome due to injury is necessary for improved care delivery especially given the impacts of injuries in global health burdens. Similar to trends in prior studies in sub-Saharan Africa, our secondary analysis found that a large proportion of injuries were caused by blunt trauma such as RTIs and falls [7,8] and primarily in young males [7–9]. The rate of penetrating trauma in our patient population in Kigali, Rwanda is also similar to prior studies [7] and much lower than that of other sub-Saharan countries [9,10] indicating that trauma care resources in Rwanda should place a special focus on the rapid stabilisation of blunt trauma patients. We found a high rate of hospital admission in our secondary analysis [8,9] than reported by in other studies examining data from trauma registries, including a prior one examining data from Kigali, Rwanda [7,10]. The higher rate of hospital admissions points to a substantial trauma burden among the younger, male patient population thereby overwhelmingly affecting economically productive members of Rwandan society. Obtaining granular data to better direct hospital resources and planning, for example standardised blood bank transfusion protocols and standardised clinical trauma pathways, could provide positive clinical benefits towards the care of this important sociodemographic group. Improving the capture of key intervention and patient demographic metrics in the form of a trauma registry and standardizing documentation for trauma patients is critical for measuring the impact of interventions and quality of care being provided to trauma patients at CHUK.

Strengthening of local trauma care capacity remains a key solution particularly in ECs where the initial resuscitation, imaging, and procedural interventions for trauma patients occur and where a cohesive trauma care team and management guidelines can be especially crucial. Given that CHUK functions as a primary trauma receiving hospital, the increased complexity of trauma care being provided to patients here is consistent with its advanced trauma care designation. Future studies should examine trauma care staffing patterns as well as patient arrival times within the CHUK EC so as to supplement staff and resources during times of high patient volume or high patient acuity arrival. The feasibility of implementing a trauma registry that will allow unprecedented opportunities for the evaluation of trauma patient outcomes at CHUK should also be examined.

There are several limitations of this study. As the secondary analysis relied on data collected during a retrospective chart review, missing data and incomplete patient charts remains an issue and the quality of the chart review is affected by the thoroughness of the information recorded by the hospital providers. We sought to minimise any inconsistencies by utilising a standardised instrument for data abstraction as well as trained personnel however accurate charting and documentation remain a significant challenge and could certainly have affected the quality of the data. In particular, this may have skewed data analysis away from the sickest patients who may be unable to cooperate fully with physical examination or history or provide socio-demographic information. In addition, this data only represents pattern of traumatic injury within Kigali at a dedicated trauma center and cannot conclusively be extrapolated to hospitals outside of Kigali, as well as to more rural parts of Rwanda, which may not have the sub-specialist or interventional capabilities available.

In our cross-sectional survey, we note that traumatic injury burden is borne more proportionally by the economically significant population of young males in Kigali, Rwanda and that they tend to be sicker, requiring increased trauma care and hospital resource utilisation such as surgical interventions and intensive care unit placement. These findings suggest that the trauma population studied in our setting have significant injury burdens and the crucial step of creating a trauma registry to standardise documentation and elucidate clinical outcomes of trauma patients along with supplementing trauma care staffing and implementing standardised care pathways is paramount.

Dissemination of results

Results from this study were presented in international conferences in South Korea and South Africa as well as a national conference in the United States in Philadelphia; both included an audience of emergency medicine and trauma specialist practitioners.

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CRediT authorship contribution statement

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: SB contributed 60%; JPN contributed 20%; and DLU, LM, SP, and ARA contributed 5% 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 declared no conflicts of interest.

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