



## **Demographic and contextual influences in injury risk among adolescents in a low-income country setting: Results from a school-based survey in Tanzania**

**Michael L. Wilson\***

*Centre for Injury Prevention and Community Safety (CIPCS), PeerCorps Trust Fund, 352/64 Makunganya Street, Co-Architecture Building, 4th Floor, PO Box 22499, Dar es Salaam, Tanzania*

*\*Corresponding author*

*E-mail: michael.wilson@peercorpstrust.org*

**Benjamin A. Kamala**

*Centre for Injury Prevention and Community Safety (CIPCS), PeerCorps Trust Fund, 352/64 Makunganya Street, Co-Architecture Building, 4th Floor, PO Box 22499, Dar es Salaam, Tanzania*

*E-mail: benjamin.kamala@peercorpstrust.org*

**Andrea C. Dunlavy**

*Centre for Injury Prevention and Community Safety (CIPCS), PeerCorps Trust Fund, 352/64 Makunganya Street, Co-Architecture Building, 4th Floor, PO Box 22499, Dar es Salaam, Tanzania*

*E-mail: andrea.dunlavy@peercorpstrust.org*

**Hamisi A. Kigwangalla**

*Centre for Injury Prevention and Community Safety (CIPCS), PeerCorps Trust Fund, 352/64 Makunganya Street, Co-Architecture Building, 4th Floor, PO Box 22499, Dar es Salaam, Tanzania*

*E-mail: hamisi.kigwangalla@peercorpstrust.org*

### **Abstract**

**Objective:** This study investigated the social, demographic and contextual factors associated with injury among adolescents in a low-income urban sub-Saharan African setting.

**Methods:** Data on 2 176 adolescents aged 11–16 years were divided into three groups: Those that reported not being injured, those that had been injured once, and those that had been injured multiple times within a 12-month recall period. We conducted bivariate analyses to screen for associations with several social, demographic and contextual factors. Then a multinomial logistic regression was performed to examine associations while adjusting for covariates.

**Results:** Within the recall period, 22.14% of participants reported one serious injury and 10.96% reported multiple injuries. Compared with non-injured participants, those injured two or more times were mainly male (relative risk ratio (RRR) = 1.71 [1.27–2.31]), younger (RRR = 0.77 [0.68–0.86]), depressed (RRR = 1.98 [1.43–2.74]) and had high rates of truancy (RRR = 2.56; CI = 1.71–3.84). A travel time of more than 30 minutes to and from school was also associated with increased rates of injury (RRR = 1.61; CI = 1.13–2.29).

**Conclusions:** Injuries are an important source of morbidity among school-attending adolescents in Dar es Salaam. The findings support more research into the contextual factors that predispose adolescents to excessive injury in the region. School settings have the potential to provide safety education in the region.

**Keywords:** injury, sub-Saharan Africa, urban setting, school health

## INTRODUCTION

Injuries represent a significant cause of mortality worldwide, resulting in approximately 950 000 deaths each year (Peden et al 2008). The majority of these deaths occur among the world's poor and in settings where a focus on infectious disease control obscures the excessive mortality caused by injury. In sub-Saharan Africa (SSA), injury has become the third leading cause of death, and traffic collisions account for a large share of the burden (Moshiro, Mswia, Alberti, Whiting & Unwin 2001; Ruiz-Casares 2009). For children below the age of five years, injuries contribute to more deaths annually than the combined totals of deaths from diphtheria, measles, polio, tetanus and whooping cough. Beyond the first five years of life, injuries pose the greatest threat to child and adolescent survival in the region. However, despite having the world's fastest-growing population of adolescents, relatively little is known about the determinants or contextual circumstances that predispose them to excessive injury (Peden et al 2008; Peltzer 2008).

In high-income country (HIC) settings, the behavioural attributes of adolescents at increased risk for injury have received significant research attention in recent years. This is partially due to an increasing recognition of adolescence as being a distinct period of life associated with substantial transitions – whether physiological, neurological or hormonal (Patton et al 2010; Wilson 2012). In Canada, for example, steep gradients in injury risk were found among adolescents who engaged in substance use, who were disengaged from school or who argued with their parents (Pickett, Garner, Boyce & King 2002). In a recent study it was found that early engagement in risky behaviours consistently predicted increases in the risk of injury by age 15 years across 25 North American and European countries (Looze et al 2012).

In low- and middle-income countries (LMICs), by contrast, research has tended to focus on the contextual circumstances of injury risk (Ruiz-Casares 2009). For example, large-scale population migration from rural areas to large cities has been identified as a factor in the rise of crowded unplanned settlements. These settlement patterns exacerbate the social and environmental conditions that stimulate increases in hazardous living spaces (Kojima 1996; Prothero 1994). Residential fires, roadways that compete with children's play areas and makeshift waste disposal sites have increased the likelihood of youth being burned, hit as pedestrians in a motor vehicle collision or coming into contact with poisons (Burrows, Van Niekerk & Laflamme 2010). Injury patterns often differ by age and gender. Additionally, prior studies (DeVore & Ginsburg 2005; Engström, Diderichsen & Laflamme 2002; Pickett et al 2005; Posner et al 2002; Schoenhuber & Gentilini 1988; Towner, Jarvis, Walsh & Aynsley-Green 1994; Yiengprugsawan et al 2012) have found injury to be associated with poverty, anxiety, signs of depression, physical activity, parental supervision, type of exposure to the traffic environment and truancy.

In SSA, injured adolescents are unlikely to have adequate access to treatment, reconstructive surgery or psychosocial rehabilitation. If disfigured, they are unlikely to return to school; and without an education, they are more likely to have difficulty in securing employment as an adult (Wilson 2012). Families must often borrow money to care for an injured child, which drives already poor households deeper into poverty (Mock, Gloyd, Adjei, Acheampong & Gish 2003; Wilson 2012).

Few nations in the region have the comprehensive health surveillance that exists in more affluent settings. In those that have hospital-based surveillance systems that include injuries, problems with data quality have been identified, as it is difficult to ascertain risk or protective factors from clinical case reports (Roman, Lewis, Kigwangalla & Wilson 2011). Additional complications arise in meeting the needs of young people before they become injured, as there are few centres in the region that respond to the unique needs of adolescents (Michaud, Berg-Kelly, Macfarlane & Benaroyo 2010).

In the United Republic of Tanzania, several studies have attempted to document injury patterns via hospital- and population-based data collection (Justin-Temu, Rimoy, Premji & Matem 2008; Moshiro et al 2005). However, these studies fell short of exploring determinants for injury patterns specific to adolescents. In addition to the limits of hospital-

based data previously mentioned, few population-based cohorts were specifically designed to measure injury-related risk or protective factors (Kamala, Wilson & Hasselberg 2011). The aim of this study was to explore the socio-demographic and contextual factors associated with injuries among adolescents in a low-income urban African setting, and to assess whether variations in risk differed according to the number of injury events.

## METHODS

### Sample

Our data were drawn from the 2006 Tanzanian Global School-based Student Health Survey (GSHS), a self-administered questionnaire that collects information on risk and protective factors for school-attending adolescents in 43 mainly low- and middle-income countries. The complete data collection methods and procedures are reported elsewhere (WHO 2012). Briefly, data were collected in Tanzania via a two-stage cluster sampling procedure representative of all secondary schools in Dar es Salaam (DES). At stage one, schools were selected with a probability proportional to the school's enrolment size. At stage two, classes were randomly selected, with all students in selected classes being eligible to participate. The school response rate was 100%, with the overall student response rate being 87%. A total of 2 176 students aged 11–16 years participated in the survey. We excluded 22 participants who did not have complete data, resulting in a final sample of 2 154 (52% were female). At the time of data collection, the study was approved by the Ministry of Health and Social Welfare.

### Measurements

We defined injury using the survey question: *"During the past 12 months, how many times were you seriously injured?"* The response categories were *"0 times", "1 time", "2 or 3 times", "4 or 5 times", "6 or 7 times", "8 or 9 times", "10 or 11 times" and "12 or more times"*. We trichotomised the responses into 0 times (reference category), one time, and two or more times.

In line with our research aim, we explored several associations in the present sample, using the following questions from the GSHS:

Associations with hunger were examined using the question: *"During the past 30 days, how often did you go hungry because there was not enough food in your home?"* The responses were *"never", "rarely", "sometimes", "most of the time" or "always"* and were dichotomised into *"sometimes/most of the time/always"* against *"never/rarely"*.

Anxiety was examined using the question: *"During the past 12 months, how often have you been so worried about something that you could not sleep at night?"* The responses were *"never", "rarely", "sometimes", "most of the time" or "always"* and were dichotomised into *"sometimes/most of the time/always"* against *"never/rarely"*.

We examined signs of depression using the question: *"During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing your usual activities?"* (Yes/No).

We examined days of physical activity using the question *"During the last 7 days, on how many days were you physically active for a total of at least 60 minutes per day?"* The responses ranged from *"0"* to *"all 7 days"* and were used in all analyses as a continuous variable.

We examined transit time to and from school using the question: *"During the past 7 days, how long did it usually take for you to get to and from school each day?"* The responses were *"less than 10 minutes per day", "10–19 minutes", "20–29 minutes", "30–39 minutes", "40–49 minutes", "50 to 59 minutes" and "60 or more minutes"*. We trichotomised these responses into three categories: *"< 10 minutes", "10 to 29 minutes" and "30 or more minutes"*.

We examined associations with truancy using the question: *"During the past 30 days, on how many days did you miss classes or school without permission?"* The responses were "0 days", "1 to 2 days", "3 to 5 days", "6 to 9 days" and "10 or more days". Students were considered truant if they missed more than 3 days of school within the 30 days prior to the survey.

Associations with three forms of parental supervision were examined using the question: *"During the past 30 days, how often did your parents or guardians check to see if your homework was done?"*; *"During the past 30 days, how often did your parents or guardians understand your problems and worries?"*; and *"During the past 30 days, how often did your parents or guardians really know what you were doing with your free time?"* The responses to each were "never", "rarely", "sometimes", "most of the time" or "always". For each of these, we dichotomised the responses into "most of the time/sometimes/always" and "rarely/never".

## **Statistical analysis**

We first conducted bivariate analyses in which we screened for associations between the trichotomised injury variable and the dichotomised independent variables. We used Pearson's chi-square for categorical variables and ANOVA for continuous variables. Subsequently, we employed multinomial logistic regression to examine the associations with each injury category compared with non-injured participants, while adjusting for age, gender, hunger status, days of physical activity, truancy, travel time to school and mental health variables. The measures of association for the regression were reported as relative risk ratios (RRR), with confidence intervals (CI) being computed at the 95% level. All analyses were conducted using Stata 12 (StataCorp, 2011) for open source Linux ([www.linuxmint.com](http://www.linuxmint.com)).

## **Results**

Within the recall period, 22.14% ( $n = 477$ ) participants reported having had one serious injury and 10.96% ( $n = 236$ ) reported having had two or more. Among the specified causes of injuries were "I fell" (47%), "something else" (17.85%), "something fell on or hit me" (14.21%), "I was in a fire" (7.77%), "I was fighting with someone" (5.79%), "motor vehicle accident" (4.96%) and "I was attacked or assaulted" (2.64%). Participants were mainly injured while engaged in a sporting activity (37.4%), walking or running (21%), doing nothing (16%) or while riding a bicycle or scooter (13%).

From the survey question: *"During the past 7 days, on how many days did you walk or ride a bicycle to and from school?"*, we computed that 36% of participants reported that they walked or rode a bicycle to and from school. No further information was available on other types of transportation.

## **Bivariate analyses**

In the bivariate analysis (table 1), the percentage of males, the level of hunger, mental health problems (anxiety and signs of depression), longer travel time to school and truancy increased with the number of injuries. No differences were found for age, days of physical activity or any form of parental supervision.

**Table 1: Bivariate analyses of serious injury among school-attending adolescents in Dar es Salaam, Tanzania (2006)**

Variable	Rates of serious injury and percentages of total			
	None (n = 1441)	One (n = 477)	Two or more (n = 236)	P-value
Mean age (SD)	13.02 (1.36)	13.10 (1.21)	12.73 (1.27)	0.258
Gender (male)	44.96	52.53	57.14	< 0.001
Hunger (yes)	10.55	12.58	16.10	0.036
Anxiety (yes)	10.96	19.29	24.58	< 0.001
Signs of depression (yes)	19.15	29.56	33.05	< 0.001
Mean days of physical activity (SD)	3.84 (2.70)	4.13 (2.77)	4.53 (2.67)	0.763
Travel time to school				0.012
<10 minutes per day	44.00	44.03	33.90	–
10–29 minutes per day	28.80	29.98	29.24	–
> 30 minutes per day	27.20	26.00	36.86	–
Truancy (> 3 days)	8.12	9.43	20.76	< 0.001
Parents involved with homework (yes)	56.77	56.60	54.24	0.766
Had understanding parents (yes)	36.43	34.17	43.22	0.600
Parents knew about what they did in their free time (yes)	13.12	13.00	15.68	0.543

### Multivariate analysis

Compared with non-injured participants (table 2), those reporting one injury within the recall period were more likely to be male (RRR = 1.29 [1.04–1.60]) and to have increased anxiety (RRR = 1.60 [1.19–2.16]) and signs of depression (RRR = 1.60 [1.25–2.04]). Those who reported two or more serious injuries were also mainly male (RRR = 1.71 [1.27–2.32]), younger (RRR = 0.77 [0.68–0.86]), anxious (RRR = 1.80 [1.23–2.63]), had signs of depression (RRR = 1.98 [1.43–2.74]), doing more physical activity (RRR = 1.10 [1.04–1.16]), more likely to be truant (RRR = 2.56 [1.71–3.84]) and to have a daily transit time of 10–29 minutes (RRR = 1.44 [1.00–2.07]) or greater than 30 minutes to and from school (RRR = 1.61 [1.13–2.29]).

**Table 2: Multivariate analysis of serious injury among school-attending adolescents in Dar es Salaam, Tanzania (2006)**

Variable	Ratio of serious injuries as relative risks RRR (95% CI)*			
	One injury	P-value	Two or more injuries	P-value
Age	1.00 (0.92–1.08)	0.966	0.77 (0.68–0.86)	< 0.001
Gender (male)	1.29 (1.04–1.60)	0.022	1.71 (1.27–2.32)	< 0.001
Hunger (yes)	1.13 (0.81–1.57)	0.470	1.20 (0.78–1.86)	0.407
Anxiety (yes)	1.60 (1.19–2.16)	0.002	1.80 (1.23–2.63)	0.002
Signs of depression (yes)	1.60 (1.25–2.04)	< 0.001	1.98 (1.43–2.74)	< 0.001
Days of physical activity	1.03 (1.00–1.08)	0.053	1.10 (1.04–1.16)	0.001
Travel time to school				
< 10 minutes daily	–	–	–	–
10–29 minutes daily	1.02 (0.79–1.32)	0.859	1.44 (1.00–2.07)	0.050
> 30 minutes daily	0.91 (0.70–1.18)	0.604	1.61 (1.13–2.29)	0.009
Truancy (>3 days)	1.07 (0.73–1.56)	0.742	2.56 (1.71–3.84)	< 0.001

\*Reference group: no injuries

\*Model adjusted for all variables indicated

## DISCUSSION

To our knowledge, this was the first study to examine injury correlates among a school-based population in DES. Overall, we found the frequencies of reported injuries in DES to be within the ranges reported across the SSA region for single injuries during a similar period of recall: Kenya (23%), Namibia (23%), Swaziland (22%), Uganda (28%), Zambia (25%), Zimbabwe (31%) (Peltzer 2008). The DES rates also fell within the highest and lowest values found among 35 HICs for one medically attended injury (lowest/highest: Greenland 18.2%/Lithuania 33.0%), but on the lower end for two or more medically attended injuries (Poland 10.1%/England 35.1%) (Pickett et al 2005). Comparisons with prior studies in Tanzania were rendered somewhat difficult owing to differences in the aggregation of injury data by age. For example, in one study, population rates are dichotomised into two population groups, 5–14 years and 15–44 years, making comparisons among adolescents difficult. However children aged 5–14 years did have slightly higher odds of sustaining a minor injury compared with their older counterparts (Moshiro et al 2005).

We found that older adolescents were less likely to be injured two or more times. An additional body of literature (Baxter-Jones, Maffulli & Helms 1993; Caine, DiFiori & Maffulli 2006; Newgard & Lewis 2005) suggests that owing to the effects of puberty on physical changes in the body, injury risk may reach an apex during the early stages of puberty. An additional later increase in risk occurs when youth begin using motorised light vehicles such as scooters (Hasselberg, Laflamme & Weitoft 2001). However, the limited age range under study did not allow for a fuller exploration of this phenomenon. Additionally, the low average rates of secondary school attendance in the region may mean that those who are able to reach secondary school may have had home and social environments that were conducive to better overall levels of health and safety, in turn promoting scholastic achievement (Filmer & Pritchett 1999; Hargreaves et al 2008).

Consistent with indications in the literature (Heath, Pate & Pratt 1993; Ruiz-Casares 2009), males were over-represented among those injured, and being injured was accompanied by poorer states of mental health. Rates of injury

increased with physical activity and injured adolescents were more likely to be absent from school, all findings consistent with the published literature (Backx, Erich, Kemper & Verbeek 1989; Barnes et al 2001).

In the bivariate analyses, we found a significant association between hunger and serious injuries; the association did not remain significant, however, when adjusted for covariates. We hypothesised that the lack of variability in the sample (limited to school-attending adolescents) may have been a contributing factor. As secondary school attendance rates in Tanzania are below the SSA average (Bommier & Lambert 2000), the inclusion of adolescents outside of school settings may have contributed more meaningful variability to detect statistically significant differences with regard to hunger status.

We found no significant association between injury and parental supervision in the present sample, despite indications in the literature that suggested otherwise (DeVore & Ginsburg 2005). One hypothesis is that supervision likely plays a greater role in modifying injury risks among younger children than it does among adolescents (Morrongiello, Corbett, McCourt & Johnston 2006).

The present study provides an important examination of injury patterns and associations specific to an adolescent population in DES, Tanzania. The strengths that enhance the reliability of our results include having data that were collected using a widely used standardised questionnaire and a sample size that was sufficient to detect statistically significant differences. However, the results must be viewed in light of their limitations. The survey did not include information on the home environment, which might have enabled the examination of contributing factors. Secondly, there was no way to determine injury severity. The injuries reported in this study as "serious" were the subjective responses of the participants. It was not possible to follow up with participants to obtain more information about their injury circumstances. Thus any mention of severity should be interpreted with caution. Thirdly, the sample is limited to adolescents that had the means to attend school. Tanzania, with a secondary school participation rate of 26% for males and 24% for females, has one of the lowest secondary school participation rates in the region (UNICEF 2012). Fourthly, the lack of information on the mode of transit was a limiting factor, which would have better supplemented the results concerning transit time. Lastly, the cross-sectional design of the study does not allow for the determination of causal relationships.

## **CONCLUSIONS**

Using a representative sample from schools in DES, we found that more than one-third of adolescents reported having had one or multiple serious injuries within a 12-month period. These injuries occurred among young people who were likely to have been among the least socioeconomically disadvantaged, representing a possible underestimate of the injury burden. Although severity information was not available, we can still conclude that injuries represent an important health threat to adolescents in DES and that measures should be taken to advance preventive measures. Further research employing multilevel designs may help to clarify relevant contextual factors that predispose adolescents to injury in the region.

## **PREVENTION IMPLICATIONS**

Taken together, these results highlight the potential for safety education in school-based settings. It is in these settings that a captive audience of adolescents during a high-risk period of their lives might benefit from safety instruction. Specific interventions based on these findings may include the creation of safe routes to school for adolescents who walk or cycle to and from school? or general safety instructions in the area of sport.

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