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Patterns of Injury and Violence in Yaoundé Cameroon: An Analysis of Hospital Data

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Abstract

Background Injuries are quickly becoming a leading cause of death globally, disproportionately affecting sub-Saharan Africa, where reports on the epidemiology of injuries are extremely limited. Reports on the patterns and frequency of injuries are available from Cameroon are also scarce. This study explores the patterns of trauma seen at the emergency ward of the busiest trauma center in Cameroon's capital city.

Materials and methods Administrative records from January 1, 2007, through December 31, 2007, were retrospectively reviewed; information on age, gender, mechanism of injury, and outcome was abstracted for all trauma patients presenting to the emergency ward. Univariate analysis was performed to assess patterns of injuries in terms of mechanism, date, age, and gender. Bivariate analysis was used to explore potential relationships between demographic variables and mechanism of injury.

Results A total of 6,234 injured people were seen at the Central Hospital of Yaoundé's emergency ward during the year 2007. Males comprised 71% of those injured, and the mean age of injured patients was 29 years (SD = 14.9). Nearly 60% of the injuries were due to road traffic accidents, 46% of which involved a pedestrian. Intentional injuries were the second most common mechanism of injury (22.5%), 55% of which involved unarmed assault. Patients injured in falls were more likely to be admitted to the hospital ($p < 0.001$), whereas patients suffering intentional injuries and bites were less likely to be hospitalized ($p < 0.001$). Males were significantly more likely to be admitted than females ($p < 0.001$)

Discussion Patterns in terms of age, gender, and mechanism of injury are similar to reports from other countries from the same geographic region, but the magnitude of cases reported is high for a single institution in an African city the size of Yaoundé. As the burden of disease is predicted to increase dramatically in sub-Saharan Africa, immediate efforts in prevention and treatment in Cameroon are strongly warranted.

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Introduction

Injuries are rapidly becoming one of the major causes of death and disability globally. In 2002, injuries contributed

14% to the total burden of adult disease [1]. There are an estimated 5 million injury-related deaths yearly, making injuries one of the leading causes of death for children and adults in both developed and developing countries [2]. Over 90% of mortality due to unintentional injuries alone occurs in low- or middle-income countries, a disparity that is often overlooked [3, 4]. Injury-related mortality rates in sub-Saharan Africa are among the highest in the world [5].

According to the World Health Organization, the Central African nation of Cameroon has an estimated annual mortality rate due to injury of 101.8 per 100,000 population and an estimated annual burden of disease due to injury of 4,430 disability-adjusted life-years (DALYs) per 100,000 population, putting the total contribution of burden of disease due to injury roughly on par with that of malaria [6, 7]. Although the role of injury prevention in reducing this burden of disease has been emphasized, it is necessary to understand the patterns of injury in terms of mechanism and the demographic affected in each context before appropriate interventions can be made. At present, information regarding the epidemiology of injury in sub-Saharan Africa is sparse. Community-based surveys are available from a few countries in sub-Saharan Africa [8–11], but even hospital-based reports are limited. Among sub-Saharan African countries, South Africa has generated a substantial amount of hospital-based literature, but the economic and political context is unique in this country, making extrapolations to other settings difficult [12, 13]. Several small, injury-specific, hospital-based case-series of gunshot wounds and abdominal injuries are available from Cameroon [14–16], but reports describing the overall patterns of injury mechanism and demographic sectors affected are rare.

In the absence of other data sources, hospital-based data may provide an initial understanding of the scope and pattern of injury in a given context. The goal of the present study was to explore the mechanisms of injury and to describe the epidemiology of injuries seen at a busy emergency ward in a large tertiary care hospital in Cameroon's capital city.

Materials and methods

This retrospective review of administrative data was conducted using the emergency ward logs at the Central Hospital of Yaoundé, a 500-bed hospital that is one of five tertiary care centers in Cameroon's administrative capital, only three of which receive trauma patients. The hospital is in a large, urban environment and serves an estimated population of over 1.5 million inhabitants. An emergency ward is open for admissions 24 h a day, and surgeon and subspecialty services are available. Although the hospital has a limited number of ambulances available for patent transport, the overwhelming majority of patients arrive at the hospital via informal means, such as private or commercial transport vehicles.

All patients presenting to the emergency ward with an injury between the dates of January 1, 2007, and December 31, 2007, were included in the study. Injury was defined according to the ICD codes listed in Chapters XIX and XX of the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* (ICD-10), according to the World Health Organization's *Guidelines for Injury Surveillance* [17, 18].

The hand-written log used for record-keeping in the emergency ward of the Central Hospital of Yaoundé was reviewed for any injury-related presentations. Information regarding the date of presentation, mechanism of injury, age, sex, and outcome of the injured person were abstracted in a de-identified format. Injury mechanisms were grouped into the following categories: road traffic injuries, intentional injuries, falls, burns, bites (other than human), work and recreation, and other. Road traffic injuries were entered into the emergency log in terms of type of collision (i,e., automobile versus motorcycle) and not in terms of role of the injured person. This resulted in over 13 different permutations of road traffic injury mechanisms. For ease of comprehension, if a pedestrian or motorcycle was involved in the collision, then this designation was used to categorize the injury. "Other" mechanisms of road traffic injury included injuries involving bicycles, trains, and hand-held carts, among others. Age was treated as a continuous variable and was broken into age categories commonly used to assess age-mechanism relationships in the literature [19]. Potential outcomes of injured patients were described as follows: Admission to the Central Hospital of Yaoundé for medical care; admitted to the Central Hospital for surgical care; transfer to another facility; discharged from the emergency ward; and death in or upon arrival at the emergency ward. For comparative analysis, the variable designated "Outcome" was further dichotomized into "Admitted" and "Discharged," with the "Admitted" designation including all injuries requiring further care or resulting in death in the emergency ward.

Data were entered into Excel, then edited and converted to Stata statistical software for analysis. Univariate and bivariate analyses were performed for all demographic characteristics, mechanisms, and sub-analysis for mechanisms with available information. All frequencies for demographic information, injury mechanisms, and outcome are presented as proportion of total injuries, excluding those entries with missing values for that variable. Bivariate analyses were done using the chi square test for dichotomous variables, the *t*-test with unequal variances for continuous variables, and binomial analysis for

representation by sex. A p value of less than 0.05 was determined to be statistically significant. This study was approved by the Central Hospital of Yaoundé. Anonymous, secondary, de-identified data were shared with authors at the International Injury Research Unit, Department of International Health, Johns Hopkins University, for joint analysis.

Results

A total of 6,324 injured persons presented to the emergency ward of the Central Hospital of Yaoundé during the one-year period of 2007. The mean age of injured persons was 29 years (SD = 14.9), and 71% of those presenting were male. Of the 85% of patients that had information on residence recorded, the majority of injured persons came from Yaoundé, but 10.5% came from surrounding areas.

Road traffic injuries (RTI) were the most frequent mechanism of injury, comprising nearly 60% of all trauma, followed by intentional injuries at 22.5% (n = 1,375) and falls at 8.4% (n = 517) (Table 1). Upon sub-analysis by mechanism, it was found that 46% of RTI involved a pedestrian, 32% involved an automobile, and 21% were motorcycle-related, while other mechanisms comprised 1.1% of all injuries. Of the 3,662 RTI, 218 (5.9%) of the patient files were missing information on type of RTI mechanism. The frequency of intentional injuries by mechanism was characterized by a majority of unarmed assault (55.5%), followed by assault with non-firearm weapons (31.4%) (Fig. 1). Assault with a firearm comprised 7.1% of intentional injuries. "Justice Populaire," a form of public justice involving mob violence against a suspected thief or criminal, contributed 4.4% of all intentional injuries. Of note, for 527 (38.5%) of the intentional injuries recorded, there was no indication of the mechanism of injury. Bites were the fifth most common form of injury, with 153 cases recorded. Dog bites were the most frequent, at 55%, followed by snake bites at 38%. Monkey bites were the least common contribution, at 1% of all bites (Fig. 2). The records of only 2.5% of bite injuries did not specify which kind of animal was involved.

There was no significant difference between the mean ages of males and females presenting with injury (Table 2). When the proportion of gender affected by each mechanism was compared with the expected proportion given the gender composition of the overall sample, there was no significant deviation for RTI. Conversely, males were overrepresented for mechanisms of intentional and work-related injuries, whereas females were overrepresented in terms of falls, burns, and bite injuries. Additionally, a significantly higher

Table 1 Frequency of injuries by mechanism with only one mechanism assigned per subject (n = 6,324 subjects)

Mechanism	Frequency	Proportion (%)[a]
Road traffic injuries	3,662	59.8
Intentional injuries	1,375	22.5
Falls	517	8.4
Burns	173	2.8
Bites	153	2.8
Work and recreation	107	1.8
Other	135	2.2
Missing	202	
Total	6,324	100

[a] Includes non-missing data only

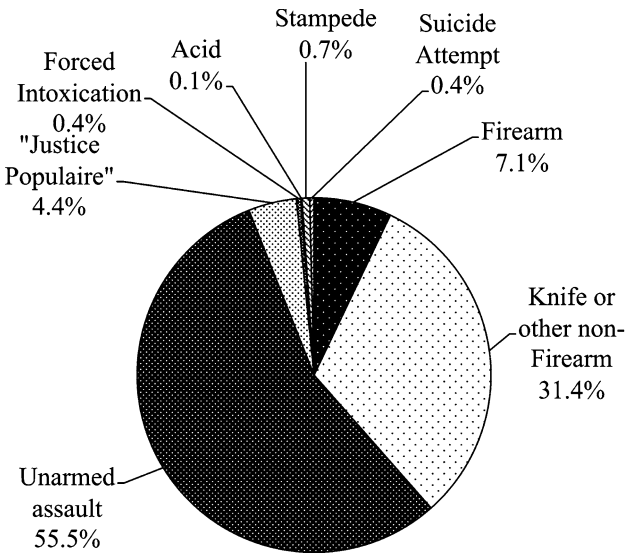

Fig. 1 Frequency of intentional injury by mechanism (n = 841)

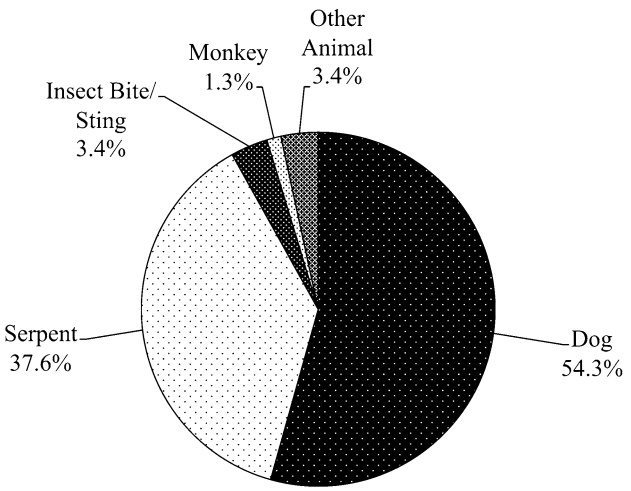

Fig. 2 Frequency of bite injuries by mechanism (n = 149)

Table 2 Comparison of age, injury mechanism by gender

	Males ($n = 4,509$)	Females ($n = 1,795$)	Missing ($n = 20$)	p Value[a]
Age, mean (SD)	29.1 (14.1)	28.7 (16.7)	37.9 (20.0)	0.4
Injury mechanism, *n* (%)	4,509 (71.3)	1,795 (28.4)		<0.001
RTI	2,594 (71.0)	1,059 (30.0)	9	0.28
Intentional injuries	1,032 (75.3)	339 (24.7)	4	0.001
Falls	335 (65.2)	179 (34.8)	3	0.001
Burns	111 (64.5)	61 (35.5)	1	0.039
Bites	76 (49.7)	77 (50.3)	0	<0.001
Work/recreation	103 (96.3)	4 (3.7)	0	<0.001
Other	104 (78.2)	29 (21.8)	2	0.09
Missing mechanism	154 (76.6)	47 (23.4)	1	0.1
Outcome, *n* (%)				
Admitted[b]	1,508 (33.5)	411 (22.9)	2 (0%)	<0.001

RTI road traffic injury

[a] Comparisons between males and females were done using a one-sample binomial test for overall male/female representation, a *t*-test for unequal variances for continuous variables, and the chi square test for dichotomous variables, including non-missing values only

[b] "Admitted" patients included all patients who were admitted to the facility for further surgical or medical treatment, who were transferred for admission to another facility, or who died in the emergency ward

Table 3 Distribution of injury mechanism by age group (*n*, %) ($n = 5,886$; age information was missing in 7% of the sample)

Age group (years)	Mechanism of injury								Total
	RTI	Intentional	Falls	Burns	Bites	Work and recreation	Other	Unknown	
<15	523 (15.5)	60 (4.7)	164 (33.2)	77 (46.4)	43 (29.3)	12 (11.9)	24 (19.2)	34 (18.7)	937 (15.9)
15–45	2,340 (69.2)	1,076 (83.4)	220 (44.5)	81 (48.8)	83 (56.5)	81 (80.2)	78 (62.4)	112 (61.5)	4,071 (69.2)
46–59	389 (11.5)	125 (9.7)	68 (13.8)	8 (4.8)	16 (10.9)	7 (6.9)	17 (13.6)	23 (12.6)	653 (11.1)
60 and older	128 (3.8)	30 (2.3)	42 (8.5)	0 (0)	5 (3.4)	1 (1.0)	6 (4.8)	13 (7.1)	225 (3.82)
Total	3,380 (100)	1,291 (100)	494 (100)	166 (100)	147 (100)	101 (100)	125 (100)	182 (100)	5,886 (100)

proportion of males (33.5%) were ultimately admitted to the hospital than females (22.9%; $p < 0.001$).

When mechanism of injury was stratified across age groups, over 83% of intentional injuries were found in the 15–45 year cohort, although this group comprised only 69.2% of the overall injured population (Table 3). Additionally, 13.3% of intentional injuries were incurred by the group aged 60 years and older, although this group represented only 3.8% of injured patients. The group aged younger than 15 years comprised only 15.9% of the sample, but this group constituted 33.2% of falls, 46.4% of burns, and 29.3% of bites. The distribution of RTI across age groups was representative of the age composition of the overall sample.

When RTI mechanism was evaluated by age, automobile-associated injuries had the highest mean age of injured persons, at 32.8 years (SD = 13.3) (Table 4). Pedestrians had a mean age of 26.9 (SD = 16.8) and were the youngest group of RTIs. The RTI mechanism with the oldest mean age was "Other" mechanisms (33.4, SD = 14.9).

Table 4 Mean age and proportion of males involved by mechanism of RTI

Mechanism	Proportion, % ($n = 3,662$)	Age, years (mean, SD) ($n = 3,380$)[a]	Male, % ($n = 3,653$)[b]
Auto	30.0	32.8 (13.3)	69.1
Pedestrian	43.2	26.9 (16.8)	66.5
Motorcycle	19.6	28.6 (10.1)	82.6
Other	1.1	33.4 (14.9)	84.6
Missing	5.6	29.7 (15.7)	73.4
Total	100	29.2 (14.7)	71

[a] Only includes subjects with age information available

[b] Only includes subjects with information on gender available

Most patients (69.5%) admitted for injury were ultimately discharged from the emergency ward without further inpatient care (Fig. 3). Patients were transferred to another facility 1.2% of the time, and 28.9% were admitted to the Central Hospital. Of those admitted to the hospital, approximately three times as many patients received

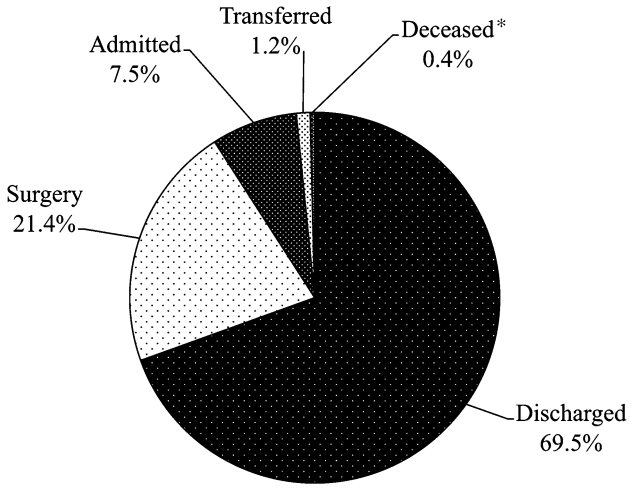

Fig. 3 Disposition of injury patients presenting to the emergency ward at the Central Hospital of Yaoundé. *Only includes deaths occurring in or upon arrival at the Emergency Ward

Table 5 Outcome by injury mechanism (*n*, %)

	Admitted	Discharged	*p* Value[a]
RTI	1,126 (30.8)	2,535 (69.2)	0.523
Intentional injuries	357 (26.0)	1,018 (74.0)	<0.001
Falls	204 (39.5)	313 (60.5)	<0.001
Burns	51 (29.5)	122 (2.8)	0.772
Bites	21 (13.7)	132 (86.3)	<0.001
Work/recreation	37 (34.9)	69 (65.1)	0.318
Other	56 (41.5)	79 (58.5)	0.005
Total	1,927 (30.5)	4,395 (69.5)	

[a] Unadjusted comparison performed using the chi square test

surgical care as received medical care. Only 0.4% of individuals died either in or upon arrival to the emergency ward. When evaluated by mechanism, RTI and burn mechanisms were not associated with an increased or decreased proportion of admitted patients compared to the overall study population (Table 5). Patients who suffered falls were more likely to be admitted ($p < 0.001$), whereas those with intentional injuries and bites were less likely to be admitted ($p < 0.001$). When stratified by the month of year, a peak in frequency of injury was found in December, with approximately 700 injuries occurring during that month, nearly 100 more injuries than in the month with the next highest frequency, March (Fig. 4). June had the fewest injuries, at 424 injuries.

Discussion

As reports of patterns and frequency of injury in Cameroon are rare in the published literature, the information

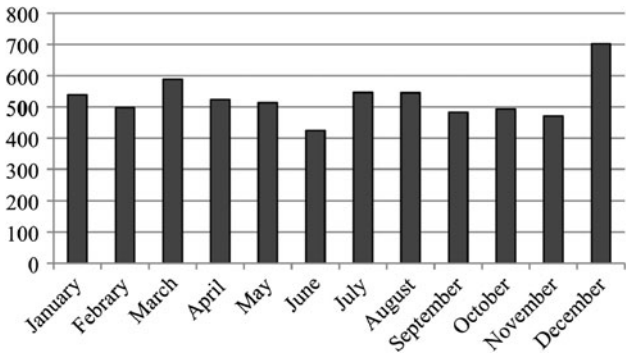

Fig. 4 Distribution of injuries by month of the year

presented in this article serves to broaden understanding of the scope of injuries in Cameroon's capital city, Yaoundé. While these data represent the catchment area of one hospital in Yaoundé, some of the findings are reflective of many other contexts in sub-Saharan Africa and other low-income countries.

Of the mechanisms reported, RTI represented the overwhelming majority, at nearly 60% of all injuries seen in the emergency ward. The preponderance of males in the study population reported here is echoed both globally and in other studies from sub-Saharan Africa, as well [5, 20–22]. In addition to contributing to the highest proportion of injuries globally, RTI was also the most frequent mechanism reported in urban hospital-based studies from Uganda, Kenya, and Nigeria, with reported proportions ranging from approximately 30–80% [20–25]. The global literature suggests that pedestrians are highly represented in most reports of RTI [26–29]. Of the RTIs in the present study, pedestrians were involved 43.2% of the time, similar to the frequency found in Uganda (38%), but more than that found in Nigeria (26.3%) [22, 30].

In comparison to the available hospital data from urban sub-Saharan Africa, the proportion of trauma due to intentional injuries in this study is quite high, comprising 22.5% and ranking second among all causes of injury. Falls have been found to be the second most common cause of injury—behind RTIs—at an urban center in Uganda [22]; a report from Nigeria found that intentional injuries ranked second behind RTI in their facility, but totaled only 16.9% of trauma presentations [21]. Of the patients with an intentional injury seen in Yaoundé, 75.3% were male, a lower incidence than that found in Nigeria (89.5%) [21]. Interestingly, patients with intentional injuries had the most missing data in terms of details about type of injury at 527 (38.5%); the mechanism of injury with the next most frequently missing information was RTI, at only 6%. The reason for this level of omission with regard to intentional injuries is unclear, but may simply reflect a lack of structured administrative methods for recording such information, or it may represent a more complex social or cultural phenomenon.

Males not only comprised a greater proportion of injured patients than females, but they were also significantly more likely to be admitted for further treatment than their female counterparts. In developed country settings, reports on the effect of gender on injury outcomes are mixed; road traffic injured females were found to have a slightly higher risk of mortality from the same physical impact as males in one study, but gender was found to have no association with outcomes in blunt trauma in another [31, 32]. The reasons for the difference in admissions for injured males and females found in the present study are difficult to understand and may be multifactorial, including possible increased severity of injury associated with male gender or possible increased availability or use of financial resources by injured males.

The association between female gender and increased burns has been noted elsewhere in the developing world and is again echoed in the findings of this study [33–36]. However, females had a higher representation among patients injured by falls and bites, as well. In a community-based survey on injuries in South Africa, dog bites were reported only in female respondents, however the number of events was extremely small [37]. Irrespective of gender, the predominance of dog bites among bite-related injuries has been noted previously in older reports from Latin America, Nigeria, and the Ivory Coast [38–40].

Perhaps the most striking finding in this study is the large number of injuries found at a single institution. While the Central Hospital of Yaoundé is a large tertiary center, it is only one of several hospitals and many smaller clinics in Yaoundé. A total of 6,324 injuries were reported; in comparison, the 1998 trauma registry data compiled from five hospitals in Kampala, Uganda, which at the time had a population similar in size to that of Yaoundé in 2007, yielded 4,515 injured patients, 75% of them at one hospital [22]. In Ghana, a total of 2,022 trauma patients were seen in a teaching hospital in Kumasi, Ghana's second largest city at that time, with a population of 650,000 [20]. Nairobi's population in 2005 was estimated at 3 million; a total of 775 trauma admissions were reported from a 2,000-bed hospital at that center. At the other end of the spectrum, single-center figures from urban South Africa may approach or exceed 1,000 admissions per month [41]. Although direct comparisons cannot be made between these reports because of differences in time, urban populations, and numbers of facilities per setting, it is still useful to appreciate the volume of trauma seen by similar facilities in sub-Saharan Africa to inform an understanding of the burden of trauma seen at the Central Hospital of Yaoundé.

The results of the present study must be interpreted bearing the existing limitations in mind. As with all hospital-based reports, there is an inherent selection bias that must be recognized. Previous reports from rural Ghana have found that approximately 50% of injured patients ultimately seek formal care, and as few as 20% seek hospital-based care; however, hospital utilization by burned-injured children was found to be positively associated with proximity and urban setting [42, 43]. Given the Central Hospital of Yaoundé's urban location, it is reasonable to speculate that its catchment population is more likely to utilize hospital-based care. Nevertheless, the proportion of injured patients in and around Yaoundé who do not seek care at the Central Hospital is impossible to enumerate, given current resources. Individuals who die at the scene of an injury in Yaoundé are often taken directly to city morgues and are therefore more likely to escape capture by a hospital registration system; this may, in part, explain the low number of fatal events reported. The ultimate outcomes of patients after leaving the emergency room, whether for admission to the hospital or discharge to the home, also contributes to the low number of deaths in the present study. Additionally, others have speculated that hospital treatment may generally be sought by more seriously injured patients or those who have access to more financial and social resources, often rendering hospital data unrepresentative of the "true" injured population in a given setting [44]. Although these sources of potential bias exist and must be acknowledged before drawing inferences from reported results, the hospital-based data reported here still contribute to an initial characterization of injured persons in Yaoundé.

Missing data elements were also present in this report, most notably in terms of mechanism of intentional injury, but also for residence and age variables (15 and 7%, respectively). The data were inspected for obvious signs of administrative lapses, such as windows of dates where there were no reported injuries, and none were found; however, this inspection does not ensure that all cases were reported. It is also possible that some cases were not entered into the administrative logs. While missing data is an unwelcome component of any analysis, it is frequently encountered in administrative data, even in high-income settings. The National Trauma Data Bank (NTDB) from the United States, one of the largest and most consistently used sources of injury data in the world, commonly lacks information for standard variables, resulting in exclusion of reported cases from 13 to 25% of the time [45, 46]. As with the NTDB, the missing data elements in the present study do not preclude exploration and analysis of available data, as long as the limitations introduced by missing data are appreciated.

Given these limitations, information from a large urban hospital in a country with no previously reported epidemiologic data provides valuable insight into the very real problem of trauma in Cameroon. Despite the extreme likelihood of incomplete capture of injured patients by the

hospital system, the results from the Central Hospital of Yaoundé records indicate a potentially high burden of injury in Cameroon's capital city. As this low-middle income country continues along a trajectory of epidemiologic transition, it is extremely likely that the problem of trauma in Cameroon will become much worse in the very near future. The results of this study argue for immediate efforts in injury prevention and improvement in trauma care, both in terms of policy and practice.

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