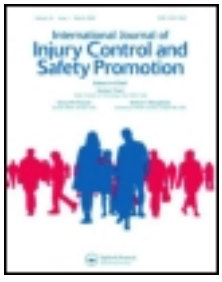

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Childhood and adolescent injuries in elementary schools in north-western Uganda: extent, risk and associated factors

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Childhood and adolescent injuries in elementary schools in north-western Uganda: extent, risk and associated factors

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Childhood injuries remain understudied in Uganda. The objective of this study was to determine the extent, nature and determinants of school-related childhood injury risk in north-western Uganda. A cohort of 1000 grade fives from 13 elementary schools was followed-up for one term. Survival and multi-level modelling techniques compared the risk rates across gender, schools and locations. Childhood injuries are common in north-western Uganda. Most of them occur during travel, breaks, practical classes and gardening, while walking, playing, learning and digging. Most injuries result from collisions with objects, sports and falls. Two-thirds of children receive first aid and hospital care. Times to injury were 72.1 and 192.9 person days ($p = 0.0000$). Gender differences in time to event were significant ($p = 0.0091$). Girls had better survival rates: cumulative prevalence of childhood injury was 36.1%; with significant gender differences ($p = 0.007$). Injury rate was 12.3/1000 person days, with a hazard ratio of 1.4. Compared to girls, boys had a 37% higher injury rate ($p = 0.004$). Rates varied among schools. Associated factors include sex and school. Rural–urban location and school differences do influence childhood injury risk. Childhood injuries are common: the risk is high, gender- and school-specific. Determinants include gender and school. Location and school contexts influence injury risk.

Keywords: school children; injury risk; injury rates; multi-level survival analysis

Introduction

Childhood and adolescent injuries are a major public health problem accounting for approximately 950,000 annual fatalities worldwide (Peden et al., 2008). Ninety per cent of the fatalities are unintentional; 95% of them occurred in low-income countries, and a large proportion among school children (Kobusingye, Guwatudde, & Lett, 2001; Lett, Kobusingye, & Ekwaru, 2006; WHO & UNICEF, 2005). In Africa, the prevalence of childhood and adolescence violation ranges between 38.6% and 71.5%. In Uganda, one of three serious intentional injuries in referral care involve young people between ages of 13 and 23 years, 28% of them, students, 95% being assaulted. Furthermore, schools, homes and roads are the leading locations of childhood injury with falls, traffic, blunt force and burns being the most common mechanisms (Mutto, Lawoko, Nansamba, Ovuga, & Svanstrom, 2011; Mutto, Lett, Lawoko, Nansamba, & Svanstrom, 2010; Jayaraman et al., 2009). The extent and nature of the childhood injury risk in Ugandan schools and homes is not, however, well understood. In China, injury rates among students range between 5 and 50/100 students/year, with greater risk in males (Li, Wang, Huang, & Luo, 2003; Yang, Yeh, Cheng, & Lin, 1998). The growing sexual and labour exploitation of children world-wide is also beginning to draw attention (WHO, 2006; International Labour Office, 2006; Diallo, Hagemann, Etienne, Gurbuzer, & Mehran, 2004).

Previously, age, gender, truancy, disobedience, substance abuse, past violence, low academic achievement, alienation, sports, depression, other personality variables, poverty, poor housing conditions, domestic energy source, maternal age, parenting and supervision quality, parental conflict and divorce, bullying and peer influence were identified as key determinants of childhood injuries (Anderson, Benjamin, & Bartholow, 1998; Bettencourt & Kernahan, 1997; Bettencourt & Miller, 1996; Booth, Rose-Krasnor, McKinnon, & Rubin, 1994; Carlson, Marcus-Newhall, & Miller, 1990; Guerra, Huesmann, Tolan, Van Acker, & Eron, 1995; Junger & Wiergersma, 1995; Kolvin, Miller, Scott, Gatzanis, & Fleeting, 1990; Lett et al., 2006; McCord, 1991; Mutto et al., 2010; Potts,

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Martinez, & Dedmon, 1995; Pulkkinen, 1995; Spencer, Dobbs, & Phillips, 1988; Starkuniviene & Zaborski, 2005). Personality variables were particularly thought to influence aggression under provocation (Bushman & Baumeister, 1998; Netter, Hennig, Rohrmann, Wyhlidal, & Hain-Hermann, 1998; Pihl, Lau, & Assaad, 1997). However, the mechanisms through which the above factors mediate specific childhood injuries in those Ugandan locations are not well understood.

The significance of these findings notwithstanding, important gaps remain in the research. First, many previous studies independently viewed predictors of child injuries at either individual or aggregate levels. Yet, implied in the theoretical models (of injuries), e.g. epidemiologic, Haddon and ecological models are the facts that the interplay between individual and contextual factors may actually increase (children's) vulnerability to injuries (Bronfenbrenner, 1979; Gordon, 1948; Rivara, 2001). This interplay occasions specific time and contextual dependencies that may render the standard epidemiologic and statistical models inefficient and inappropriate. The emergence of multi-level techniques has made this distinction possible. For prevention, such distinction enables identification of level(s) to be targeted for public health policy and programme action. In addition, while injury determinants have been severally investigated, the propensity of their underlying hazards (e.g. fight or fall) has not been extensively investigated, to the best of our knowledge. The adaptation of methods previously commonly used in cancer and other research to injuries (i.e. survival analysis) can make such studies possible. While Dickman & Adami (2006) did point the limitations of survival experiences, they remain pertinent in informing secondary prevention from a process point of view.

Other gaps in the research include the effect of stakeholder perceptions on definition and visibility of different injury types, and their causes and solutions. Previously, such perceptions were associated with stakeholder responses to injuries (Butchart et al., 2000). In addition, the role of traditional strategies grounded in holistic perspectives of health including spiritual, emotional and social dimensions in the definition and construction of prevention strategies is also important (Ivars et al., 2008).

In summary, therefore, such studies that address the above gaps will enable a deeper understanding of childhood and adolescence injury risk in time and space, which is crucial for informing prevention policy and programmes. This article is a step in that direction. It specifically focuses on school-related childhood injury risk because schools are important locations for socialisation (UNO, 1986) and north-western Uganda because it is one of the most under-studied regions of Uganda and yet it faces two fairly 'fluid' and unstable international boundaries. Injury risk is regarded as probability of occurrence of an injury event during a specified school period. Aggregated (survival) experiences and hazard functions are used to illumine previously hypothesised contextual protective effects (Bernard, 1991). Time and space variations in (injury) risk are assessed: such effects were reported earlier (Engstrom, Laflamme, & Diderichsen, 2003; Nakito, Mutto, & Lett, 2006; Pickett, Garner, Boyce, & King, 2002; Yang et al., 1998) although without sufficient control for exposure-time and contextual effects. School-related injury risks were hypothesised to have distinct hazard functions with contextual and learner-specific covariates. A 1999 hospital-based study had identified the same group as most at risk of traffic injuries (Andrews, Kobusingye, & Lett, 1999) and a subsequent cohort study estimated their cumulative traffic injury prevalence at 0.5% (Nakito, Mutto, Howard, & Lett, 2008); both studies were urban health facility-based and did not use MLA techniques.

Methods

Settings

The study was carried out in elementary schools in a largely rural north-western Ugandan district which has a few urban and peri-urban neighbourhoods among the many typically rural communities; approximately 75 km north of the regional capital-near Uganda–Sudan Border. The majority (89%) of the residents' are ethnic Aringa: 80% of them Muslims. The area is still recuperating from years of armed rebellion. Subsistence agriculture is its main economy. Over 60% of the population lives below poverty line (Deininger & Okidi, 2003).

Design

Cohort design was used to explore the extent, nature and determinants of school-related childhood and adolescent injury risk. An injury or violation event was considered school related if experienced by a sampled school child specifically because of schooling and (school) related exposure. Because the children in this study were all non-residents of the primary schools, such injuries could happen to them at home, on the way to and from school or at school. Grade-five children were selected because of their command over English language and availability for follow-up injury and violence prevention activities within the same schools. A specific register was created for this study at the beginning of the term. The class teachers updated the register every fortnight on the basis of whether or not the child had had an injury and violent event in the previous two weeks. For those who reported to have had an injury or violent event, a separate injury and

violence surveillance form was completed. Those who were injured or violated in-between were automatically reflected in the register, a surveillance form was also immediately completed by the teacher. Sample size was calculated with a variance inflation adjustment based on an ICC of 0.04 and average cluster size of 50 established from an earlier northern Ugandan study (Mutto, Kahn, Lett & Lawoko, 2009). The cohort was followed-up fortnightly between 2 February 2009 and 30 April 2009. Data were analysed in November 2010 using Stata version 11 (STATA Corporation, 2001). Participating schools were selected by local (District) Education Officials on the basis of predefined inclusion criteria including consent, accessibility, safety, security, ownership, location within original premise, grade five class size of above 40 (at least 25% of them girls), parents', teachers' and district education authority consent. School-related injuries and violations happening at school, at home or on the way to and from school were recorded by trained teachers using a standard format. Of the screened schools, only 13 were retained because of local interest.

Measures

The main outcome measures were school-related injury or violation events. Other recorded individual level covariates included age, sex and attitudes towards conflict and violence (the information on attitudes towards conflict and violence was used to validate a new scale *published elsewhere*). Contextual variables included school, location and institutional religious affiliation. Tracked injury characteristics were time, place, activity at time, intent, social behaviour, and physical action, injury mechanism, severity, nature, affected body part and outcomes (refer to the summary of measures in Table 1). The primary respondents were the grade-five children.

Analysis

Survival analysis techniques were used to estimate and compare injury rates and survival proportions among ages, genders, schools, locations and institutional religious affiliations. Since days were the adopted units of observation time, person-days were used to estimate the actual at-risk time contributed by the entire cohort. Times to first injury or violation event varied among the children, and a child remained eligible to contribute to the at-risk person-days as long as he or she had not yet experienced his or her first event. Time and contextual effects of injury risk were evaluated using Poisson and Cox proportional hazards models. The proportional hazards assumptions were evaluated using log-rank and scaled Schoenfeld residuals tests. Assumption violations and ties were addressed through stratification and efron techniques (Grambsch & Therneau, 1994; Hosmer, Lemeshow, & May, 2008).

Table 1. Definitions and measures of study variables.

Variable	Definition	Measure
Injury	Organic level lesions resulting from acute exposures to energy in excess of physiological tolerance thresholds, or insufficiency of vital elements (Baker, 1992). Injuries are dichotomized as unintentional if inadvertent or intentional, if deliberate	Binary (outcome)
Violation	Intentional use of force or power, actual or threatened, against another person, self or group, resulting in or with likelihood of resulting in injury, death, deprivation or mal-development. (WHO 2000)	Binary (outcome)
Age	Number of years lived since birth	Continuous
Sex	Being either male of female	Binary
Physical act	Physical mechanism leading to injury or applied violation	Categorical
Social behaviours	The behavioural expression that contextualized the event	Categorical
School	The institution where the child is enrolled and attending classes	Categorical
Location	Whether school is located in rural or urban or peri-urban setting	Categorical
Affiliation	Religious affiliation of founding establishment / religious culture (protestant, catholic or Islamic)	Categorical
Survival time	Time from beginning of term to injury event	Continuous
Injury/violation date	Date when the exact injury or violation event happened	Date
Effect on child's schooling	How the incident affected schooling	Categorical

Multi-level logistic regression techniques (Goldstein, Browne, & Rasbash, 2002; Leyland & Groenewegen, 2003; Snjjders & Bosker, 1999) were then used to explore effects of contextual covariates, specifically, institutional religious affiliation, location and school on childhood injury probabilities. MLA techniques allow for inclusion of contextual effects in analysis of individual level injury and violation risk. All models were assessed for appropriateness using likelihood ratio tests and the most appropriate model was used to address current study objectives.

Model definition for MLA

Model one was empty; model two contained individual level explanatory factors, model three included school level factors and model four included societal factors particularly religious affiliation and location.

Estimated effects for MLA

The fixed effect was the cumulative childhood injury prevalence (probability) in the cohort and the random effects were the variations attributed to contextual factors as expressed by the variance partition coefficient.

Permission for this study was granted by Yumbe District Education Authorities and ethical clearance was given by Gulu University Faculty of Medicine Committee for Research on Human Subjects.

Results

Cohort characteristics

The cohort consisted of 1000 grade-five children between ages of 9 and16 years from 13 elementary schools in north-western Uganda. Male:female ratio was 12:10. The age distributions were similar among schools, locations and affiliations. Cohort bio-demographics are summarised in Table 2. Follow-up lasted for one school-term (2 February 2009 to 30 April 2009). Loss to follow-up was approximately 5% and consistent with the underlying enrolment attrition for this grade and region. Children are officially considered to have dropped out of school only during interclass transitions. Previous studies in the region had estimated the enrolment attrition at this grade in Yumbe to range between 3.5–7% (Mutto et al., 2010). Five per cent of the children in this study could not be accounted for by the end of the follow-up period. The losses did not significantly alter the bio-demographic profile of the cohort.

Extent of problem

A total of 361 injury events were recorded during follow-up, 37.9% of them among girls and 22.6% were intentional. The mean age of injured children and adolescents was 12.9 years (SD = 1.2, min = 9 years, max = 18 years), and did not significantly differ from means of uninjured and general cohort (see Table 2). The leading injury locations were playgrounds (35%), gardens (45%) and roads (12.5%). These three accounted for 92.5% of reported events. The majority of injury events happened before and after school (63.4%) and during scheduled [class] breaks (24.3%) (9.7% and 14.6%, respectively during mid-morning and lunch breaks). The most risky activities were sports (accounting for 32.5% of injuries), followed by classroom activities (15.4% of injuries) and walking (12.5% of injuries).

The most frequent injuries were sprains/strains (31.7%), bruises (19.51%), cuts (19.5), penetrating wounds (12.2%) and animal/insect bites (7.3%). The rest accounted for 9.9%. Most commonly associated physical acts were collisions with objects (19.9%), falls (23.4%), sports (11.6%), weapon carrying (8.9%) and technical equipment-related (6.4%). The most prevalent associated social behaviours were truancy (13.8%), late coming (26.9%) and class disruption (7%). Nearly, two-thirds (63.4%) of injured children received school first-aid or definitive care in health facilities (31.7% each, received first-aid and definitive hospital care). Only 23.5% of incidents affected schooling. The median number of days missed because of injury was three (min = 1, max = 360 days). The most commonly injured body parts were legs (34.2%), feet (34.2%), wrists and hands (12.2%), forearms (7.3%) and head (7.3%).

Risk

Approximately 18% of the cohort experienced at least one injury or violation event during follow-up. The crude mean time to injury event was 182.6 person days (SD = 0.80.3, Min = 1, Max = 240) with significant differences between unintentional and intentional injuries (72 person days, 95% CI = 64.3–79.9 for intentional injuries compared to 192.9 person days, 95% CI = 187.9–197.8 for unintentional injuries), log-rank test of equality of intentional and unintentional injury survival functions was significant ($\chi^2 = 253$, $p = 0.0000$). The gender desegregated observed and expected events are presented by intent in Table 4 in accordance with the guidelines for reporting such studies (Altman, De Stavola, Love, & Stepniewska, 1995). The disaggregated survival experiences and hazard rates are also presented in the Kaplan–Meier plot (Figures 1 and 2).

There were significant gender differences in mean times to injury or violation (mean for girls = 190.1 person days, 95% CI = 182.8–197.4 person days; mean

Table 2. Community and individual level characteristics (age and sex by religious affiliation, school location & school).

	Individual level										
	Mean age (SD)/years					Injury status (n/%)					
	Injured		Not injured		Sample	Injured		Not injured		Total	
Community level	Boys	Girls	Boys	Girls		Boys	Girls	Boys	Girls	Injuries (n/%)	Sample (n)
School code	12.5(1.2)	12.8(1.2)	13.3(1.9)	13.3(1.4)	12.9(1.4)	13(23.2)	24(42.9)	12(21.4)	7(12.5)	37(66.1)	56
S103	11.9(1.1)	13.0(1.0)	12.5(1.0)	12.9(1.4)	12.5(1.3)	43(34.1)	3(2.4)	33(26.2)	50(39.7)	46(35.7)	126
S109	13.1(1.6)	13.6(0.6)	13.9(5.4)	13.2(1.2)	13.5(3.6)	18(18.8)	3(3.1)	40(41.7)	36(37.5)	21(21.6)	96
S107	13.0(1.4)	12.9(1.4)	13.0(1.5)	12.8(0.4)	12.9(1.2)	15(28.8)	11(21.2)	13(25.0)	10(19.2)	26(53.1)	52
S114	13.7(1.4)	13.0(0.8)	13.4(1.7)	13.6(1.7)	13.5(1.6)	9(9.8))	4(4.3))	34(36.9)	45(48.9)	13(14.1)	92
S104	15.5(5.6)	13.6(0.9)	13.2(0.8)	17.9(6.4)	15.7(5.4)	25(47.2)	8(15.1)	5(9.4)	15(28.3)	33 (62.3)	53
S111	12.7(1.2)	12.7(1.4)	12.4(1.2)	13.0(1.2)	12.6(1.2)	19(23.8)	10(12.5)	34(42.5)	18(22.5)	29(35.8)	80
S118	12.9(1.3)	13.9(1.4)	13.3(1.9)	12.9(1.4)	13.4(1.7)	7(7.4)	28(29.8)	40(42.6)	19(20.2)	35(37.2)	94
S112	13.1(1.2)	14.5(0.6)	13.3(1.1)	12.7(1.6)	13.1(1.4)	35(45.5)	4(5.2)	7(9.1)	31(40.3)	39(50.6)	77
Location ($n = 1000$)											
Rural	13.4(2.6)	12.9(1.2)	13.2(2.5)	13.4(2.4)	13.3(2.3)	175(22.4)	106(13.6)	269(34.5)	230(29.5)	281(36.1)	780
Urban	12.5(1.1)	13.9(1.4)	13.4(1.9)	12.9(1.4)	13.4(1.7)	6(6.4)	28(29.8)	41(43.6)	19(20.2)	34(36.2)	94
Peri-urban	11.9(1.1)	13.0(1.0)	12.4(1.1)	12.9(1.4)	12.5(1.2)	43(34.1)	3(2.4)	30(23.8)	50(39.7)	46(36.5)	126
Affiliation											
Protestant	13.5(3.1)	13.4(1.4)	13.0(1.6)	13.7 (3.5)	13.4(2.6)	163(20.9)	131(16.8)	270(34.7)	214(27.5)	294 (37.8)	778
Catholic	11.9(1.1)	13.0(1.0)	12.4(1.1)	12.9 (1.4)	12.5(1.3)	43(35.7)	3(2.4)	30(23.8)	50(39.7)	46(36.5)	126
Muslim	13.1(1.7)	13.7(0.6)	13.9(5.4)	13.2 (1.2)	13.6(4.6)	18(18.8)	3(3.1)	40(41.7)	35(36.5)	21(21.9)	96

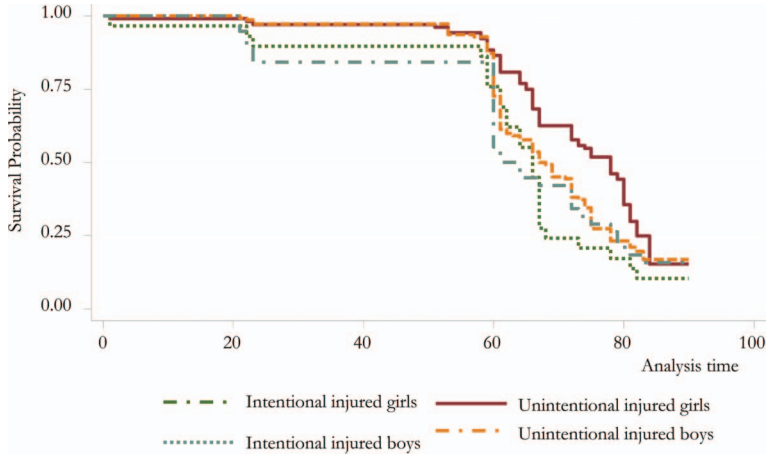

Figure 1. Gender desegregated Kaplan–Meier survival estimates.

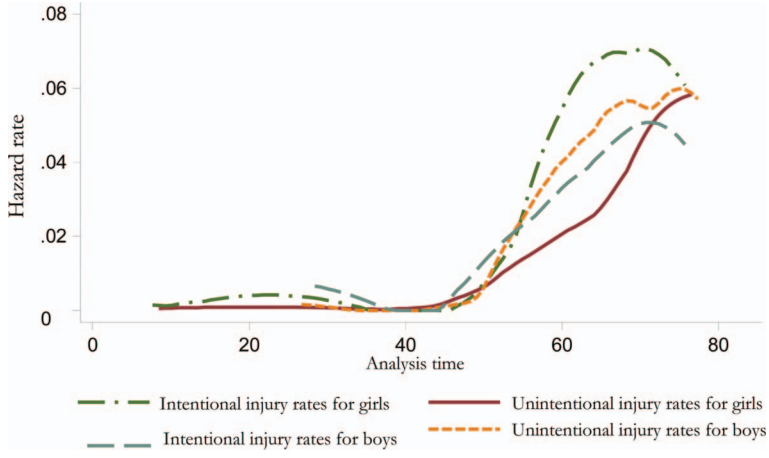

Figure 2. Smoothed and gender desegregated hazard estimates.

for boys = 176.7 person days, 95% CI = 169.9–183.6 person days; $t = 2.6125$, $p = 0.0091$). Log-rank test of equality between survival functions for boys and girls gave χ^2 value of 3.45 with $p = 0.06$. The gender disaggregated survival proportions are illustrated by the Kaplan–Meier plot in Figure 2, suggesting superior survival experiences for girls compared to boys.

The gross cumulative prevalence of school-related childhood and adolescent injury in the cohort was 36.1%; with significant gender differences (male and female cumulative injury proportions, respectively, were 39.7% and 31.4%, $\chi^2 = 7.3336$, $p = 0.007$).

The crude rate of school-related childhood injuries in the cohort was 11.6/1000 person days, with significant gender differences (11.3 and 12.2/1000 person days, respectively, for boys and girls), giving a hazard ratio of 1.4 (95% CI = 1.1–1.73, z = 2.09, $p = 0.014$; as presented in Table 4). The effect of gender on injury rate, as assessed through Wald test, shows significant variations between levels of intent ($\chi^2 = 95.35$, $p = 0000$). Within specific schools, having accounted for location and institutional religious affiliation, boys had a 25% higher injury rate ($p = 0.037$, 95% CI = 1.01–1.55). There were rate variations among schools (as summarised in Table 3). The Poisson model of gender, intent and school had an acceptable fit [(1/df) Deviance = 0.7 and (1/df) Pearson = 1.2]. No monthly variations were detected in injury rates.

Associated factors

The main individual level determinant of elementary school-related childhood injury risk was gender (IRR 1.3, 95% CI = 1.02–1.56, $p = 0.031$). The effect of age was minimal as expected in this study because of the homogeneity of the cohort (since only grade-five children were included). The significant contextual determinants included school ($\chi^2 = 66.48$, $p = 0.0000$)

Table 3. Gender and intent disaggregated injury rates by school, location and affiliation.

	Injury rates/100 person-days							
	Unintentional			Intentional				
Level	Boys (95% CI)	Girls (95% CI)	All unintentional (95% CI)	Boys (95% CI)	Girls (95% CI)	All intentional (95% CI)	Overall (95% CI)	Hazard ratio
Schoolcode								
S103	5.5 (2.9–10.5)	4.5 (2.9–7.0)	4.8 (3.3–6.9)	8.3 (3.1–22.2)	33.3 (8.3–133.4)	11.1 (4.9–24.7)	5.3 (3.8–7.4)	1.0 (Reference))
S109	5.1 (3.5–7.5)	2.8 (0.4–19.7)	4.9 (3.4–7.3)	4.2 (2.4–7.2)	16.7 (2.3–1.2e)	4.4 (2.6–7.5)	4.8 (3.5–6.5)	0.49 (0.31–0.78
S107	4.1 (1.9–8.7)	14.3(2.0–101.4)	4.5(2.3–9.1)	3.7 (1.7–8.3)	14.3 (3.6–57.1)	4.6 (2.3–9.1)	4.5 (2.8–7.4)	0.23 (0.13–0.42)
S114	5.6 (3.3–9.5))	4.3 (2.3–8.1)	5.0 (3.4–7.5)	4.3 (0.6–30.9)	4.2 (0.6–29.6)	4.3 (1.1–17.0)	4.9 (3.4–7.2)	0.72 (0.43–1.19)
S104	2.6 (1.5–4.7	16.7 (4.2–66.6)	3.0 (1.7–5.2)	4.2 (1.9–9.3)	16.7 (7.5–37.1)	6.7 (3.7–11.7))	4.1 (2.8–6.0)	0.82 (0.49–1.37)
S111	11.8 (7.3–18.9)	2.9 (1.3–6.4)	6.5 (4.3–9.8)	7.0 (2.6–18.7)		7.0 (2.63–18.7	6.6 (4.5–9.6)	0.48 (0.29–0.80)
S118	4.6 (2.1–10.3)	4.8 (2.9–7.8)	4.7 (3.1–7.2)		12.2 (6.3–23.4)	12.2 (6.3–23.4)	5.7 (4.0–8.2)	0.55 (0.33–0.89)
S112	2.6 (1.6–4.0)	8.3 (2.7–25.8)	2.8 (1.9–4.3)	2.1 (0.8–5.6)	5. 6(0.8–39.4)	2.4 (1.0–5.8)	2.7 (1.9–4.0)	0.54 (0.33–0.91)
Location	3.9 (3.2–4.7)	4.5 (3.5–5.7)	4.1 (3.5–4.8)	3.9 (2.7–5.7)	5.8 (3.9–8.6)	4.6 (3.5–6.1)	4.2 (3.7–4.8)	1.0 (Reference)
Rural Urban	4.6 (2.1–10.3)	4.8 (2.9–7.8)	4.7 (3.1–7.2)		12.2 (6.3–23.4)	12.2 (6.3–23.4)	5.7 (4.0–8.2)	0.87 (0.64–1.20)
Peri-urban	5.1 (3.5–7.5)	2.8 (0.4–19.7)	4.9 (3.4–7.3)	4.2 (2.4–7.2)	16.7 (2.3–1.2e+)	4.4 (2.6–7.5)	4.8 (3.5–6.5)	1.16 (0.83–1.62)
Affiliation								
Protestant	1.3 (1.1–1.7)	1.3 (0.9–1.7)	1.3 (1.1–1.6)	1.5 (1.0–2.3)	1.6 (1.0–2.6)	1.5 (1.2–2.2)	0.2 (0.1–0.3)	1.28 (0.91–1.12)
Catholic	1.4 (0.9–1.9)	0.7 (0.2–2.6)	1.3 (0.9–1.8)	1.6 (0.9–2.7)	1.5 (0.2–10.8)	1.6 (0.9–2.7)	0.2 (0.1–0.3)	1.0 (Reference)
Muslim	1.4 (0.7–2.9)	1.5 (0.2–10.6)	1.5 (0.8–2.8)	1.2 (0.6–2.1)	1.5 (0.4–5.9)	1.2 (0.7–2.1)	0.1 (0.07–0.2)	0.47 (0.26–0.83)

and location ($\chi^2 = 25.59$, $p = 0.0000$) as presented in Table 5. The results also showed the effect of gender to vary among schools and locations ($\chi^2 = 12.14$, $p = 0.0002$).

Discussion

This study explored the extent, nature and determinants of school-related childhood and adolescent injury risk in north-western Uganda; specifically, if major, and learner, intent, (school and rural–urban) context specific.

We found injuries (sprains, strains, bruises, cuts, penetrating wounds and animal/insect bites) to be common childhood risks in north-western Ugandan schools in consistence with previous accounts (Kobusingye et al., 2001; Mutto et al., 2011; Nakito et al., 2008; Peden et al., 2008). Most incidents were attributed to deviant actions (truancy, late coming and class disruption). Travel (to and from school), break time activities and practical class including gardening were most injurious, while collisions with objects, sporting and falls were the commonest physical acts leading to school-related injury. Two-thirds of injuries received first-aid or health facility care.

The cumulative prevalence of school-related childhood injuries in north-western Uganda was 36.1% with an average injury rate of 12.3/1000 person days, and significant gender differences. A similar rate was reported in China (Li et al., 2003; Yang et al., 1998). There were also significant gender, intent and contextual differences regarding survival experiences and injury rates: girls had superior survival experience compared to boys who had a 37% higher rate in consistence with previous findings (Barss et al., 1989). Average time to first school-related injury was 182.6 person days with significant differences between the intentional and unintentional incidents. Although less prevalent, intentional injuries have a higher random

Table 4. Observed and expected injury events by gender and intent.

Intent	Observed events	Expected events	X^2	P-value
Unintentional	221	297.4		
Intentional	73	14.6	253	0.0000
Gender				
Girls	117	132.7		
Boys	177	161.3	3.45	0.06

Table 5. Multilevel logistic regression modelling of factors associated with elementary school related childhood and adolescence injuries in north-western Uganda.

Variable	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Fixed effects:				
Individual- level				
Age		0.96 (0.89/1.03)	1.04 (1.03-1.27)	1.04 (1.04-1.12)
Sex				
Girls		(Reference)	(Reference)	(Reference)
Boys		1.5 (1.15-2.07)	1.76(1.29-2.41)	2.27(1.45-7.47)
Community level (School code)				
S103 (Reference)			1.0	1.0
S109			4.56 (2.23-9.29)	
S107			15.12 (6.10-34.46)	3.52 (1.52-8.19)
S114			1.97 (1.14-4.42)	1.97 (1.14-4.42)
S104			1.59 (1.53-3.86)	1.51 (1.51-3.92)
S111			3.44 (1.61-7.35)	3.42 (1.60-7.33)
S118			4.27 (2.02-9.02)	
S112			2.13 (1.00-4.50)	2.13 (1.00-4.51)
Location				
Rural				(Reference)
Urban				4.08 (1.12/18.67)
Peri-urban				6.85 (1.42/33.15)
Random effects:				
Intercept	-0.57 (- 0.69- -0.44)	-0.49 (- 1.33-0.35)	−0.27 (/1.27-0.73)	−1.06(- 2.29-0.17)
Community level variance (SE)	0.07	0.43	0.51	0.63
VPC (%)		11.6	13.4	16.1
Explained PCV (%)			13.4	16.8

Notes: OR, Odds ratio; CI, confidence interval; SE, standard error; VPC, variance partition coefficient; PCV, proportional change in variance.

hazard function, which (hazard function) also differed significantly among intents, genders, schools and rural–urban locations. Contextual effects (rural/urban and school location) accounted for 16.8% of the variability in school-related childhood injury risk in north-western Uganda.

Several factors could have accounted for the observed extent, nature and determinants of school-related childhood injury risk in north-western Uganda. First, possible differences in local perceptions of intentional and unintentional childhood (injury) threats. Butchart et al. (2000) earlier found such perceptions to influence local injury responses. Second, previously unrecognised but possibly effective local injury prevention strategies may have been at play, especially those grounded in traditional and holistic perspectives (Ivars et al., 2008), which are often excluded in typically quantitative scientific approaches. Such strategies may include rules, regulations, values, parental actions and other socio-cultural resources. Our investigations in this area also evidence the presence of unevaluated injury and violence prevention strategies in this community (unpublished data). This could contrast current understandings of injury risk-based on manifested prevalence which places the public health importance of unintentional injuries ahead of that of intentional injuries.

Third, stakeholder dispositions towards intentional and unintentional injury control may also differ. Butchart et al. (2000) also showed this to be influential in the evaluation of injury causes, solutions and self-efficacy. Individuals may regard unintentional injuries as inevitable acts of 'God' which may influence the amount of effort they may be willing to invest in their prevention and control. Generally, however, parents and school managers tend to be sensitive to violent threats against children and may proactively establish mechanisms to safe-guard them. This may have contributed to the reciprocal manifestation of the hazard functions and prevalence measures of the two injury classifications. Most schools set rules and regulations against violence partly because of parental concerns, but few invest similar levels of effort towards unintentional injuries: it is not clear whether this is because of lack of environmental risk awareness. A similar level of effort towards unintentional injuries focusing on environmental risks may significantly change injury profiles in north-western Ugandan elementary schools. Further investigations may be necessitated into possible triggers of violent events in elementary schools.

The findings may also be indicative of the poor quality of child care and supervision in north-western Uganda as evidenced by fact that the most common injury locations and times were travel to and from school, play, practical class and break time activities. This is also consistent with previous findings (Mutto et al., 2010). Possible explanations could include lack of awareness of childhood as a high risk stage, lack of knowledge of developmental limitations and needs of children, lack of access to proven prevention strategies on account of knowledge and cost, and lack of understanding of safety (responsibility) mandates especially between home and school settings. While safety at home is clearly parental responsibility, and at school, that of management, responsibility for children's safety on the way between home and school may be unclear: a policy response may be necessitated.

The study findings underscore the importance of contextual differences in childhood injury risk in north-western Ugandan schools which may have major implications for prevention programming. Although previously suggested, specifics of the contextual influences on (school related) injury risk were not specifically explored in this study and may require more targeted investigations. The particular attributes of interest include the different dimensions of physical and social environments which heighten specific childhood injury risks and how such risks may be aggravated by poor regulation and/or limited use of protective strategies. The effect of poverty and ignorance in north-western Uganda may also need specific study. Previous studies did link sports-related accidental falls and fist fighting to inadequate use of protective devices (William et al., 1996). It is not uncommon for children in Uganda to lack protective play equipment or fight during competitive sports. While inherently risky, use of protective devices could significantly reduce the extent of school-related childhood injury risk in north-western Uganda. The study also showed injury risk to be evenly distributed across the school term; Nakito et al., (2006) had reported inter-term risk differences in traffic injuries possibly due to seasonal factors.

We evidence inadequate application of risk mitigation strategies, which may have contributed to the heightened risk of injury during daily life (activities). Previously, this was identified as a major obstacle to injury prevention (Mutto et al., 2010). Reasons for the limited adoption and use of proven interventions and risk mitigation strategies were not specifically assessed in this study, but could include knowledge, attitudes, availability and affordability gaps. An earlier review of helmet use among commercial motorcyclists in Kampala had shown similar reasons for none-use (Mutto et al., 2006). The reasons for this specific case in north-western Uganda need further investigation. Most Ugandan schools lack the required resources to provide specialised safety equipment for sports, practical lessons, travel and gardening. The present case could be a microcosm of a bigger problem where

effective innovations remain inaccessible on account of knowledge, attitudes, access and cost.

The main study limitations include short follow-up; since only one-third of the school year was observed. Major seasonal trends in staple food supply, competitive sports and hunting had been shown to influence local childhood and adolescent injury patterns. In addition, only grade-five pupils were followed and yet age-specific risk differences were previously reported. Finally, it was not possible to record daily school attendance during the study. This could have specific ramifications for the utility of the observed survival experiences of the northern Ugandan school children as earlier alluded to by Dickman and Adami (2006) regarding the limitations of the survival experience measure. This may have modified the exposure levels among the children.

Conclusion

Injuries are common school-related childhood risks in north-western Uganda. Gender, intent, school and location are key (determinants of childhood) injury survival experiences in north-western Ugandan schools. Intentional injuries have a higher hazard function but lower prevalence than unintentional injuries. Violence is the injury greatest risk to watch out for as children begin school. Unintentional injuries are important but their risk is low. Under-recognised social resources may be responsible for keeping the (high) intentional injury hazard under check. The most injurious activities are travel, practical class, break time activities and gardening. Determinants of school-related childhood injuries include, gender, school and rural–urban location. Time and contextual effects do influence and directly contribute to the variability in school related childhood injury risk in north-western Uganda.

Recommendation

There is need to prioritise and address safety among school-age children in north-western Uganda with particular focus and emphasis on adult supervision at home, during travel to and from school, practical class and farm work, and class breaks. The development of simple injury prevention educational materials is urgently needed. Urgent community level actions are needed to secure access routes to schools. There is also need to document and evaluate hitherto under-recognised social recourses that seem to keep violence under check. Longer quantitative studies are needed to assess seasonal risk trends across a typical school year. Schools and communities need to be mobilised to address specific aspects of their physical environments that may cause childhood injuries.

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