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Original article

Patterns of injury at an Ethiopian referral hospital: Using an institutional trauma registry to inform injury prevention and systems strengthening

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ABSTRACT

Background: Data about injury patterns and clinical outcomes are essential to address the burden of injury in low- and middle-income countries. Institutional trauma registries (ITRs) are a key tool for collecting epidemiologic data about injury. This study uses ITR data to describe the demographics and patterns of injury of trauma patients in Addis Ababa, Ethiopia in order to identify opportunities for injury prevention, systems strengthening and further research.

Methods: This is an analysis of prospectively collected data from a sustainable ITR at Menelik II Specialized Hospital, a public teaching hospital with trauma expertise. All patients presenting to the hospital with serious injuries requiring intervention or admission over a 13 month period were included. Univariable and bivariable analyses were performed for patient demographics and injury characteristics.

Results: A total of 854 patients with serious injuries were treated during the study period. Median age was 33 years and 74% were male. The most common mechanisms of injury were road traffic injuries (RTI) (37%), falls (30%) and blunt assault (17%). Over half of RTI victims were pedestrians. Median delay in presentation was 2 h; 17% of patients presented over 6 h after injury. 58% of patients were referred from another hospital or a clinic, and referrals accounted for 84% of patients arriving by ambulance. Median emergency center length of stay was 2 h and 62% of patients were discharged from the emergency center.

Conclusion: This study highlights the utility of institutional trauma registries in collecting crucial injury surveillance data. In Addis Ababa, road safety is an important target for injury prevention. Our findings suggest that the most severely injured patients may not be making it to the referral centers with the capacity to treat their injuries, thus efforts to improve prehospital care and triage are needed.

African relevance: Injury is a public health priority in Africa. Institutional trauma registries play a crucial role in efforts to improve trauma care by describing injury epidemiology to identify targets for injury prevention and systems strengthening efforts. In our context, pedestrian safety is a key target for injury prevention. Improving prehospital care and developing referral networks are goals for systems strengthening.

African relevance

- Injury is a public health priority in Africa.
- Institutional trauma registries play a crucial role in efforts to improve trauma care by describing injury epidemiology to identify targets for injury prevention and systems strengthening efforts.
- In our context, pedestrian safety is a key target for injury prevention.
- Improving prehospital care and developing referral networks are goals for systems strengthening.

Introduction

The World Health Organization's (WHO) Global Burden of Disease project estimates one billion injuries requiring healthcare annually worldwide [1]. Injury results in five million deaths per year, accounting

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for 11% of all disability-adjusted life years lost annually worldwide [2]. Over a third of these deaths could be prevented with improvements in trauma care in low- and middle-income countries (LMICs) [3,4]. Resource limitations, uncoordinated systems of care and a paucity of injury epidemiology data are formidable barriers to improving trauma care. Institutional trauma registries (ITRs), which longitudinally compile prospectively collected data about patient demographics, injury patterns and clinical interventions, have been a key research tool in several sub-Saharan African countries [5–8].

This study describes the process of establishing an ITR and reports on the epidemiology of trauma patients presenting to a public teaching hospital with trauma expertise in Addis Ababa, Ethiopia. These data help to identify opportunities for injury prevention, systems strengthening and further research in order to address the large unmet burden of trauma in our community.

This study was approved by the Addis Ababa University Institutional Review Board and the University of California San Francisco Committee on Human Research.

Methods

Ethiopia is a low-income country in East Africa with a population of 102 million, and 31% of the population living on less than $1.25/day [9,10]. Ethiopia ranks 169 out of 177 on the United Nations Human Development Index, with an annual per capita expenditure on health of $16 [11]. Addis Ababa is the nation's capital and the largest urban area in the country, with a population of 3.2 million [9].

Menelik II Specialized Hospital (MSH) is a public hospital in Addis Ababa affiliated with Addis Ababa University. With expertise in general surgery, orthopedics and neurosurgery, it serves as one of the three trauma referral centers in the city, providing specialized care to both patients presenting primarily and those referred from other hospitals and health centers in Addis Ababa and other regions of the country. Its emergency center (EC) is staffed around the clock by surgery and internal medicine housestaff.

This is an analysis of prospectively collected data from a sustainable ITR that was developed and implemented at MSH. Prior to this study, trauma surveillance data at MSH were collected informally without standardization or quality control. For this study, we developed a novel protocol using a specially designed trauma data form that included all elements of the Minimum Data Set being developed by the WHO Global Alliance for the Care of the Injured Trauma Data Working Group (Appendix 1). The form also included items of particular interest locally, such as granular data about the parties involved in road traffic injuries (RTI) and data about intoxication with alcohol and *khat*, a local stimulant drug of abuse that is widely believed to contribute to unsafe driving practices in Ethiopia [12]. The form extensively utilized check boxes to facilitate data collection and ensure consistency to simplify coding.

Forms were completed by surgical interns at the end of patients' EC stay, and data were compiled in a FileMaker Pro 13 database by an EC nurse with specialized research training. To quantify injury severity, we collected all data elements required to calculate the Kampala Trauma Score (KTS) [5], a novel injury scoring system that has been shown to discriminate mortality well in both low- and middle income country (LMIC) settings when the resources needed to collect comprehensive anatomic injury data are not available [13,14]. KTS assigns a score of 5–16, with scores ≤ 13 representing severe injuries [15]. Number of serious injuries was quantified retrospectively by the study team based on recorded ER diagnoses, including injuries to internal organs, orthopedic injuries and second and third degree burns. We excluded isolated soft tissue injuries, first degree burns, concussions, nasal bone fractures, and hand and foot injuries.

We piloted and revised the trauma data form iteratively, soliciting feedback on the form and protocol from supervising surgeons, housestaff and nursing staff. We also evaluated pilot data to identify data fields that were being excluded or inappropriately filled to optimize form clarity and ensure good data quality and completeness. For quality assurance following pilot implementation, we used the EC's patient logbook, which is maintained by the triage nurse, to identify missed patients and extracted data on their EC course by chart review. We also reviewed 5% of research forms against clinical charts on a monthly basis to ensure accurate data collection. The results of these quality assurance processes were used to refine the protocol and direct ongoing feedback to housestaff and the research nurse. We tracked project expenses, which may be of interest for other researchers.

Patient data were imported to Stata 13.1 for analysis. All patients presenting to MSH with serious injuries—defined as injuries requiring medical or surgical treatment or hospital admission—over the 13 month period from March 2015 to April 2016 were included in this analysis.

Univariable and bivariable descriptive analyses were performed to characterize patient demographics, injury mechanism and context, transfer status, injury severity, interventions performed in the EC, disposition from the EC, and clinical outcomes. Bivariable analyses were performed using Fisher's exact and chi-squared tests for categorical variables and Wilcoxon rank-sum tests for ordinal variables. Multivariable logistic regression was used to evaluate predictors of non-

Table 1
Patient characteristics of trauma patients presenting to Menelik II Specialized Hospital.

	All (n = 854)	Discharged (n = 512, 61.8%)	Non-discharged[a] (n = 316, 38.2%)	p-Value
Demographics				
Male sex, n (%)	618 (73.5)	255 (70.4)	245 (78.0)	**0.017**
Age in years, mean (SD)	37.2 ± 17.0	36.9 ± 16.5	37.5 ± 17.6	0.916
Region of residence, n (%)				
Addis Ababa	606 (73.2)	409 (81.2)	183 (60.8)	< **0.001**
Affar	2 (0.2)	1 (0.2)	1 (0.3)	0.608
Amhara	28 (3.4)	10 (2.0)	16 (5.3)	**0.010**
Oromia	184 (22.2)	83 (16.5)	91 (31.2)	< **0.001**
SNNPR	7 (0.9)	0 (0.0)	7 (2.3)	**0.001**
Abroad	1 (0.1)	1 (0.2)	0 (0.0)	1.000
Time in EC				
ER length of stay, median (IQR)	2 (2–4)	2 (2–3)	3 (2–6)	< **0.001**
> 6 h, n (%)	116 (15.0)	50 (10.4)	65 (22.6)	< **0.001**
> 24 h, n (%)	29 (3.7)	14 (2.9)	15 (5.2)	0.104

IQR: interquartile range; SNNPR: Southern Nations, Nationalities and People's Region; EC: emergency center.
The bolded p-values are those that are statistically significant (i.e. < 0.05)
[a] Non-discharged patients include those who were admitted to MSH, were referred to another hospital, died in the emergency center or left against medial advice.

Table 2
Injury mechanism of trauma patients presenting to Menelik II Specialized Hospital.

Injury mechanism, n (%)	All (n = 854)	Discharged (n = 512, 61.8%)	Non-discharged[a] (n = 316, 38.2%)	p-Value
GSW	10 (1.2)	2 (0.4)	8 (2.6)	**0.006**
RTI	306 (36.5)	165 (32.7)	130 (42.1)	**0.007**
Animal	7 (0.8)	2 (0.4)	5 (1.6)	0.112
Blunt assault	138 (16.5)	83 (16.5)	52 (16.8)	0.893
Burn	11 (1.3)	5 (1.0)	6 (1.9)	0.349
Fall	247 (29.5)	170 (33.7)	70 (22.7)	**0.001**
Machine	23 (2.7)	18 (3.6)	4 (1.3)	0.052
Other blunt	74 (8.8)	50 (9.9)	23 (7.4)	0.230
Other penetrating	22 (2.6)	9 (1.8)	11 (3.6)	0.113

GSW: gunshot wound; RTI: road traffic injury.
The bolded p-values are those that are statistically significant (i.e. < 0.05)
[a] Non-discharged patients include those who were admitted to MSH, were referred to another hospital, died in the emergency center or left against medial advice.

discharge from the EC, a composite outcome that included admission to MSH, transfer to another hospital, death in the EC or leaving the EC against medical advice. p-Values < 0.05 were considered statistically significant.

Results

A total of 854 patients with serious injuries were treated in MSH EC during the 13-month study period (Table 1). Sex was captured for 98.5% of patients, and of those 73.5% were male. Age was captured for 86.2% of patients, and of those median age was 33 years, with 4.6% pediatric (i.e. younger than 18 years) and 10.7% geriatric (65 years or older). There were no children younger than 10. Region of residence was captured for 97% of patients, and of those most patients lived in Addis Ababa (73.2%).

Emergency center disposition was captured for 97.0% of patients, and of those 61.8% were discharged, 30.7% were admitted to MSH, 5.0% were referred to another hospital for subspecialty care, 1.5% died in the EC and 1.1% left against medical advice. Of those who were admitted to MSH, 12.6% were taken directly to the operating room and 5.1% were admitted to the intensive care unit. Most referrals to other hospitals occurred due to lack of inpatient beds or surgical materials, or for evaluation by a subspecialist such as a plastic surgeon. Women and patients injured in Addis Ababa were significantly more likely to be discharged, even after controlling for injury severity and age group in multivariable logistic regression models.

Median EC length of stay was 2 h (IQR 2–4), with 15.0% of patients remaining in the EC for >6 h and 3.9% for >24 h. Median EC length of stay was higher for patients who were not discharged (3 vs. 2 h, p < 0.001), as was the proportion of patients with an EC length of stay > 6 h (22.6% vs. 10.4%, p < 0.001). Similarly, median EC length of stay was higher for patients with severe injuries (4 vs. 2 h, p = 0.003), as was the proportion of patients with an EC length of stay > 6 h (27.6% vs. 14.7%, p < 0.001).

Table 3
Types of road traffic injuries among trauma patients presenting to Menelik II Specialized Hospital.

Road traffic injury type, n (%)	All (n = 291)	Discharged (n = 158, 56.4%)	Non-discharged[a] (n = 122, 43.6%)	p-Value
Pedestrian	166 (57.0)	87 (54.0)	74 (46.0)	0.348
Car	56 (19.2)	25 (48.1)	27 (51.9)	0.178
Minibus	19 (6.5)	13 (72.2)	5 (27.8)	0.162
Bajaj	16 (5.5)	11 (68.8)	5 (31.3)	0.306
Truck	15 (5.2)	9 (60.0)	6 (40.0)	0.774
Motorcycle	10 (3.4)	7 (70.0)	3 (30.0)	0.378
Bicycle	6 (2.1)	3 (60.0)	2 (40.0)	0.871
Bus	3 (1.0)	3 (100.0)	0 (0.0)	0.126

[a] Non-discharged patients include those who were admitted to MSH, were referred to another hospital, died in the emergency center or left against medial advice.

Table 4
Injury characteristics of trauma patients presenting to Menelik II Specialized Hospital.

	All (n = 854)	Discharged (n = 512, 61.8%)	Non-discharged[a] (n = 316, 38.2%)	p-Value
Injury setting, n (%)				
Street	506 (59.6)	291 (57.3)	198 (62.9)	0.113
Private home	148 (17.4)	94 (18.5)	51 (16.2)	0.397
Workplace	110 (13.0)	71 (14.0)	36 (11.4)	0.291
Open spaces	47 (5.5)	34 (6.7)	11 (3.5)	**0.050**
Public places	22 (2.6)	15 (3.0)	7 (2.2)	0.351
Farm	16 (1.9)	3 (0.6)	12 (3.8)	**0.001**
Intent, n (%)				
Unintentional	661 (80.6)	408 (81.9)	232 (78.1)	0.189
IPV	155 (18.5)	86 (17.3)	62 (20.9)	0.206
Self-harm	7 (0.9)	4 (0.8)	3 (1.0)	0.763
Intoxicated, n (%)				
Alcohol	121 (14.3)	66 (13.0)	51 (16.3)	0.193
Khat	34 (4.0)	16 (3.2)	15 (4.8)	0.231
Injury severity, n (%)				
Severe (KTS ≤ 13)	34 (4.8)	3 (0.7)	30 (11.0)	<**0.001**

IPV: interpersonal violence; KTS: Kampala Trauma Score.
The bolded p-values are those that are statistically significant (i.e. < 0.05)
[a] Non-discharged patients include those who were admitted to MSH, were referred to another hospital, died in the emergency center or left against medial advice.

Injury mechanism was captured for 98.1% of patients, and of those the most common injury mechanisms were road traffic injury (RTI), fall and blunt assault (Table 2). Penetrating mechanisms including gunshot wounds (GSW), stabbings, lacerations and being bitten or gored by an animal accounted for 4.4% of injuries. Falls were significantly more common among females (43.8% vs. 23.9%, p < 0.001) and geriatric patients (50.0% vs. 28.2%, p < 0.001), while blunt assault was significantly more common among males (19.9% vs. 7.3%, p < 0.001). Victims of RTI and GSW were significantly less likely to be discharged, while victims of falls were significantly more likely to be discharged.

Among the patients injured in an RTI, details of the incident were captured for 95.1%, with the majority being injured as pedestrians struck by motor vehicles (56.7%) (Table 3). Most pedestrians were struck by cars (75.6%), followed by *minibuses* (12.1%) and buses or trucks (9.6%).

The setting in which the injury occurred was captured for 93.3% of patients, and of those, 59.6% were injured in the street, 17.4% in a private home, 13.0% in a workplace such as a factory or construction site (Table 4). Falls occurred most commonly in private homes (36.8%), in the street (36.0%) and in workplaces (15.8%). Blunt assaults occurred most commonly in the street (54.7%), in private homes (14.6%) and at workplaces (12.4%).

Injury intent was captured for 96.0% of patients, and of those 80.6% sustained unintentional injuries. Victims of interpersonal violence were more likely to be male (22.6% vs. 7.9%, p < 0.001) and adult (19.5% vs. 10.4%, p = 0.025). Intoxication with alcohol was reported or suspected in 14.3% of patients, including 32.1% of blunt assault victims and 12.5% of RTI victims. Intoxication with *khat* was reported or suspected in 4.0% of patients, including 10.5% of blunt assault victims and 3.6% of RTI victims. Victims of intentional injuries were significantly

Table 5
Prehospital characteristics of trauma patients presenting to Menelik II Specialized Hospital.

	All (n = 854)	Discharged (n = 512, 61.8%)	Non-discharged[a] (n = 316, 38.2%)	p-Value
Distance from site of injury to hospital, n (%)				
≤10 km	321 (60.7)	217 (69.1)	92 (46.9)	**<0.001**
11–100 km	159 (30.0)	78 (24.8)	76 (38.8)	**0.001**
>100 km	49 (9.3)	19 (6.1)	28 (14.3)	**0.002**
Time from injury to hospital arrival, n (%)				
≤1 h	298 (37.7)	180 (37.9)	107 (36.5)	0.702
1.5–6 h	362 (45.8)	233 (49.0)	121 (41.3)	**0.036**
>6 h	130 (16.5)	62 (13.0)	65 (22.2)	**0.001**
Means of EC arrival				
Taxi	352 (46.2)	244 (52.8)	99 (35.5)	**<0.001**
Ambulance	247 (32.4)	99 (21.4)	142 (50.9)	**<0.001**
Private car	113 (14.8)	76 (16.2)	32 (11.4)	0.069
On foot	46 (6.0)	40 (8.7)	6 (2.2)	**<0.001**
Police	4 (0.5)	4 (0.9)	0 (0.0)	0.303
Referral, n (%)				
None	353 (41.7)	255 (50.3)	87 (27.6)	**<0.001**
Health center	203 (24)	129 (25.4)	72 (22.9)	0.402
Private clinic	66 (8)	46 (9.1)	18 (5.7)	0.081
Public hospital	197 (23)	73 (12.4)	130 (41.3)	**<0.001**
Private hospital	21 (3)	12 (2.4)	6 (1.9)	0.660

The bolded p-values are those that are statistically significant (i.e. < 0.05)
[a] Non-discharged patients include those who were admitted to MSH, were referred to another hospital, died in the emergency center or left against medial advice.

more likely to be intoxicated with alcohol (38.0% vs. 8.6%, $p < 0.001$) or *khat* (12.2% vs. 2.0%, $p < 0.001$).

Sufficient data were available to calculate a KTS value to quantify injury severity for 83.1% of patients, and of those 4.8% were severely injured with KTS ≤ 13. Most severely injured patients were not discharged (90.9%) and non-discharged patients were significantly more likely to have severe injuries than discharged patients (11.0% vs. 0.7%, $p < 0.001$). Patients arriving by ambulance were more likely to be severely injured than others (11.2% vs. 2.1%, $p < 0.001$), and 72.7% of severely injured patients arrived by ambulance. RTI victims were more likely to be severely injured than those injured by other mechanisms (7.3% vs. 3.5%, $p = 0.02$), and geriatric patients were more likely to be severely injured than younger patients (12.7% vs. 3.8%, $p = 0.001$). When insufficient data were available to calculate KTS, the problem was missing age for 81.4% of patients, and only 9.1% were missing respiratory rate.

Estimated distance from the site of injury to MSH was captured for 61.9% of patients, and of those 60.7% were injured within 10 km of MSH, and 90.7% were injured within 100 km of MSH (Table 5). Patients injured closer to MSH were more likely to be discharged from the EC. 94.8% of patients were injured in their region of residence. Estimated time from injury to arrival at MSH was captured for 92.5% of patients. Median time from injury to arrival was 2 h, with 37.7% of patients arriving within 1 h and 83.5% arriving within 6 h of their injuries. Patients arriving over 6 h after their injuries were more likely to not be discharged (55.2% vs. 35.6%, $p = 0.001$).

Information about how patients arrived at MSH was captured for 89.2% of patients, and of those 46.2% arrived by taxi and 32.4% arrived by ambulance. Severely injured patients were more likely to arrive by ambulance (72.7% vs. 31.3%, $p < 0.001$), and patients arriving by ambulance were more likely to not be discharged from the EC (58.9% vs. 27.4%, $p < 0.001$).

Information about whether patients were referred from another healthcare setting was captured for 99.2% of patients, and of those 58.3% of patients were referred. Of the referred patients, 55.1% were referred from clinics and 44.9% were referred from other hospitals. Referrals from other healthcare settings accounted for 84.4% of ambulance arrivals. Referred patients were less likely to arrive at MSH within 1 h of injury (27.8% vs. 72.2%, $p < 0.001$) or within 6 h of injury (78.7% vs. 90.4%, $p < 0.001$).

Of patients who were not referred, 51.9% arrived within 1 h of their injuries and 90.4% arrived within 6 h. Referred patients were more likely to not be discharged (25.4% vs. 47.5%, $p < 0.001$), especially those referred from private hospitals (66.3%). 84.0% of referrals occurred within Addis, with only 5.8% of referred patients traveling over 100 km for referrals.

In a multivariable logistic regression model, robust predictors of non-discharge included severe injury (OR 12.68, $p < 0.001$, 95% CI 3.66–43.96), penetrating injury mechanism (OR 3.22, $p = 0.009$, CI 95% 1.34–7.70), arrival to MSH by ambulance (OR 2.57, $p < 0.001$, 95% CI 1.73–3.81), EC arrival over 6 h from the time of injury (OR 1.86, $p = 0.011$, 95% CI 1.16–2.99), referral from another healthcare setting (OR 1.52, $p = 0.039$, 95% CI 1.02–2.27) and RTI injury mechanism (OR 1.48, $p = 0.046$, 95% CI 1.01–2.19).

Developing, piloting and implementing the ITR and collecting data for 13 months cost a total of $1400 USD, including costs of a computer, an external hard drive for data backup, and photocopying forms, as well as salary for the research nurse. We estimated ongoing annual cost of $900 USD to sustain the project.

Discussion

This study used prospectively collected injury surveillance data from a sustainable ITR to provide an in-depth picture of the epidemiology of injury treated at MSH in Addis Ababa, Ethiopia. These findings can guide future injury prevention strategies and systems strengthening efforts.

ITRs facilitate analysis of trends in injury patterns over time, comparisons between different institutions, and evaluation of the impact of public health interventions. ITRs have been used throughout sub-Saharan Africa, though there has been significant heterogeneity in data collection protocols and the types of data that are incorporated [16,17]. This particular ITR protocol resulted in a high capture rate with good data completeness with cost that was feasible to sustain in our setting. We believe our high capture rate was the result of developing a protocol that was well-suited for our practice environment with input from local clinicians, supplemented by retrospective extraction of data from clinical charts on the rare occasion that patients did not have a trauma data form completed at the end of their ER stay. By soliciting input from local clinicians in designing our ITR protocol, we were also able to collect a nuanced dataset addressing several topics of local public health interest.

The majority of trauma patients treated at MSH are young adult men who are often economically productive members of their families and communities, highlighting the potential social and economic impact of injury beyond the individual level [18]. RTI accounts for a substantial portion of the burden of injury treated in our EC, and RTI victims were especially likely to have severe injuries and to not be discharged from the EC.

The high burden of RTI has been reported throughout in Ethiopia, as summarized in a recent meta-analysis of studies of injury epidemiology in Ethiopia by Endalamaw et al. that found RTI accounted for 32% of all injuries treated in hospitals [19]. RTI is similarly prevalent in ITR-based studies of injury epidemiology by Tyson et al. in Malawi [20], Chichom-Mefire et al. in Cameroon [21] and Botchey et al. in Kenya [22].

Our study is unique in capturing data about both parties involved in collision and highlighting the prevalence of injuries sustained by pedestrians struck by motor vehicles. Efforts to improve road safety for both pedestrians and motorists are an important focus for injury prevention efforts in the area.

In this study, 32% of trauma patients arrived in the MSH EC by ambulance, which is notably higher than the 20% reported in a study of emergency patients in Addis Ababa hospitals recently reported by

Sultan et al. [23]. Most trauma patients arriving in the MSH EC by ambulance were transported from other healthcare settings where they may have received resuscitation, not directly from the scene of injury. Laeke et al. reported a similar trend among patients with head injuries in Addis Ababa [24]. We found that patients arriving by ambulance were more likely to be severely injured and to not be discharged. This contrasts with the finding by Abebe et al. that for RTI victims in Adids Ababa, ambulances were primarily used to transport low-acuity referral patients [25]. Referrals accounted for 58% of all trauma patients cared for in the MSH EC and 84% of those arriving by ambulance. Sultan et al. found that both increasing ambulance availability and educating the public about EMS resources were necessary to improve prehospital trauma care in Addis Ababa [23].

Emergency medical services remain in their infancy in our Addis Ababa, and many patients initially present to medical centers without the capacity to care for trauma patients, delaying definitive care. Similar challenges due to limited prehospital care have been noted in ITR studies by Hamadani et al. in Mozambique [26] and Ibrahim et al. in Nigeria [27]. Improved EMS services throughout sub-Saharan Africa may help to ensure that patients receive appropriate triage and prehospital resuscitation.

Alcohol or *khat* intoxication contributed to 13% of RTI and 39% of intentional injuries. Although intoxication is not reported in many retrospective reports on injury epidemiology in Ethiopia, one study by Bulto et al. from Dire Dawa in eastern Ethiopia also found that alcohol and *khat* were common risk factors for injury [28]. Public education about the risks of intoxication may be an effective target for injury prevention efforts.

Some limitations are inherent in our single center dataset and clinician-driven data collection methodology. Referral patterns often reflect institutional expertise, so some trauma subgroups such as children and burn victims are more likely to be seen at other hospitals in Addis Ababa [29,30]. We relied on self-reported injury data from patients and their companions, and we may have missed data about injuries diagnosed later in patients' clinical courses. The “number of serious injuries” used to calculate KTS was determined retrospectively based on recorded EC diagnoses, as opposed to prospectively by the treating provider in the EC as was done by Kobusingye and Lett when validating KTS [5], which may be a source of misclassification bias. Finally, we were unable to collect data on the hospital courses of patients admitted from the EC or long-term outcomes in this initial dataset.

Of note, patients who died before reaching our hospital were not including in this analysis, so the most severely injured patients in the community were likely not captured here, which may result in a distorted picture of injury epidemiology. For example, verbal autopsy study found drowning to be the leading cause of injury mortality in Ethiopia, hinting that drowning patients are more likely to die in the prehospital setting [31].

Future studies should address prehospital care, hospital courses and long-term outcomes of trauma patients. Analyzing data on mortality and functional outcomes in light of injury severity would also allow for comparison of expected to observed outcomes, which is useful for performance improvement efforts. A regional trauma registry that compiles data from the numerous medical centers where trauma patients receive care would also be invaluable.

Conclusions

While injury is a major public health concern worldwide, it is important to understand local patterns of injury to guide injury prevention strategies and systems strengthening efforts. This study highlights the utility of institutional trauma registries in collecting crucial injury surveillance data in sub-Saharan Africa. In Addis Ababa, road safety is a key target for injury prevention and efforts to improve prehospital care and our referral system are needed.

Dissemination of results

Results from this study were shared with staff members in the Menelik II Specialized Hospital Department of Surgery, who runs its trauma service in the EC. An early analysis of this data was presented at the Society of Academic Emergency Medicine's 16th Annual Meeting in New Orleans, LA, USA on May 12, 2016.

Authors' contribution

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: ADL contributed 50%; NS and SK 15% each; CJJ and RAD 10% each. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Conflicts of interest

The authors declared no conflicts of interest.

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Appendix A. Supplementary data

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