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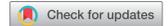
Incidence, patterns and risk factors for injuries among Ugandan children

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ABSTRACT

There is limited epidemiological data on childhood injuries in developing countries. This study assessed the incidence, patterns and risk factors for injuries among children aged 0–5 years in Wakiso District, Uganda. To determine differences, chi-square and Wilcoxon rank sum tests were used. Risk factors were assessed using Poisson regression. Overall, information from 359 children of mean age 32 months (SD: 18.4) was collected. Annual incidence of injuries was 69.8 per 1000 children/year (95% CI 58.8–80.8). One fatal injury due to burns was reported. Incidence of injuries was less associated with being female (IRR: 0.56, 95% CI 0.34–0.90) and increasing age of the caretaker (IRR: 0.96, 95% CI 0.92–0.99). The high incidence of childhood injuries necessitates the need for interventions to reduce injuries among children.

Background

The World Health Organisation (WHO) estimates that 630,000 children under the age of 15 years die from injuries annually (WHO, 2016); more than 95% of these deaths occur in low- and middle-income countries (Peden et al., 2008). Most childhood injuries, from low socio-economic households result from drowning, fire-related burns, road traffic injuries, falls and poisoning (Peden et al., 2008).

Studies describing prevalence of childhood injuries among children under 5 years in developing countries have reported prevalence rates ranging from 2.9% to 45.8%, with burns, falls and cuts being the most common causes of injuries (Fatmi et al., 2009; Gyedu et al., 2014; Kamal, 2013; Moshiro et al., 2005). In semi-urban settings, the most common causes of childhood injuries are falls, followed by cuts/lacerations and burns (Gyedu et al., 2014).

In Ugandan rural and urban areas, incidence of injuries among the general population is 116 per 1000 population per year in all age groups (Kobusingye, Guwatudde, & Lett, 2001). Hospital-based studies among children under 5 years in Uganda indicate falls and burns as the most reported injuries (Hsia et al., 2011; Mutto, Lawoko, Nansamba, Ovuga, & Svanstrom, 2011). The lack of community studies on injuries among children under 5 years limits our current understanding of the incidence and nature of childhood injuries. We therefore conducted a community-based study to determine the incidence, patterns of injuries and risk factors for these injuries among children under 5 years in peri-urban areas of Wakiso district, Uganda.

Methods

Study setting

This study was conducted in Kigungu and Bweya parishes of Wakiso district, about 40 kms from Kampala, Uganda's capital city. These parishes are located in a semi-urban area where fishing, trading, subsistence farming and non-formal employment are predominant occupations.

Study population

Eligible households were required to have at least a child aged 0–5 years or lost a child aged 0–5 years due to injuries within a period of 5 years prior to the study.

Sample size, selection and data collection

This population-based cross-sectional study employed quantitative data collection methods. We used the WHO formula for calculating sample sizes for injury community surveys (McGee, Sethi, Peden, & Habibula, 2004) where: number of households was determined by using a prevalence of 2.9% from a similar study conducted in Tanzania (Moshiro et al., 2005). A factor of 4 was used to achieve a 95% confidence level, factor necessary to raise the sample size by 10% to allow for non-responses = 1.1, design effect (f) = 2, margin of error (e) = ±5%, the proportion of children less than 5 years in a household (p) = 0.15 and an average household size (n_h) = 6. Using this approach, the sample size was 110 households from each parish, with a minimum total of 220 households.

Systematic random sampling was used to select households. Trained research assistants determined the direction of the first household by spinning a bottle at a centroid area. Selection of subsequent households was alternated. In each household, the primary caretaker was interviewed, with preference given to senior (or oldest) female in the household since they were most likely to know the injury history of all household members (McGee et al., 2004). Data on household characteristics, occurrence of injuries 6 months prior to the study and injury-related deaths among children under 5 years in the previous 5 years was collected.

Incidence of injuries was assessed using a standardized questionnaire with questions adapted from the WHO survey tool for injuries (McGee et al., 2004). The questionnaire was translated into Luganda, the local language in the community. The questionnaires were pretested in Mulago III parish, a slum area in Kampala and administered by trained female research assistants.

Data analysis

We defined the outcome as an occurrence of injury that prevented the child from carrying out his or her normal play or daily activities for at least one day or for which formal medical care was sought outside the household. This definition is proposed by the UNICEF Innocenti Research Centre to ensure that injuries that are insignificant in terms of health care, economic and social costs are not counted (Linnan et al., 2007).

We created a wealth index quintile using 13 items that measured the socio-economic status such as 'Do you own a TV?' or 'Do you own a bicycle?' or 'Do you have electricity at home?'. The responses for these items were either a 'Yes = 1' or 'No = 0'. Thereafter, the principal component analysis was used to create weighted measures through using the first factor loading results that accounted for the highest variability in the data. These were subsequently scored and wealth index quintiles were created from lowest to highest.

Demographic characteristics, frequency, mechanism and patterns of injuries were descriptively summarized and differences by parish, gender and age-groupings, respectively, were assessed using chi-square and Fishers Exact tests for categorical and median (IQR) for continuous variables. The annual incidence of injuries was presented per 1000 years with a corresponding 95% confidence interval (CI). Risk factors for childhood injuries were determined by Poisson regression. The univariate and multivariate models were fitted to assess the association between the number of injuries in a household and caretaker at an individual and household level. Variables with a univariate p-value ≤ 0.1 were considered for inclusion in the multivariate model. Model fit was assessed by the Poisson regression goodness of fit. Data was entered in Epi data version 2.1 (Lauritsen, Bruus, & Myatt, 2001) and analysed using STATA 13 (StataCorp, 2013).

Results

A total of 359 children of median age 32 (IQR: 18–48) months from 234 households were identified. More than half of the

Table 1. Demographic characteristics of caretakers and households by parish (N = 234).

	Overall n (%)	Kigungu 102 (43.6%)	Bweya 132 (56.4%)	p-value
Median age (IQR) years	27.5 (23–33)	28 (22–33)	27 (23–33)	0.80
Sex of respondent				
Male	15 (6.4)	5 (4.9)	10 (7.6)	0.41
Female	219 (93.6)	97 (95.1)	122 (92.4)	
Marital status				
Single	20 (8.6)	10 (9.8)	10 (7.6)	0.91
Co-Habiting	71 (30.3)	31 (30.4)	40 (30.3)	
Married	110 (47.0)	46 (45.1)	64 (48.5)	
Widowed/separated/ divorced	33 (14.1)	15 (14.7)	64 (48.5)	
Education				
Never gone to school	11 (4.7)	5 (4.9)	6 (4.6)	0.10
Primary education	110 (47.0)	57 (55.9)	53 (40.2)	
Secondary education	103 (44.0)	36 (35.3)	67 (50.8)	
Tertiary education	10 (4.3)	4 (3.9)	6 (4.6)	
Occupation				
Gainfully employed	123 (52.6)	47 (46.1)	76 (57.6)	0.08
Farmer	15 (6.4)	4 (3.9)	11 (8.3)	
Unemployed[a]	91 (38.9)	48 (47.1)	43 (32.6)	
Other	5 (2.1)	3 (2.9)	2 (1.5)	
Number of children in household ≤ 5 years				
1	134 (57.3)	59 (57.8)	75 (56.8)	0.58
2	69 (29.5)	31 (30.4)	38 (28.8)	
3	21 (9.0)	10 (9.8)	11 (8.3)	
4	8 (3.4)	2 (2.0)	6 (4.6)	
5	2 (0.9)	0 (0.0)	2 (1.5)	
Wealth Index Quintile[b]				
1 (Lowest)	50 (21.4)	18 (17.7)	32 (24.2)	0.72
2	56 (23.9)	27 (26.5)	29 (22.0)	
3	44 (18.8)	19 (18.6)	25 (19.0)	
4	37 (15.8)	18 (17.7)	19 (14.4)	
5 (Highest)	47 (20.1)	20 (19.6)	27 (20.5)	

[a]Unemployed, student, homemaker, retired; [b]poorest to richest using scores on household items.

children were from Bweya parish 211/359 (58.8%) and majority were female 187/359 (52.1%). A total of 234 caretakers of median age 27.5 (IQR: 23–33) years were interviewed. Caretaker and household characteristics are summarized in Table 1.

Incidence of injuries

Table 2 shows that overall, 72 injuries occurred among the children in 6 months prior to the study; an incidence of 69.8 injuries/1000 children/year (95% CI 58.8–80.8). Male children were more susceptible to injuries 42.7 injuries/1000 children/year (95% CI 33.9–51.4) compared to female children 27.1 injuries/1000 children/year (95% CI 20.1–34.2). More injuries occurred among children between one and two years of age – 22.3 injuries/1000 children/ year (95% CI 16.8–29.8).

Mechanism and pattern of injuries

Falls and burns were the most common causes of injuries among male and female children. Incidence of burns was 29.7/1000 children/year and 17.1/1000 children/year among male and female children, respectively, as summarized in Table 3.

Table 4 summarizes findings on mechanisms and patterns of injury by age-group. Burns accounted for the majority of injuries among children below 1 year 8/15 (53%) while falls caused majority of injuries among those > 12–24 months, 9/24 (37.5%) and > 24–36 months 10/18 (55.6%).

Table 2. Incidence of injuries.

	Injuries frequency n (%)	Incidence/ 1000/year	95% CI
Overall number of injuries	72 (19.4)	69.8	58.8–80.8
Sex			
Male	44 (61.1)	42.7	33.9–51.4
Female	28 (38.9)	27.1	20.1–34.2
Age-group at time of injury			
≤12	15 (20.8)	14.5	9.4–19.7
>12–24	24 (33.3)	22.3	16.8–29.8
>24–36	18 (25.0)	17.4	11.8–23.1
>36–48	11 (15.3)	10.7	6.2–15.1
>48–60	4 (5.6)	3.9	1.2–6.6
Intent of injury			
Unintentional	69 (95.8)	66.9	56.1–77.7
Intentional	3 (4.2)	2.9	0.6–5.2
Mechanism of injury			
Traffic	2 (2.8)	1.94	0.04–3.8
Fall	25 (34.7)	24.2	17.6–30.9
Struck or hit by person or object	4 (5.6)	3.9	1.2–6.6
Stab	5 (6.9)	4.8	1.9–7.8
Fire or heat	24 (33.3)	23.3	16.8–29.8
Others	12 (16.7)	11.6	7.0–16.3
Types of injuries sustained			
Fracture	6 (8.3)	5.8	2.5–9.1
Sprain, strain	1 (1.4)	1.0	0.1–3.5
Dislocation	6 (8.3)	5.8	2.5–9.1
Cuts, bites, open wound	30 (41.7)	29.1	21.8–36.3
Bruise/superficial injury	10 (13.9)	9.7	5.5–13.9
Burns	14 (19.4)	13.6	8.6–18.6
Concussion, head injury	2 (2.8)	1.9	0.5–5.0
Other	3 (4.2)	2.9	0.6–5.2
Severity of injury			
Minor	60 (83.3)	58.2	48.1–62.3
Severe	11 (15.3)	10.7	6.2–15.1
Disability or mortality			
Disabled following injury	5 (6.9)	4.8	1.9–7.8
Death	1 (1.4)		

Note: Severe is any hospitalization (admission) or a reported disability excluding death; minor is medical or no medical attention and no hospitalization; total estimated population (0–5 years) = 2063.

Table 4. Mechanism and pattern of injury by age group.

Age in months at time of injury	0–12, n = 15 (20.8%)	>12–24, n = 24 (33.3%)	>24–36, n = 18 (25.0%)	>36–48, n = 11 (15.3%)	>48–60, n = 4 (5.6%)
Mechanism of injury					
Traffic	0 (0.0)	0 (0.0)	0 (0.0)	1 (9.0)	1 (25.0)
Fall	5 (33.3)	9 (37.5)	10 (55.6)	0 (0.0)	1 (25.0)
Struck or hit by person or object	0 (0.0)	2 (8.3)	1 (5.6)	0 (0.0)	1 (25.0)
Stab	2 (13.3)	2 (8.3)	0 (0.0)	1 (9.0)	0 (0.0)
Burns	8 (53.3)	8 (33.3)	4 (22.2)	3 (27.3)	1 (25.0)
Others	0 (0.0)	3 (12.5)	3 (16.7)	6 (54.6)	0 (0.0)
Types of Injuries sustained					
Fracture	0 (0.0)	0 (0.0)	4 (22.2)	1 (9.1)	1 (25.0)
Sprain, strain	0 (0.0)	0 (0.0)	1 (5.6)	0 (0.0)	0 (0.0)
Dislocation	1 (6.7)	3 (12.5)	1 (5.6)	0 (0.0)	1 (25.0)
Cuts, bites, bruises	10 (66.7)	13 (54.2)	8 (44.4)	8 (72.7)	1 (25.0)
Burns	4 (26.7)	4 (16.7)	3 (16.7)	2 (18.2)	1 (25.0)
Concussion, head injury	0 (0.0)	2 (8.3)	0 (0.0)	0 (0.0)	0 (0.0)
Other	0 (0.0)	2(8.3)	1 (5.6)	0 (0.0)	0 (0.0)

Table 5. Caretaker, household and individual risk factors for childhood injuries in Wakiso District.

	Crude		Adjusted	
Factor	IRR (95% CI)	p-value	IRR (95% CI)	p-value
Individual (child)				
Child's gender				
Male	1 (Ref)		1 (Ref)	
Female	0.55 (0.34–0.89)	0.02	0.56 (0.34–0.90)	0.02
Caretaker and household factors				
Caretaker's age	0.96 (0.93–0.99)	0.01	0.96 (0.93–0.99)	0.03
Wealth Index Quintile				
1 (Lowest)	1 (Ref)		1 (Ref)	
2	1.39 (0.53–3.66)	0.50	1.22 (0.46–3.21)	0.39
3	3.11 (1.31–7.34)	0.01	3.08 (1.30–7.28)	0.01
4	2.53 (1.05–6.10)	0.04	2.55 (1.05–6.19)	0.04
5 (Highest)	2.92 (1.22–7.00)	0.02	2.84 (1.12–6.79)	0.02

Outcome of injuries and risk factors

One male child aged 2 years died after a burn-related injury. A total of 5 children less than 2 years old were reportedly disabled due to unintentional injuries. The causes of injuries among these disabled children were falls (3 children), road traffic accident (1 child) and burns (1 child).

At univariate analysis, female children, age of the caretaker and being unemployed were associated with childhood injuries. After controlling for the wealth index quintile, lower incidence rates were associated with being a female child (IRR: 0.56, 95%CI 0.34–0.90) and an increasing age of the caretaker (IRR: 0.96, 95%CI 0.92–0.99) (Table 5).

Table 3. Mechanism and pattern of injury by gender.

	Male n = 44 (61.1%)			Female n = 28 (38.9%)		
	n (%)	Injury incidence/1000/year	95% CI	n (%)	Injury incidence/1000/year	95% CI
Mechanism of injury						
Traffic	1 (2.3)	2.0	0.2–7.1	1 (3.6)	1.9	2.3–6.9
Fall	15 (34.1)	29.7	19.2–40.1	10 (35.7)	22.8	13.8–31.8
Struck or hit by person or object	4 (9.1)	7.9	2.5–13.4	0 (0.0)	–	–
Stab	2 (4.5)	4.0	1.1–10.1	3 (10.7)	5.7	1.2–20.3
Fire or heat	15 (34.1)	29.7	19.2–40.1	9 (32.1)	17.1	9.3–24.9
Other[a]	7 (15.9)	13.8	6.6–21.1	5 (17.9)	9.5	3.6–15.4
Types of injuries sustained						
Fracture	4 (9.1)	7.9	2.5–13.4	2 (7.1)	3.8	1.0–9.7
Sprain, strain	1 (2.3)	2.0	0.2–7.1	0 (0.0)	–	–
Dislocation	4 (9.1)	7.9	2.5–13.4	2 (7.1)	3.8	1.0–9.7
Cuts, bites, bruises	18 (40.9)	35.6	24.2–47.0	12 (42.9)	22.8	17.8–31.8
Bruise/superficial injury	6 (13.6)	11.9	5.2–18.5	4 (14.3)	7.6	2.4–12.6
Burns	8 (18.2)	15.8	8.1–23.5	6 (21.4)	11.4	5.0–17.8
Concussion, head injury	2 (4.6)	4.0	0.1–7.8	0 (0.0)	–	–
Other[b]	1 (2.3)	2.0	0.2–7.1	2 (7.1)	3.8	1.0–9.7

[a]Includes cuts; [b]includes swelling and pain.

Discussion

Our study aimed to highlight the importance of injuries in contributing to morbidity and mortality of children in the peri-urban areas of Uganda by determining the incidence, patterns and risk factors of childhood injuries among children under 5 years. We found a high injury incidence of 69.8 injuries/1000 children/year. Our study showed that fewer injuries were reported among female children and in households with older and unemployed caretakers.

The childhood injury incidence per year from our study is higher than what has been reported in other developing countries. For instance, studies from Pakistan and Nepal reported annual incidences of 47.8 and 29 per 1000 children, respectively (Fatmi et al., 2009; Pant et al., 2015). The higher rate observed in our study could partly be attributed to the definition of injury. For example, the study from Pakistan defined injury as that observed in a child who had an accident which required expert attention (Fatmi et al., 2009). This definition excludes children who were unable to seek medical attention for any reason, but whose injury was severe enough to limit their daily activities for at least one day. Although the study from Nepal accommodated the effect of injury on normal daily activities and schooling, the effect had to be severe enough to last for at least three days (Pant et al., 2015). A study from Ghana used a comparable definition to our study (Gyedu et al., 2014); in their study, the annual injury incidence in children less than 18 years was high at 593.5 per 1000 children. However, sub-group analysis for injury incidence in children less than 5 years was not described in that study.

The high incidence of injuries in our study could also be attributed to the study setting. Our study was conducted in a peri-urban area, which neighbours Kampala City. From a prior study, incidence of injuries in Uganda is higher in the urban settings compared to rural settings (Kobusingye et al., 2001).

Our results indicate that boys have a higher incidence of injuries compared to girls, a finding that is commonly reported (Fatmi et al., 2009; Moshiro et al., 2005; Peden et al., 2008). A number of theories have been advanced to explain why boys tend to have more injuries than girls. It is believed that compared to girls, boys tend to have higher activity levels, are less likely to have their exploration restrained by parents and are more likely to be allowed to play alone (Peden et al., 2008).

The majority of the injuries (95.8%) were unintentional, as has been observed elsewhere (Peden et al., 2008). Furthermore, we found that the majority of the injuries occurred among children aged 1–2 years. This contrasts with the study from Nepal (Pant et al., 2015) which found majority of the injuries occurring among children 2–3 years (Pant et al., 2015). However, children aged between 1–3 years share many developmental risks (they learn to walk, are more mobile and interested in exploring the environment) which predisposes them to injuries (Peden et al., 2008).

The majority of the injuries from our study were minor injuries. Severe injuries constituted 15.3% of injuries. The incidence of 10.7/ 1000 children/year though relatively small, is nonetheless significant as the consequences of some injuries on a child may be lifelong and fatal, and injuries contribute to significant social and economic costs to the family and the health

care system (Hu, Wesson, Kenney, Chipman, & Spence, 1993; Miller, Romano, & Spicer, 2000).

We found that falls and burns were the leading causes of injuries among children irrespective of their sex, quite similar to findings in Uganda (Hsia et al., 2011) and other low- and middle- income settings (Fatmi et al., 2009; Gyedu et al., 2014; Kamal, 2013; Razzak, Luby, Laflamme, & Chotani, 2004). Childhood falls and burns have been attributed to poor safety in homes, poor parental supervision, unsafe neighbourhoods and lack of safe play spaces (Bartlett, 2002; Haynes, Reading, & Gale, 2003; LeBlanc et al., 2006). Children aged 3–4 years, suffered injuries largely caused by other mechanisms, such as traffic injuries and being hit by objects, suggesting the need for interventions to reduce the vulnerability of this group as they explore the external environment.

We found that having older caretakers was protective against injury incidences. Our findings are consistent with research elsewhere (Hjern, Ringbäck-Weitoft, & Andersson, 2001; O'Campo, Rao, Gielen, Royalty, & Wilson, 2000). This suggests that older caretakers are probably more experienced in child care.

Currently, the absence of other comparative data from community-based studies on incidence and risk factors of injuries among children 0–5 years in semi-urban areas in Uganda makes it difficult to compare the country trends on injuries based on our study. However, the incidence and patterns observed in this study suggest that peri-urban areas in Uganda may have a high incidence of injuries than previously thought, and that injuries are an important contributor to childhood morbidity among children 0–5 years but remain a neglected health concern (Gosselin, Spiegel, Coughlin, & Zirkle, 2009). Even though we did not assess the cost implication of injuries in our study, the high childhood injury incidence underscores the need for policies and research directed towards injury prevention in these communities, especially since a number of studies suggest that injuries impact productivity and result in high expenditure by the country (Miller et al., 2000; Mock, Quansah, Krishnan, Arreola-Risa, & Rivara, 2004).

Study limitations

Community-based injury studies tend to suffer recall bias and this might have affected some of our results. Although data was based on self-reports of caretakers, and therefore subject to 'desirability bias', we interviewed the main caretakers in the family who are most likely to know the injuries of everybody. We see no major motivation for mothers to over report injuries in this study.

We used a recall period of 6 months for all injuries and 5 years for deaths. Reporting of major injuries in a period of 6 months is least affected by recall even though this period may reduce the rate of reporting for minor injuries (Mock, Acheampong, Adjei, & Koepsell, 1999). A recall period of 5 years for death was based on the assumption that people remember deaths for long periods.

Conclusion and recommendation

Our study provided evidence that suggests that injuries among children under 5 years are relatively common. These injuries

lead to morbidity and mortality in this age group. The causes of injuries in this age group should not be underestimated. We therefore recommend institution of interventions, including policy development, aimed at reducing the injuries in children aged 0–5 years in Uganda.

Ethics and consent

The study was approved by the Research Ethics Committee at Makerere University School of Public Health and the Uganda National Council for Science and Technology. Written informed consent was obtained from the caretakers to participate in this study.

Authors' contributions

A. Batte, G. E. Siu and B. Tibingana participated in the conceptualization and design of the study. A. Batte, G. E. Siu, B. Tibingana, A. Chimoyi, L. Chimoyi, N. Paichadze and K. Otwombe participated in data management, statistical analysis, interpretation of results and writing of the manuscript. All authors have read and approved the manuscript.

Disclosure statement

The authors declare that there are no competing interests.

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