Original Article

Patterns of Injury at Two University Teaching Hospitals in Rwanda: Baseline Injury Epidemiology Using the Rwanda Injury Registry

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ABSTRACT

Introduction: Globally, more worldwide deaths in 2010 could be attributed to injuries than the total number of deaths from infection with AIDS, tuberculosis, and malaria combined, with a disproportionate number of these deaths occurring in low- and middle-income countries. Yet, worldwide research and plans for prevention of injuries are far below other world health problems, especially in developing countries.
Methods: A 31-item, 2-page registry form was adapted from regional trauma registries for use in Rwanda to collect data at the two main university referral hospitals in Kigali and Butare. Beginning in 2011, registrars recorded demographics, pre-hospital care, initial physiology, early interventions, and disposition of injured patients who met our selection criteria. Inpatient 30-day discharge status, mortality, and complications were abstracted from patient charts, ward reports and operating room logs. Descriptive analysis was used to evaluate patterns of injury and basic injury epidemiology at the two study hospitals from August 1, 2011-January 31, 2013.
Results: A total of 3599 patients were registered from August 1, 2011 to January 31, 2013. Patients were predominantly male, and road traffic crashes were the leading cause of injury overall, contributing to a greater proportion of injuries in the more urban capital than the smaller city of Butare. The majority of patients were admitted to the hospital. All variables evaluated except for the percentage of injuries acquired via a penetrating mechanism showed statistically significant differences at an alpha significance level of 0.05, illustrating that the trauma population presenting at the two hospitals may be quite different.
Conclusion: The Rwanda Injury Registry indicates a high burden of road traffic injuries in a predominantly working age male population over an eighteen-month period. This information can be useful in expanding injury surveillance programs and hopefully implementing population-based prevention programs.

Keywords: injuries - injury registry - trauma registry - outcomes, patterns - road traffic crashes - road traffic accident

INTRODUCTION

Injuries can be defined as physical damage inflicted by a transfer of energy, or by the sudden loss of heat activity or oxygen. Injuries are categorized according to the underlying intent. They can be unintentional, which includes road-traffic accidents, falls, drownings, burns, and poisonings. Or, injuries can be intentional, which includes those caused by self-harm, interpersonal violence and conflict [1].
Throughout the world in 2010, there were 5.1 million deaths from injuries alone, which is greater than the total number of deaths from infection with AIDS, tuberculosis, and malaria combined. 89% of these deaths from injury occurred in low- and middle-income countries, showing that these countries are disproportionately affected. In addition, males are more frequently affected than females, with males accounting for about 68% of all injury-related deaths in 2010 [1].
Injuries from road traffic accidents cause a significant burden in all countries of the world, but in low- and middle- income countries the burden is the greatest [1]. According to the World Health Organization, it is predicted that by 2020, road traffic injuries will rank third highest in the causes of disability adjusted life years (DALYs) lost. Africa has the highest rate of mortality from road traffic injury where it is 28.3 per 100,000 people. This is compared to Europe where the mortality from road traffic injury is 11.0 per 100,000 [2]. Despite this data, unfortunately worldwide research and plans for prevention of injuries are far below other world health problems, especially in developing countries [3].
Rwanda has a history of having one of the worst road-safety records, not only in Africa, but also amongst the rest of the world. However, in the country's efforts to recover from the trauma inflicted by the genocide of 1994, safety and prevention have come to the forefront of the government and have won international acclaim [4]. Despite the increased attention given to safety measures, and the improved access to medical care, the morbidity and mortality due to road traffic injuries continues to have negative impacts on the country by impeding socio-economic development [5]. Thus, further investigation describing mechanisms of injury must be implemented in order to allow the development of further injury prevention methods.

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METHODS

Study Design

A 31-item, 2-page registry form was adapted from regional trauma registries for use in Rwanda at the two university teaching hospitals in the country. Following a one-month training and initiation period, formal data collection began in March 2011 at the Centre Hospitalier Universitaire Kigali (CHUK) and July 2011 at the Centre Hospitalier Universitaire

Butare (CHUB). Demographics, pre-hospital care, initial physiology, early interventions, and disposition were recorded on paper forms in the emergency department by a nurse registrar for all patients who met the selection criteria. A trained data manager entered all data into a searchable, password-protected Microsoft Access 2010 database (Microsoft Corporation, Santa Rosa, CA). Inpatient 30-day discharge status, mortality, and complications were abstracted from patient charts, ward reports and operating room logs.

Patient Selection

Patients presenting to the Accident and Emergency Department (A&E) at CHUK or CHUB following an injury who meet the following selection criteria are entered into the prospective injury registry. Criteria include:
1) Any injured patient who is transferred from a district hospital for evaluation of their injury
2) Any injured patient who dies in A&E from their injury
3) Any injured patient who is admitted to the hospital (defined as in-patient hospitalization or A&E stay of >24 hours)

Patients who present from home, a local health centre or the accident scene for a minor injury and are treated in an outpatient fashion and sent home within 24 hours are excluded due to budget constraints, logistical concerns, and limited registrar staffing.

Data Analysis

Data were exported from the Microsoft Access database and analyzed using SAS 9.3 (SAS Institute, Inc, Cary, NC). All data extracted for statistical analyses were de-identified. Validated trauma scoring systems such as the Injury Severity Score and the Kampala Trauma Score [6] were calculated from clinical data collected at admission and used to control for injury severity. Descriptive analysis was used to evaluate patterns of injury and basic injury epidemiology at the two study hospitals from August 1, 2011-January 31, 2013. Dates were chosen starting after the start of data collection in Butare in order to provide the most comprehensive data since initial implementation of the registry at both hospitals. Univariate analysis was conducted to compare the basic demographics, physiologic parameters, and cause of injury between the two hospitals.

RESULTS

A total of 3599 patients were registered from August 1, 2011 to January 31, 2013 with 2060 at CHUK and 1539 at CHUB. Patients were predominantly male (75%, n=2683) and young, with a mean age of 31.0 (IQR 17-43). Males comprised 77% of the injured population (n=1584) with a mean age of 30 (IQR 18-39) at CHUK and 71% of patients (n=1099) with a mean age of 33 (IQR 15-49) at CHUB. Figure 1 depicts the overall age distribution of patients in the registry, evaluated as a percentage of all trauma registry patients at CHUK, CHUB, and both hospitals combined, respectively.

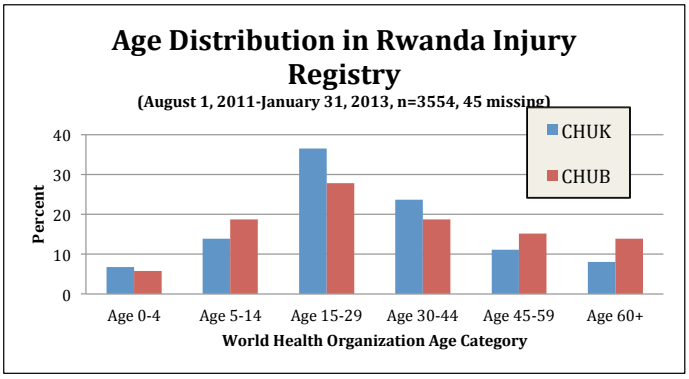

Figure 1

Figure 2 illustrates the causes of injury at both hospitals and overall. Road traffic crashes were the leading cause overall (46%), contributing to a greater proportion of injuries in the more urban capital, CHUK (53%), than the smaller city of Butare, CHUB (36%). Falls were the leading cause of injury at CHUB (41%) and the second leading cause at CHUK (22%) and overall (30%). Blunt force injuries contributed to just over 12% of injuries overall, as well as at CHUK and CHUB individually. Burn injuries (including fire and scald injuries) caused less than 5% of injuries in all categories. Penetrating injuries (inflicted via a sharp instrument such as a knife or machete or via gunshot) contributed to only 3% (n=117) of all injuries (3%, n=62 at CHUK; 4%, n=55 at CHUB).

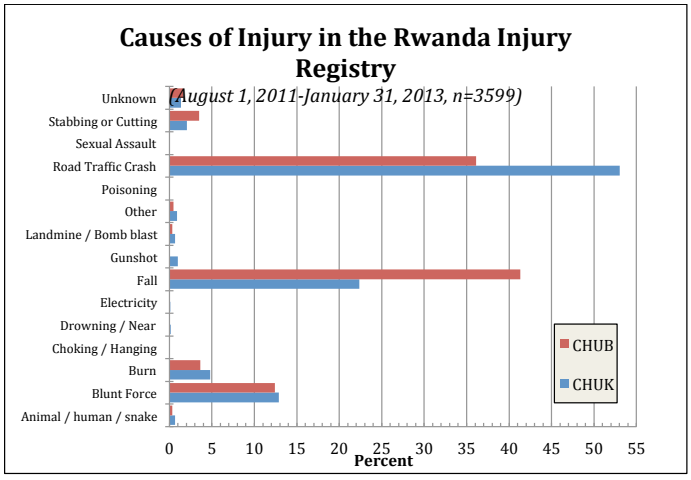

Figure 3 depicts the disposition (or destination) from the emergency department after initial evaluation for patients who met criteria for inclusion. For the full cohort of patients at both hospitals, the majority of patients (62%, n=2254) were admitted to the hospital, with 20% (n=721) going directly to the operating room. Nearly a quarter (24%, n=857) were treated in the emergency department and sent home. Figure 4 depicts the differences in disposition between CHUK and CHUB, highlighting a higher admission rate and referral rate at CHUB and a larger relative mortality and discharge from emergency at CHUK.

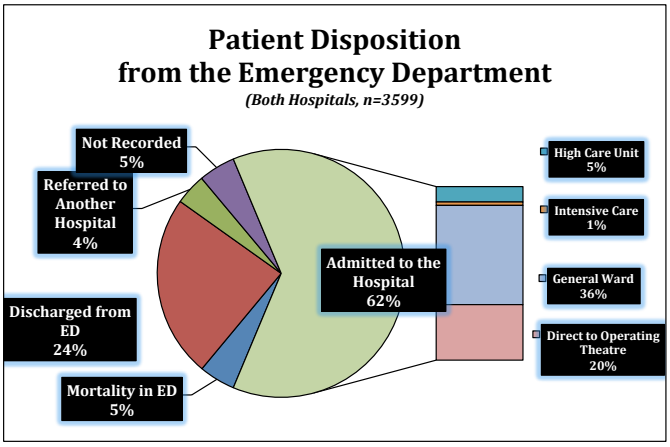

Figure 4.

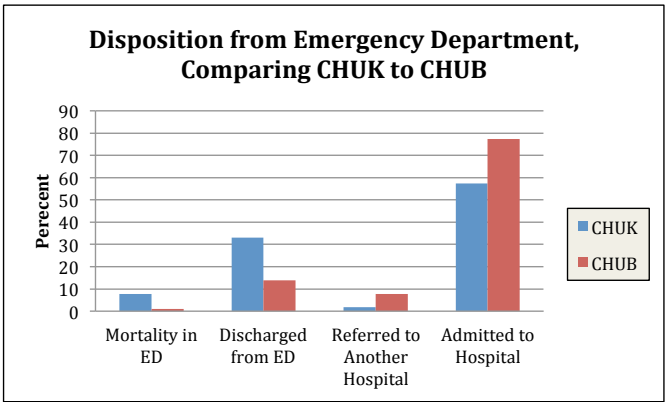

Table 1 compares some of the baseline injury epidemiology between CHUK and CHUB. All variables evaluated except for the percentage of injuries acquired via a penetrating mechanism showed statistically significant differences at an alpha significance level of 0.05, illustrating that the trauma population presenting at the two hospitals may be quite different. While it may be difficult to evaluate the clinical significance of the differences in the continuous variables (Age, Systolic Blood Pressure (SBP), Pulse, Glasgow Coma Score (GCS), Revised Trauma Score (RTS), and Kampala Trauma Score (KTS)), the results highlight a significantly higher proportion of severely injured patients, represented by those with an initial GCS of 3-8, at CHUK (9.76% vs. 3.25%) with an odds ratio (OR) of 3.22 (95% CI 2.34-4.42). As has been previously noted, road traffic crashes contributed to a significantly larger proportion of the injuries at CHUK, suggesting potentially different transfer patterns and acuity of injury.

Table 1. Comparing Injury Epidemiology at CHUK and CHUB

Variable	CHUB (n=1539)	CHUK (n=2060)	p-value	Odds Ratio (95% CI)
Gender (% Male (n))	71.41% (1099)	76.97% (1584)	0.0002	1.34 (1.15-1.56)
Age (Mean (SE))	32.5 (0.6)	29.9 (0.4)	0.01	
Pediatric (% (n))	29.50% (454)	26.21% (540)	0.029	0.85 (0.73-0.98)
Physiologic Parameters at Admission				
SBP (Mean (SE))	123.3 (0.5)	121.9 (0.5)	0.003	
Pulse (Mean (SE))	86.0 (0.5)	88.9 (0.6)	0.008	
GCS (Mean (SE))	14.5 (0.05)	13.5 (0.07)	<0.0001	
RTS (Mean (SE))	7.6 (0.03)	7.4 (0.02)	<0.0001	
KTS (Mean (SE))	13.3 (0.03)	13.9 (0.03)	<0.0001	
GCS 3-8 (% (n))	3.25% (50)	9.76% (201)	<0.0001	3.22 (2.34-4.42)
Cause of Injury				
Penetrating (% (n))	3.57% (55)	3.01% (62)	0.35	0.84 (0.58-1.22)
Road Traffic (% (n))	36.13% (556)	53.01% (1092)	<0.0001	1.99 (1.74-2.28)

** SBP = systolic blood pressure, GCS = Glasgow Coma Scale, RTS = Revised Trauma Score, KTS = Kampala Trauma Score*

DISCUSSION

Hospital-based trauma registries play an important role in informing the care of the injured patient by describing injury patterns and severity. The Rwanda Injury Registry indicates a high burden of road traffic injuries in a predominantly working age male population over an eighteen-month period. This information can be useful in expanding injury surveillance programs and hopefully implementing population-based prevention programs. Our results are consistent with previous studies in low-resource settings [7, 8]. Road traffic crashes contributed to 49% of injuries recorded in the trauma registry at Mulago Hospital in Kampala, Uganda from 2004-2005 [9]. The same authors further evaluated city mortuary data to create a comprehensive mortality database in 2007, concluding that 46% of deaths were secondary to road traffic crashes, with a similar distribution amongst working age males [10].

Yet, all trauma is not created equally. The significant differences found in patient demographics between the two hospitals illustrate that the trauma population presenting at each hospital may be quite different. The results highlight a significantly higher proportion of severely injured patients, represented by those with an initial GCS of 3-8, at CHUK (10% vs. 3%). This is likely due to the availability of a CT scanner and neurosurgical evaluation at CHUK, services not available at the time of the study at CHUB. As has been previously noted, road traffic crashes contributed to a significantly larger proportion of the injuries at CHUK, suggesting potentially different transfer patterns and acuity of injury. While serving as a nationwide referral center for trauma, the university hospital in Kigali also serves an urban population, and it is the primary hospital servicing the emergency response ambulances in the city.

Our results highlight a higher admission rate and referral rate at CHUB and a larger relative mortality and discharge from emergency at CHUK, perhaps secondary to the accessibility of emergency care for urban patients. Whereas the majority of patients at CHUB are triaged/transferred by district hospitals and thus have a high admission rate, there are two important factors to be considered at CHUK. Firstly, the District of Nyarugenge (one of the three districts in Kigali City) has no district hospital. CHUK plays the role of district hospital for the Nyarugenge district. Secondly, CHUK suffers a shortage of hospital beds. Many patients will not be admitted in the wards simply because there are no beds in the wards. This will increase the number of patients that are discharged from the Emergency because the Emergency needs space for new patients. Furthermore, CHUB does not have a formal emergency department whereas CHUK has several rooms of beds for patients admitted to the ED. Rather, CHUB has a triage room near the operating theatre, so patients are immediately received in the surgical or to the recovery room if there are severe traumatic brain injuries or other severe injuries. For CHUK, patients are held much longer in ED because of lack of slots on wards and this may partly explain the large number of discharges at the CHUK ED before admission as well as mortality in CHUK ED.

These considerations have important implications for policy implementation and overall health system strengthening. Given the responsibilities as a referral center but also

as a district hospital for Nyarugenge, it is also unclear whether a high burden of "walking wounded", i.e., those patients with minor injuries who are treated and sent home, at CHUK consume material and personnel resources that may limit the ability for district hospitals to transfer patients in a timely fashion. Our study found an emergency department discharge rate of 25% (33% CHUK vs. 14% CHUB), and our protocol excludes many of these "walking wounded" cases. This is mainly due to budget constraints, limited nurses available for data collection, and poor patient documentation of these walking wounded cases. This further limits the generalizability of our data to the overall population, and makes it important in the future to compare the data to other sources such as hospital logs and police records to create a more representative picture of the burden of injury in the community. Further studies are needed to correlate access, utilization, and efficacy of pre-hospital care systems to get a more comprehensive picture of trauma epidemiology in Rwanda.

Implementation of the Rwanda Injury Registry has additional limitations. The data collection relies on a small number of trained Rwandan nurses who record data while also having clinical responsibilities; they are not expected to sacrifice patient care to complete data collection. Therefore, they often collect data at the end of the day from patient files where documentation may be incomplete. An initial quality control audit of the trauma registry in July 2011 found that the registry was collecting approximately 80% of the patients who met criteria for inclusion when compared to handwritten emergency department logs of patient names, mechanism of injury, and diagnosis. Interestingly, several patients were recorded in the trauma registry who had no other hospital documentation. While this may indicate fraud, this is highly unlikely and more consistent with overall poor hospital systems for patient documentation. Similar findings of inconsistent documentation were found in Malawi and Tanzania when comparing trauma registry data to retrospective chart review [11, 12].

CONCLUSION

The Rwanda Injury Registry indicates a high burden of road traffic injuries in a predominantly working age male population over an eighteen-month period. This information can be useful in expanding injury surveillance programs and hopefully implementing population-based prevention programs.

Conflicts of Interest: None

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Ethical Approval

Institutional approval to conduct this study was obtained from the University of Virginia HSR IRB and the Ethics Committee at the Centre Hospitalier Universitaire Kigali.

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