

Epidemiology of child injuries in Uganda: challenges for health policy

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Abstract

Globally, 90% of road crash deaths occur in the developing world. Children in Africa bear the major part of this burden, with the highest unintentional injury rates in the world. Our study aims to better understand injury patterns among children living in Kampala, Uganda and provide evidence that injuries are significant in child health. Trauma registry records of injured children seen at Mulago Hospital in Kampala were analysed. Data were collected when patients were seen initially and included patient condition, demographics, clinical variables, cause, severity, as measured by the Kampala trauma score, and location of injury. Outcomes were captured on discharge from the casualty department and at two weeks for admitted patients. From August 2004 to August 2005, 872 injury visits for children <18 years old were recorded. The mean age was 11 years (95% CI 10.9-11.6); 68% (95% CI 65-72%) were males; 64% were treated in casualty and discharged; 35% were admitted. The most common causes were traffic crashes (34%), falls (18%) and violence (15%). Most children (87%) were mildly injured; 1% severely injured. By two weeks, 6% of the patients admitted for injuries had died and, of these morbidities, 16% had severe injuries, 63% had moderate injuries and 21% had mild injuries. We concluded that, in Kampala, children bear a large burden of injury from preventable causes. Deaths in low severity patients highlight the need for improvements in facility based care. Further studies are necessary to capture overall child injury mortality and to measure chronic morbidity owing to sequelae of injuries.

Introduction

In recent decades, substantial reductions in child mortality have occurred worldwide owing to concerted efforts to improve child survival.¹ While these initiatives have focused on reducing the burden of communicable diseases, increasingly the impact of non-communicable diseases on child health is being recognised. Among these, injuries from road crashes alone result in 1.2 million deaths annually worldwide with 90% occurring in low- and middle income countries (LMICs).² There is growing evidence to suggest that children, particularly in developing countries, bear the major part of this burden. According to the World Health Organization (WHO), three of the top 15 causes of death in children 0-4 years old are injury related causes and, for children 5-14 years old, six of the top 15 causes are injury related.³ Most of these deaths (95%) occur in LMICs where the injury mortality rates for children are five times that of high income countries.² Mortality alone does not represent the true socio-economic impact of injury as non-fatal but disabling injuries contribute substantially to the overall burden of injury and are particularly challenging to address in resource constrained settings. Despite these disparities, and the fact that nearly half the population in low income sub-Saharan countries is less than 15 years old, there remains limited primary epidemiological data to guide effective prevention and care of childhood injuries.^{4,5} In a systematic review in 2006, Hyder et al. found that only eight countries from sub-Saharan Africa were represented in the literature on road traffic injuries in children.⁶ Many studies, including two from Uganda, did not focus exclusively on the impact of injury on children.

An awareness and understanding of the epidemiology of injury is essential to identify the populations most at risk and to develop targeted preventive and therapeutic interventions. This has been well demonstrated in high income countries where pedestrian safety measures, helmet and seatbelt laws as well as road safety campaigns have been implemented successfully. The United Nations' Children's Fund (UNICEF) reported that, from 1970 to 1995, the number of child deaths in rich countries decreased by 50%.⁷ However, this momentum has not reached LMICs where child injury is expected to rise owing to increasing urbanisation, motorisation and high fertility rates.

To address this critical gap in the epidemiology of child injury in sub-Saharan Africa, our paper aims to describe the injury patterns among children living in the capital city of Kampala, Uganda. Using data from Mulago Hospital, the National Referral Hospital for

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this country of 30 million people, we sought to understand the most common causes of injury, the prevalence of intentional and unintentional injury, the types of injury sustained and the outcomes of injury care in children aged 18 years and younger. We hypothesise that this analysis will help demonstrate the need for context appropriate interventions to reduce child injury in Kampala.

Materials and Methods

The most recent records on injured children seen at Mulago Hospital from the trauma registry maintained by the Injury Control Center-Uganda, a WHO Collaborating Center for Injury Prevention and Control, were used for this study. Mulago is a 1200-bed teaching hospital with a 24-hour casualty ward that is the entry point for emergencies. Patients are triaged into surgical or medical sections and, at the time of initial evaluation, the trained nurses, clinical officers or doctors prospectively collect injury data using a one-page registry form previously described.⁸ The form captures patient condition, demographics (age, sex, residence, occupation), clinical variables (blood pressure, pulse, respiratory rate, neurological status) as well as cause, severity and location of injury. Injury severity is meas-

ured with the previously validated Kampala trauma score, which has also been used in other countries in the region.⁹ Outcomes are captured by healthcare providers or records clerks who track the patient disposition from the casualty ward (treated and discharged from casualty, admitted, transferred to a higher level facility, died in casualty, dead on arrival) as well as the disposition for those who are admitted for injury (discharged, died, still in hospital, transferred, other), at two weeks. This registry is checked for accuracy by a hospital surgeon or senior doctor and the data are managed by the Injury Control Center-Uganda. Earlier studies suggest that the registry captures 60% of injuries presenting to the hospital.⁸ At this time, the most recent full year of data available is from 2004-2005. Prospective injury data were not recorded after 2005 owing to lack of funding, although since 2008 there have been efforts to restart the hospital trauma registry.

Stata version 10 (College Station, TX, USA) was used for data analysis. This study was approved by the Committee on Human Research and Institutional Review Board at the University of California at San Francisco.

Results

A total of 872 injury related emergency department visits for children 18 years or younger were recorded from August 1, 2004 to August 12, 2005. There were no missing values for disposition from the casualty department or for disposition at two weeks; therefore, no records were excluded and the entire sample was analysed.

General characteristics

Injured children seen at this hospital ranged in age from birth to 18 years, with 68% being male. The age distribution of injured patients exhibited an increase in emergency visits around the age of five years, followed by a plateau during the school ages and a dramatic increase near adulthood.

Patient disposition

Sixty-four per cent of patients were treated in the casualty department and discharged. Thirty-five per cent were admitted. Three children died in the casualty department and one child was dead on arrival. Two patients were transferred (although the data do not indicate to where or why).

Most common causes of injury

Seven observations were missing cause of injury data, which comprised <1% of the sample. Overall, road traffic crashes comprised the

largest proportion of injuries (34%, with 48% of those injuries as pedestrians and 37% as passengers), followed by falls and violent injuries, which were reported in 18% and 15% of cases, respectively. As shown in Table 1, road crashes predominated in the 5-18 year age group whereas burns were the most common cause of injury in children <1 year old (35%) and falls in children between 1 and 5 years (26%).

Place of injury

The majority of injuries occurred at home (43%) or on the street (40%). This pattern was similar for children of both sexes.

Injury classification, severity and outcome

The Kampala trauma score (KTS) was developed and validated by the Injury Control Center-Uganda.⁸ It combines three parameters: neurological status, respiratory rate and blood pressure. It was defined initially on a 16-point scale with KTS scores of 14-16, 11-13 and <11 designated as mild, moderate and severe injuries, respectively. The score was revised and simplified in 2004 to be recorded on a 10-point scale, with mild injury defined as KTS 8-10, moderate injury as KTS 5-7 and severe injury as KTS <5. Twenty-seven cases of the sample did not have a recorded KTS and one was clearly a result of data entry (a KTS score recorded as 19, which is not possible). For those that did have a recorded KTS, the majority of children (87%) presenting to the casual-

ty department was mildly injured according to the KTS. Only 1% was severely injured. Table 2 shows injury severity by age group and that the youngest children who were brought to the hospital had the highest proportion of severe injuries (11%), with an increasing trend of mild injury for older age groups. One patient was missing age data in this subgroup and therefore was excluded for this portion of the analysis.

Of the admitted patients, 97% had a valid KTS. By the two-week follow-up time, 61% had been discharged whereas 32% remained in the hospital. Six per cent had died. Only 16% of these patients who died sustained injuries defined as severe by the KTS, 63% had moderate injuries and the remaining 21% had sustained mild injuries. Burns (40%) and road traffic crashes (35%) were the most common causes of death in patients who were admitted to the hospital.

As shown in Table 3, the three patients who died in the casualty department had KTSs of 1 and 2. Of all the patients who were discharged, the mean KTS was 9.

Violence

Violent causes were defined as intentional injuries, regardless of mechanism, excluding animal and snake bites. There were 133 cases of violence, five of which had missing data on the specific cause of injury. Boys were more frequent victims of violence than girls. Over 67% of the violent cases were in boys and 33% in girls. All cases of violence that presented to Mulago Hospital were severely injured accord-

Table 1. Most common causes of injuries.

Age	No.	Percentage sample	Top three causes	No.	Percentage sample
<1 yr	23	3	Burn	8	35
Infant			Traffic	7	30
			Blunt injury	2	9
1-5 yr	120	14	Fall	31	26
Toddler			Traffic	24	20
			Burn	18	15
5-14 yr	428	49	Traffic	123	29
School-aged			Fall	110	26
			Violence	47	11
15-18 yr	294	34	Traffic	138	47
Young adult			Violence	71	24
			Animal/snake bites	25	9
Total	865		Traffic	292	34
			Fall	159	18
			Violence	133	15

Table 2. Injury severity by age group.

	<1 year	1-5 years	5-14 years	15-18 years	Total
Mild (8-10)	15 83%	78 70%	363 86%	277 95%	733 87%
Moderate (5-7)	1 6%	31 28%	56 13%	14 5%	102 12%
Severe (<5)	2 11%	3 3%	4 1%	1 0%	10 1%
	18	112	423	292	845

ing to their KTS category.

Table 4 shows that violent injuries were a result of blunt force in 57% of cases, followed by stabs or cuts in 15%. Numerous falls and road traffic injuries were reported as intentional and thus categorised as violent (i.e. falls or road traffic injuries not reported as intentional were classified as non-intentional). Sexual assault was reported only during one visit and choking and drowning were reported in no cases.

Discussion

Our study points to areas in hospital care that may need improvement in order to treat child injuries adequately. According to these data, child injury mortality among admitted children was six per cent. However, some of the children who died had mild or moderately severe injuries based on the KTS at presentation. These children may have had incorrect initial severity assessments as the KTS may be less accurate in children compared to adults. The KTS relies on blood pressure, which is known to be an inaccurate measure in children experiencing shock, instead of heart rate for evaluation. Additionally, children may have severe internal injuries with limited external indications or fractures owing to high skeletal and soft tissue pliability. Kobusingye et al. reported KTS accuracy scores of 0.89 ± 0.01 in children and 0.95 ± 0.01 in adults, which supports this hypothesis.⁸

A second potential explanation for the unexpected trend in mortality is inadequate resuscitation early in the post-injury period. Insufficient knowledge of paediatric emergency care, lack of supplies or the lack of a paediatric intensive care unit could contribute to inadequate care. Thus, diagnostic and therapeutic options and human resource capacity at the health facility level may require close evaluation to reduce mortality. Previous work has shown that trauma training courses for hospital personnel can improve the process and outcomes in resource constrained settings although no randomised trials exist to support these findings.¹⁰⁻¹²

In addition to showing potential shortcomings in hospital care, our study also highlights a need for child injury prevention, particularly in the areas of traffic injuries and falls. Once children reached school age, they generally suffered from injury patterns that are similar to those seen in adults. While this may be expected with increasing age and development, various factors such as size, mass, proportion and body surface area may increase the mortality and morbidity risks in children as compared to adults. Therefore, similarities in causes of injury are of concern and suggest

Table 3. Kampala trauma score by disposition at the casualty department.

KTS	Discharged	Admitted	Died in casualty department	Ran away	Referred/transferred	
1	0	0	1	0	1	2
2	0	1	2	0	0	3
3	0	1	0	0	0	1
4	0	4	0	0	0	4
5	1	11	0	0	0	12
6	6	24	0	0	0	30
7	13	47	0	0	0	60
8	56	58	0	0	0	114
9	104	133	0	1	0	238
10	363	18	0	0	0	381
	543	297	3	1	1	845

that Kampala has a high risk environment for children. The most common causes of injury noted in this sample were road traffic crashes, similar to findings in adults, although a larger proportion of school-aged children involved in road traffic accidents are pedestrians as opposed to passengers. The average age of injury was slightly higher than in previous studies reporting greater vulnerability in the 5-9 year age group.^{6,13}

Falls were also shown to be a major cause of injury among children. The results suggest that most falls occurring in the home as traffic injuries (34% of all injuries) likely account for most of the injuries that occurred in the traffic and street (40% of all injuries). This is a factor that fall prevention strategies can take into account. In comparison, a study of a rural hospital in Uganda found that falls were the leading cause of injury, followed by traffic injuries, for trauma patients under 16 years old.¹⁴ The difference between the risks posed to children in high-traffic urban areas and more isolated rural areas is apparent. However, the fact that traffic injuries and falls top both urban and rural lists shows that intervention strategies can be targeted to address particularly common types of injury.

Lastly, this study found that violence is implicated in a substantial share of injuries (15%) in children. However, we suspect that this significantly underestimates the true prevalence as children may under report intentional injuries caused by their family members, friends or caregivers. Furthermore, as all of the reported violent injuries were severe, it is likely that children who are victims of violent injury resulting in lesser severity exist but are not brought to the hospital for care. Closer evaluation of the prevalence of intentional injuries in children is essential in future studies. Based on adult data from this registry, violence is assumed to account for approximately 25-30% of injuries and we assume that children, who are less able to defend themselves,

Table 4. Mechanisms of violent injury seen in children.

Mechanism	n	%
Blunt force	73	57%
Stab/cut	19	15%
Burn	12	9%
Fall	11	9%
Sexual assault	1	1%
Gunshot	7	5%
Other	3	2%
Road traffic	1	1%
Poisoning	1	1%
Total	128	

may suffer consequences of violence more often. Previous work has also revealed the substantial impact of violence on children in conflict-prone regions.¹⁵

Previous studies in children and reviews of surgical conditions in the region have supported integrating injury prevention education into child health programmes.¹⁶ However, outcome of injury prevention has shown limited success. For example, a systematic review of pedestrian education studies by Duperrex et al. noted a change in road crossing behaviour but no evidence to suggest effect on risk of pedestrian-motor vehicle collision and injury.¹⁷ Similar findings were reported by Johansson in a study in Sweden involving kindergarten and primary school children.¹⁸

While no large scale studies on injury prevention have been conducted in low- and middle income countries, the evidence that increased awareness does not necessarily lead to a reduction in injuries raises serious challenges, particularly for resource constrained settings.¹⁹ More effective (and likely expensive) interventions such as stronger law enforcement and advanced road safety technology may simply be unaffordable. The WHO

has recommended a number of child injury prevention strategies including product modification (manufacturing staircase railings that small children cannot climb through), supportive home visits by health workers, safety devices (seat belts, smoke alarms) and community health studies (collect activity of children at time of injury).²⁰ Others have suggested that campaigns and social marketing strategies can help raise community awareness of this epidemic and that strong child advocacy may help politicians and decision makers to generate government action and increase investment in safety. This, in combination with multi-sectoral approaches to injury prevention and control, may be necessary.

Limitations

While this study contributes to the understanding of childhood injury epidemiology in Kampala, Uganda, there are limitations. Firstly, these data only evaluate cases that presented to Mulago Hospital, the only government hospital in the city of Kampala, which provides highly subsidised care. Four other private hospitals also provide emergency services but were not included here. This study can only provide information on the cases that presented to Mulago Hospital and thus cannot provide an overview of child injury in Kampala, although other data suggest that Mulago Hospital sees approximately 75% of the injury victims in Kampala.²¹

In addition, our study does not capture injured children who do not access hospital care. This study is limited to a health facility based perspective of the types of child injuries that are seen and treated in a major metropolitan city in Africa. The 23 deaths recorded in the registry are likely to be a considerable underestimate of total child deaths from injuries in Kampala as many deaths are likely to have occurred in the pre-hospital setting. Some studies suggest that the majority of potentially avertable deaths in severely injured patients occur in the pre-hospital arena.^{22,23} Prior community surveys in Kampala have demonstrated that a sizeable proportion of injured patients die without reaching care.²⁴ Thus, the lack of pre-hospital care and emergency transport may significantly contribute to the number of preventable child deaths in Kampala.

However, the proportion of children who die before reaching the hospital or proper care is currently unknown. In Kampala, the police and/or the public city mortuary record most, if not all, fatalities that occur outside of the hospital. An analysis of paediatric trauma related deaths from these data may help clarify the proportion that could be prevented by improving pre-hospital care or by preventive interventions.^{6,25-28}

Many questions still remain to be answered. The potential determinants of child injury such as poverty, family size and maternal education levels need to be explored further. It is unclear to what degree these or other risk factors contribute to child injury rates in low- and middle income countries or how they can be addressed at the society level. Further research in injury prevention and control focused on addressing child injury is critically needed.

Conclusions

Our study of injury patterns in Kampala suggests that children bear a large burden of injury and that the most common causes, specifically road traffic injuries and violence, are preventable. The study also shows that the youngest children presenting to this hospital had the highest proportion of severe injuries and that, while the majority of injuries seen in the casualty department were treated and discharged and of minor injury severity, there are still patients who receive low injury severity scores but who died after admission. A more comprehensive assessment of childhood deaths using other data sources is necessary to capture child injury mortality, and community surveys with longer-term follow-up are necessary to measure chronic morbidity imposed by sequelae of injuries in children. Deaths in mildly and moderately injured patients indicate that improvements in facility based care for injured children may need to occur. These may include increasing the human resources available to care for injured children, making skills training in emergency paediatric care more available for staff and ensuring that the necessary infrastructure to effectively provide care exists. Injury is an important component of child mortality from non-communicable diseases in resource constrained settings. Policies to prevent and minimise the impact of injury are essential to achieving the United Nation's millennium development goals for child survival.

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