

Understanding the causes and consequences of injuries to adolescents growing up in poverty in Ethiopia, Andhra Pradesh (India), Vietnam and Peru: a mixed method study

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The World Health Organization estimates that almost half of all premature deaths among 15- to 19-year olds can be attributed to injuries with most (95%) fatal injuries occurring in low- and middle-income countries. Yet the evidence base for adolescent injuries in low-income countries is poor. This article uses a mixed method approach to gain an understanding of patterns, causes and consequences of unintentional injuries among adolescents aged between 14 and 16 years in four low-income country settings. Survey data collected in 2009 in Ethiopia, India (Andhra Pradesh), Peru and Vietnam (from ~900 adolescents in each country) were integrated with qualitative research (conducted between 2007 and 2011) with a nested sample of older cohort children in Ethiopia ($n=25$) and India ($n=25$) using an iterative process. Logistic regression models were fitted to examine potential risk factors for injuries. Injuries were a concern for adolescents in all countries and occurred during work, recreation and sports or transportation. Being male was associated with an increased risk for all types of injuries, whereas being poor was only significantly associated with work injuries. Area of residence (urban vs rural) made a difference in some countries and for some kinds of injuries as did perceived health status. Qualitative findings highlight the consequences of injuries not only for the adolescents but also for the social and economic status of the entire household. Injury prevention programmes need to be specific to cultural and environmental settings, expectations of adolescent's responsibilities and responsive to the context of poverty.

Keywords Adolescent health, accidents, injury, low income, youth

KEY MESSAGES

- Adolescent injuries in low-income countries can have social and economic consequences for both the individual and the wider family unit that cannot be captured in epidemiological data alone.
- Qualitative data supplement and extend quantitative adolescent injury data where hospitalization records are poor, and where individuals may not seek or have access to medical treatment.
- The social determinants of adolescent injuries must be considered as part of prevention efforts, particularly the issues of poverty, infrastructure, cultural understandings of causation and access to appropriate treatment to prevent secondary complications.

Introduction

The recent *Lancet* series on adolescent health highlighted the urgent need to invest in the health of a growing adolescent population (Resnick *et al.* 2012). Social determinants of health models emphasize the material and social conditions in which children develop and the ways in which environments pose health risks, including the risk of accidental injury (Viner *et al.* 2012); yet, there has been little systematic study of social determinants of injuries for adolescents, even in high-income countries where the focus has been on individual health risk behaviours (unsafe sex, drug abuse, tobacco and alcohol consumption). Health risks to adolescents in high-income countries differ from those in low-income countries, where the quality of physical environments poses risks of injury. Furthermore, the primary focus of recent health prevention in low-income countries for adolescents has been on sexual and reproductive health, not injury (Patton *et al.* 2012). Yet injuries are a major cause of morbidity and mortality worldwide. The World Health Organization estimates that almost half of all premature deaths among 15- to 19-year-olds can be attributed to injuries with most (95%) fatal injuries occurring in low- and middle-income countries (Bartlett 2002; Peden *et al.* 2008; Patton *et al.* 2009; Gore *et al.* 2011). The burden of injuries is likely to increase due to urbanization, increasing road traffic and other environmental changes (Reichenheim and Harpham 1989; Peden *et al.* 2008; Harvey *et al.* 2009; Rivara 2009; Sawyer *et al.* 2012). The focus here is on unintentional injuries that account for more than 90% of deaths due to injury among adolescents (Peden *et al.* 2008). Injuries can have lifelong physical and psychological consequences and can also compromise health in adulthood. Underfunded healthcare systems, lack of trauma care and inadequate social welfare may amplify the effects of injuries (Gosselin *et al.* 2009).

For high-income countries, it has been suggested that most injuries are preventable, and costs for prevention are significantly lower than costs for treatment (Kirkwood *et al.* 2010). Examples of successful programmes include seat belt and helmet use legislation that have reduced the number of crash-related injuries (Mock *et al.* 2008). However, injury prevention strategies for adolescents rarely exist in low-income countries because of competing health priorities, such as persistent child under-nutrition and infectious diseases, lack of political will and fatalistic convictions (Balan and Lingam 2012). A recent systematic review highlighted a lack of evidence on injuries among adolescents in low-income countries (Mytton *et al.* 2009). Evidence that is available focuses on injuries in children below the age of 5 years.

The World Health Organization emphasizes that to prevent injuries more effectively, multisectoral approaches are crucial (WHO 2008). Prevention programmes need an understanding of the specific regional and national injury patterns in adolescents and address country-specific risk factors (Mytton *et al.* 2009; Chandran *et al.* 2010). Adjustment to the cultural and environmental contexts of injuries, and adolescents' attitudes towards potential risks and perceptions of causes of injuries are equally important, and remain under-researched (Green and Hart 1998; Butchart *et al.* 2000). Consequently, the applicability of prevention programmes designed for high-income countries may be limited in low-income countries. This exploratory article

contributes to the limited knowledge base by integrating survey data collected from adolescents in four low-income countries with qualitative interview data collected from two of these countries. The article explores patterns, socio-demographic risk factors and consequences of unintentional injuries among adolescents within the contexts of their daily lives.

Methods

Study setting and population

This study draws on data from Young Lives, an ongoing longitudinal study investigating the changing nature of childhood poverty in four developing countries, Ethiopia, India (Andhra Pradesh), Peru and Vietnam, over a 15-year period, 2002–17 (www.younglives.org.uk). Using sentinel site sampling, 20 study sites per country were selected by local experts with oversampling of sites covering poor areas (Wilson *et al.* 2006). The sites include urban and rural areas, representing a range of regions and contexts that reflect ethnic, geographic and political diversity of the countries. Within each sentinel site, 100 households with a child aged between 6 and 18 months (younger cohort) and 50 households with a child aged between 7 and 8 years (older cohort) were randomly selected (exact procedures used varied between sites because of topographical and administrative differences within and between countries, see [Barnett *et al.* 2012]). The first survey data collection took place shortly after recruitment in 2002, the second in 2006 and the third in 2009 using questionnaires for the children (above the age of 8 years) and their caregivers. Qualitative data collection with a 'nested' sample of 25 children from each cohort has been conducted in 2007, 2008 and 2010/2011, enabling children's experiences to be explored in depth. Combined with the longitudinal design and the detailed information gathered in the household and child surveys, this provides a unique dataset with which to study children's biographies.

The focus here is on the older cohort, as this age group has been shown to be disproportionately affected by injuries (Gore *et al.* 2011). We use data collected from adolescents aged 14–16 years in the third survey round (in 2009) from all four countries, and qualitative data collected in 2008 and 2010/11 in India and Ethiopia, respectively. We have excluded qualitative data from Peru because analysis exists of adolescents' injuries (Penny *et al.*, in preparation, who report that accidents are common, and most occur during sports and play. Adolescents often combine work and school, children who work for pay have more accidents, and almost all serious work-related injuries were during agricultural work). We have also excluded Vietnam where qualitative research has focused on children's experiences of school. In the other three countries, methods focused more generally on children's well-being and daily experiences, roles and responsibilities, thus providing opportunities for injuries to be discussed.

Young Lives has ethics approval from University of Oxford CUREC and IIN Peru. Collective consent is sought within communities, and informed consent is obtained from children and caregivers. Participants' willingness to continue their participation is regularly sought, and they are reminded that they can disengage whenever they want to. All names used here are pseudonyms [Morrow 2009].

Method to integrate survey and qualitative data

For this article, an iterative approach is used to integrate survey and qualitative analysis and interpretation (Moran-Ellis *et al.* 2006). After an initial analysis of both data sets separately, key areas where adolescents reported injuries (at work or while doing chores for the household, during recreation and sports in their free time or at school or during transportation) were identified from the survey. These key areas broadly structured a two-way process whereby survey and qualitative analysis informed each other, to acquire a deeper understanding of socio-demographic risk factors and potential long-term health consequences injuries within the living contexts of the adolescents. Both components make equal and independent contributions to the understanding of the realities of adolescent injuries, in an attempt to integrate the methods and not merely combine them (Greene *et al.* 1989; Clarke 2003).

Quantitative outcome variables and independent risk factors

Data on prevalence of injuries were collected by asking adolescents whether they had any serious injury/ies that prevented them from doing normal activities (e.g. work and school) for at least 1 day and/or required medical attention in the last 3 years. This threshold was chosen to capture major and minor injuries that have been shown to make up a high proportion of injuries in developing countries (McClure *et al.* 2002). Further questions were asked about the activities when injured, and whether the young person had fully recovered, to identify longer-term health consequences.

Potential socio-demographic risk factors to be included in the analyses were selected a priori on the basis of existing literature and are reported in Table 1. The wealth index was a composite variable calculated from three different indices: housing quality, consumer durables and services (this is the main measurement of socioeconomic status in Young Lives). Self-rated health was assessed by asking: 'How would you describe your health: very good, good, average, poor, and very poor?' Answers were categorized into very good to good and average to poor self-rated health status.

Statistical analysis

The prevalence of injuries sustained and the percentage of adolescents who were injured but did not recover fully were calculated overall and by activity. Multivariate logistic regression models adjusted for clustered sampling were fitted to estimate the association between potential socio-demographic risk factors and injuries at work, during recreation or sports and during transportation. Adjusted odds ratios (AORs) with their 95% confidence intervals (CIs) were reported. Analysis was done using STATA 11.

Qualitative sample selection and analysis

As noted, 25 adolescents in each cohort and their parents were drawn from survey participants in 2007 for qualitative longitudinal study. Qualitative study sites were selected from within the 20 study sites per country to enable exploration of variations in location, ethnicity and socioeconomic status, and to include sites from differing regions, reflecting the main

Table 1 Socio-demographic characteristics of the adolescents who participated in Round 3 of the Young Lives survey (older cohort only)

	Ethiopia	India	Peru	Vietnam
Total	972	974	674	969
Gender (<i>n</i> , %)				
Female	474 (48.7)	509 (51.2)	317 (46.8)	497 (50.2)
Male	499 (51.3)	485 (48.8)	368 (53.7)	493 (49.8)
Age (mean, SD)	15.0 (0.3)	14.9 (0.4)	14.9 (0.3)	15.1 (0.3)
Residence (<i>n</i> , %)				
Urban	403 (41.4)	249 (25.1)	414 (60.4)	204 (20.6)
Rural	570 (58.6)	745 (75.0)	271 (39.6)	785 (79.8)
Wealth ^a (<i>n</i> , %)				
Poor	777 (80.0)	420 (43.1)	286 (42.4)	235 (24.2)
Less poor	195 (20.0)	554 (56.9)	388 (57.6)	735 (75.8)
Health status (<i>n</i> , %)				
Good	772 (79.4)	835 (85.7)	440 (65.3)	486 (50.2)
Poor	200 (20.6)	139 (14.3)	234 (34.7)	483 (49.8)

^aWealth: based on wealth index of household.
SD, standard deviation.

ethnic or caste groups. Sites also reflect a balance between urban and rural areas. In India, four sites, three rural and one urban, were chosen. In Ethiopia, five sites were selected, two urban and three rural. Multiple qualitative data collection methods are used, including semi-structured individual interviews (see Crivello *et al.* 2009). At each round, participants are asked about health problems. While the survey explicitly asks questions about health, the qualitative research is loosely framed around what children recall, and want to talk about. The qualitative data reveal a wealth of information about the burden of ill-health within poor families, and preoccupations with family ill-health, including their own. Of the 25 children interviewed in Ethiopia, 5 described injuries; and of the 25 interviewed in Andhra Pradesh, 7 spoke about injuries. However, there may be differences here relating to the time period they are referring to. This is a serendipitous body of qualitative data in the sense that injuries were mentioned in the course of more open-ended discussions on other topics, but the fact that a large proportion of the sampled children mentioned injuries is in itself an indication of its importance.

Fieldwork is carried out by local research teams. Interviews are digitally recorded, transcribed and translated. Qualitative data were coded under meta-themes (well-being, transitions and services) using ATLAS-ti to enable consistency and comparability across countries and between rounds. Research teams construct sub-themes of the coding framework according to specific research foci. For this article, additional analysis of qualitative data identified examples where adolescents mentioned health, ill-health and injury. Contextual information is provided from analysis of full transcripts.

Findings

Table 1 presents the characteristics of adolescents and their households included in this article.

Injuries emerged as a concern for adolescents in both the analysis of the quantitative and qualitative data. Table 2 shows the prevalence of injuries and the number of adolescents who did not fully recover. Most injuries were reported by adolescents in India (19%), followed by Peru (14%), Ethiopia (14%) and Vietnam (8%). Injuries were sustained during work (includes paid/unpaid work and household chores), recreation and sports (during free time or at school) or transportation (includes in vehicle as passenger, riding a bike or motorbike and as a pedestrian). Between 5% (Vietnam) and 14% (Peru) of adolescents who reported an injury said they did not recover fully and suffered from ongoing health problems. In qualitative interviews, adolescents describe several immediate and long-term consequences for their schooling and capacity to work, as well as for the social and economic situation of the entire household.

Work injuries

The majority of adolescents interviewed regularly engaged in paid work and/or helped with household chores (ranging from 80.1% in India to 99% in Ethiopia). Work is a necessity for poor children in many developing countries (Bourdillon *et al.* 2010) and children in rural areas work in subsistence farming at varying degrees of intensity in locally specific tasks. Studies of injuries among children who work have tended to focus on single industries, and tend to neglect the broader social and economic consequences of injuries (Cooper *et al.* 1999; Fischer

et al. 2003; Fassa *et al.* 2010). Injuries during work were slightly more frequent in Ethiopia (6.7%) and India (6.6%) than in Peru (4.3%) and Vietnam (2.2%), reflecting rates and types of work in each country. Falls were a frequent cause for work injuries across all four countries. In Ethiopia, cuts were frequent, whereas adolescents in India reported traffic-related injuries. Animal-related injuries were reported only in Ethiopia and Peru. Nine percent of adolescents who had reported an injury in India experienced long-term health problems as a consequence, whereas in Vietnam (though the total number of work injuries was smaller) no long-term health problems were reported. Results from logistic regression models associating injuries with potential socio-demographic risk factors are presented in Table 3 below. In Ethiopia and India, boys had higher odds of work injuries than girls [Ethiopia: AOR 2.06 (95% CI: 1.08–3.94); India: AOR 1.95 (95% CI: 1.26–3.03)]. Poverty was associated with the occurrence of work injuries in Ethiopia, Peru and Vietnam with adolescents from poor households at a greater risk than the ones from better-off households ($P < 0.05$). Living in rural areas increased the likelihood of a work injury by more than 15 times in India [AOR: 15.70 (95% CI: 2.54–96.61)]. Poor perceived health almost doubled the odds for a work injury in Ethiopia [AOR: 1.75 (95% CI: 1.02–3.10)].

In qualitative interviews, adolescents described how they engaged in work from early childhood onwards, and how there are consequences that go far beyond the actual injury; these

Table 2 Prevalence and outcomes of injuries among adolescents in the last 3 years by activity and country, Young Lives study

Injuries (<i>n</i> , %)	Ethiopia <i>N</i> = 972	India <i>N</i> = 974	Peru <i>N</i> = 674	Vietnam <i>N</i> = 969
Any injuries	135 (13.8)	185 (19.0)	96 (14.2)	79 (8.2)
Not fully recovered (<i>n</i> , % of any injury)	13 (9.6)	14 (7.6)	13 (13.5)	4 (5.1)
Work injuries	65 (6.7)	64 (6.6)	29 (4.3)	21 (2.2)
Not fully recovered (<i>n</i> , % of work injury)	4 (6.2)	6 (9.4)	1 (3.4)	0
Fall	15 (1.5)	23 (2.4)	8 (1.2)	9 (0.9)
Cut/stab	26 (2.7)	4 (0.4)	12 (1.8)	7 (0.7)
Traffic	2 (0.2)	7 (0.7)	0	0
Animal related	4 (0.4)	0	3 (0.4)	0
Others	18 (1.9)	30 (3.1)	6 (0.9)	5 (0.5)
Recreation/sports injuries	55 (5.7)	78 (8.0)	61 (9.1)	30 (3.1)
Not fully recovered (<i>n</i> , % of recreation injury)	7 (12.7)	4 (5.1)	11 (18.0)	1 (3.3)
Fall	33 (3.4)	49 (5.0)	39 (5.8)	25 (2.6)
Cut/stab	7 (0.7)	0	10 (1.5)	0
Traffic	2 (0.2)	6 (0.6)	5 (0.7)	4 (0.4)
Animal related	4 (0.4)	0	2 (0.3)	0
Others	12 (1.2)	24 (2.5)	5 (0.7)	1 (0.1)
Transport injuries	15 (1.5)	43 (4.4)	6 (0.9)	28 (2.9)
Not fully recovered (<i>n</i> , % of transport injury)	2 (13.3)	4 (9.3)	1 (16.6)	3 (10.7)
Fall	7 (0.7)	8 (0.8)	2 (0.3)	10 (1.0)
Cut/stab	7 (0.7)	0	1 (0.1)	0
Traffic	4 (0.4)	28 (2.9)	2 (0.3)	16 (1.7)
Animal related	1 (0.1)	1 (0.1)	0	1 (0.1)
Others	18 (1.9)	6 (0.6)	1 (0.1)	1 (0.1)

Table 3 Logistic regression models for potential risk factors associated with injuries among adolescents in the last 3 years, by country and activity, Young Lives study

Risk factor	Ethiopia AOR (95% CI)	India AOR (95% CI)	Peru AOR (95% CI)	Vietnam AOR (95% CI)
Work injury				
Gender (female)				
Male	2.06 (1.08–3.94)*	1.95 (1.26–3.03)***	1.03 (0.52–2.07)	1.38 (0.44–4.29)
Age (≤ 14 years)				
>14 years	0.93 (0.51–1.67)	1.25 (0.79–1.98)	1.13 (0.42–3.01)	2.59 (0.64–10.41)
Residence (urban)				
Rural	0.93 (0.43–2.06)	15.70 (2.54–96.61)**	1.72 (0.69–4.29)	3.70 (0.59–23.40)
Wealth ^a (less poor)				
Poor	1.82 (1.03–3.22)*	1.28 (0.75–2.19)	2.64 (1.04–6.64)*	2.89 (1.15–7.74)*
Health status (good)				
Poor	1.75 (1.02–3.10)*	0.98 (0.47–2.05)	0.86 (0.41–1.80)	1.32 (0.55–3.13)
Recreation and sports injury				
Gender (female)				
Male	3.58 (1.72–7.45)***	1.58 (0.83–2.99)	1.41 (0.87–2.29)	3.43 (1.81–6.49)***
Age (≤ 14 years)				
>14 years	0.88 (0.56–1.38)	0.95 (0.53–1.69)	1.27 (0.79–2.05)	1.43 (0.70–2.95)
Residence (urban)				
Rural	0.82 (0.39–1.71)	0.99 (0.41–2.29)	1.33 (0.53–3.25)	0.39 (0.20–0.72)**
Wealth ^a (less poor)				
Poor	0.70 (0.39–1.27)	1.08 (0.61–1.90)	0.41 (0.18–0.93)*	0.47 (0.12–1.76)
Health status (good)				
Poor	2.05 (0.94–4.50)	1.45 (0.78–2.69)	2.35 (1.50–4.25)***	1.36 (0.75–2.43)
Transport injury				
Gender (female)				
Male	3.90 (1.06–14.41)*	2.72 (1.40–5.69)**	2.00 (0.39–10.09)	1.13(0.52–2.45)
Age (≤ 14 years)				
>14 years	0.63 (0.20–1.89)	0.94 (0.54–1.67)	2.36 (0.42–12.96)	0.83 (0.33–2.10)
Residence (urban)				
Rural	0.72 (0.25–2.09)	1.19 (0.48–2.92)	1.31 (0.30–5.61)	0.15 (0.06–0.36)***
Wealth ^a (less poor)				
Poor	1.19 (0.56–2.51)	0.73 (0.36–1.50)	5.59 (0.70–44.10)	0.75 (0.16–3.45)
Health status (good)				
Poor	1.03 (0.26–4.14)	3.71 (1.57–8.39)**	3.29 (0.64–16.93)	1.23 (0.55–2.75)

* $P < 0.05$, ** $P < 0.005$, *** $P < 0.001$.^aWealth: based on wealth index of household.

include social and economic effects as well as longer-term effects on schooling, all of which can affect children's life chances. Adolescents described how injuries happened while they work on farms, in small enterprises, in street vending and in households. As in the survey analysis, cuts, e.g. from axes, machetes and stone crushing equipment, were frequently mentioned. Animal-related injuries, such as snakebites when collecting firewood, bites and kicks from livestock, were also identified as a cause of injury (see [Morrow & Vennam 2012], for discussion of adolescents' accounts of risks in agricultural work in India and measures they take to protect themselves).

Injuries can have social and economic consequences for the adolescents affected. Bereket is an orphan living with his grandmother in Bertukan, an overcrowded area in the centre of Addis Ababa. He works at a garage, and in 2009, he injured his hand when he was changing a car tyre: 'I was fixing a tyre... I

was trying to inflate it by increasing the electric power... but unfortunately the tyre popped... and it has broken my hand'. Bereket's employer took him to hospital, and his hand was plastered. Bereket could not work for 4 months, and because he missed the examination period, the government school he had been attending refused to accept him back; therefore, he paid to attend a private school.

Injuries to adolescents can also have social and economic consequences for the entire family. When interviewed in 2009, age 13, Habtamu, a boy from Tach-Meret, a rural area in Amhara region of Ethiopia where there is food insecurity, explained that his main activities were vegetable farming, irrigating, taking vegetables to market and fetching firewood. His older brother had left home to search for work, and this increased Habtamu's workload and he took on more responsibilities. He described an accident he had when cutting

firewood, 'An axe hit me on my leg when I was chopping wood'. While the injury was 'not bad', and his parents initially tried alternative treatment, it became much worse:

First, my parents put chilli and alcohol on the sore... I was treated in this way for one month. However, I was seriously sick and I was taken to the modern health centre. I had one medicine by injection and another medicine which was taken in the form of fluid... Then I was able to recover from the injury.

Eventually, his father paid for the hospital treatment, and his younger brother collected firewood and undertook Habtamu's work on the farm, until Habtamu was better. This example illustrates two points that are both related to poverty: first, the injury affected not only Habtamu but also the household as a whole (financial burden, his brother's time for school); and second, that relatively minor injuries can easily develop into major injuries because seeking medical treatment is delayed.

Haymanot, age 13, when interviewed in 2009, is from Zeytuni, a drought-prone rural area highly dependent on government support in Tigray region of Ethiopia. She describes working in stone-crushing work for long hours (7 am to 5 pm). She injured the tip of her finger at work and this meant she 'missed work for six days due to the accident because there was swelling in my hand, ... I was not able to work'. She did not get sick pay, and did not go to the health clinic, but got better 'I was massaging it with oil'.

Thus, our analysis highlights that adolescents growing up in poor households might be particularly vulnerable to work injuries. Qualitative findings further indicate that survey evidence alone might underestimate the burden of work injuries, as many injuries might not have been captured in the survey because they were treated at home or were initially minor injuries that worsened over time due to lack of medical treatment.

Recreation and sports injuries

Recreation and sports were the most common activities associated with injuries in India (8%), Peru (9%) and Vietnam (3%) and the second most common in Ethiopia (6%). Most injuries were caused by falls followed by cuts and traffic-related injuries. In both Ethiopia and Peru, injuries during sports or recreation often resulted in long-term health problems (13 and 18% of all adolescents who sustained injuries, respectively). In logistic regression models being male increased the odds for an injury during sports or recreation by more than three times in both Ethiopia [AOR 3.58 (95% CI: 1.72–7.45)] and Vietnam [AOR 3.43 (95% CI: 1.81–6.49)] and non-significantly increased the odds in India and Peru. Rural residence more than halved the risk for a sports or recreation injury in Vietnam [AOR 0.41 (95% CI: 0.18–0.93)]. No significant association between household wealth and injuries during recreation or sports could be found. Adolescents who described their overall health status as poor had an increased risk for a recreational injury in Peru [AOR 2.35 (95% CI: 1.50–4.25)].

Qualitative analysis supported survey findings with regard to gender differences in injuries, with more boys describing

injuries than girls, reflecting findings in high-income countries (Pickett *et al.* 2005). Boys engaged more frequently in risky recreational activities, such as climbing and jumping from trees, roofs and stones, and exposed themselves to more risks for injury. For example, Yitbarek, living in Leku, a rapidly growing town in the SNNP region of Ethiopia, described how he was 'jumping from a stone near our kitchen, and then I stood on the ground where it was not level, and sprained my leg'. In Polur, a densely crowded area in Hyderabad, AP, boys described injuries from kite fighting, a popular sport for adolescents all over Asia. Injuries ranged from serious falls from roofs and electric shocks when kites become caught in electricity cables.

Several boys complained about the lack of safe recreational spaces. In Ethiopia, Miki, age 14, who lives in Bertukan, described how his area

doesn't have recreational areas, there is a lack of free space, there is a problem of housing as a result overcrowding, there are also economic problems, and it could be hazardous to raise children here... People dump garbage and liquid waste in front of your house... This exposes people... to germs. Children can get sick if they play here.

Boys in Bertukan described playing football on roads because there was no football pitch for them to use. They described how they were afraid of being hit by cars when doing so. In India, boys play cricket on wasteland that can be uneven and often leads to trips and falls.

Boys often sustained injuries during organized team sports. Miki described how he had broken his hand when he was playing football:

While I was trying to score a goal, one of the guys who was playing against me pushed me, and the other kicked my hand and I was hurt.

Adolescents were aware of potential risks in their living environments, and they also learned from their experiences, and adapted protective behaviours to avoid future injuries. For instance, one boy described how he went to fetch a ball from the roof of a house, but fell onto an iron rod, suffered an electric shock, and injured his stomach. He still remembers the incident, and now avoids climbing on roof tops.

Transport injuries

Low income countries are developing road infrastructure at a very rapid rate, and road traffic is increasing, together with the risk of accidents (Peden *et al.* 2008). Transport-related injuries were most frequently reported by adolescents in India (4.4%) and Vietnam (2.9%). Most injuries were caused by falls or crashes. Transport-related injuries had long-term health consequences for a few children in all four countries. In Ethiopia [AOR 3.90 (95% CI: 1.06–14.41)] and India [AOR 2.72 (95% CI: 1.40–5.69)] boys were at a higher risk for transport-related injuries than girls. Rural residence significantly decreased the odds of a transport injury only in Vietnam ($P < 0.001$), whereas no significant association with area of residence could be found in the other countries. Adolescents in India who perceived their health as poor had almost four times the odds of sustaining a

transport injury than the ones who described their health as good ($P < 0.005$).

The qualitative analysis indicates a gender difference in the types of transport injuries adolescents experienced and feared. In both India and Ethiopia, boys were frequently injured while riding bikes or motorbikes. High speed combined with poor quality roads, lack of lighting and too many passengers on bicycles or motorbikes were often mentioned as the cause of accidents. For example, Govindh, from Katur, a poor rural 'mandal' in Rayalaseema region in India, described how one of his class mates had been killed 2 weeks earlier:

It was 8 o'clock at night. He was on a bike, there were three people on the bike... The lorry driver parked his lorry on the side of the road... and got down... there were many pits in the road... I felt very sad.

Rajesh, age 15, who lives in Manipur, a tribal 'mandal' in the north coastal part of AP, described a motorbike accident

Few months back I fell down from my friend's motor bike... Some holes are [in the] road. He went very fast... we slipped from bike and fell off... We went to hospital immediately and got treatment.

Because of this he was unable to attend school for 10 days, and he suffered a lot from the pain caused by the injuries: 'I was very much scared after the accident...'. A study of traffic accidents in Hyderabad, India, undertaken with 2809 5- to 14-year-olds, found that boys are much more likely to be injured, but they are also more likely to be riding bicycles than girls (Dandona *et al.* 2011).

In India, girls described being afraid of being injured while using overcrowded public transport. Sarada, age 15, living in Katur, described how she was afraid of falling: 'I was afraid to get into the bus... Sometimes it will be crowded. I was even pushed down also'. The risk of falling was especially great as doors were often missing.

Explaining injuries

Findings from qualitative interviews indicate how adolescents' cultural beliefs influence perceptions of the causes of injuries. Spiritual forces, the 'evil eye' and punishment for previous sins were often mentioned. In Ethiopia, people tend to believe that bad things that happen to somebody could be divine punishment for doing something wrong. For example, during religious holidays or Sundays, orthodox followers are expected to spend their time not working, but going to church and then going home. If something happens to somebody, it is common for people to ask 'what wrong have they done?' or 'who cursed them?' (Y Tafere, personal communication). Afework (from Bertukan in Addis Ababa) described how his brother was cursed when playing football 'on the day of St Mary' and was hit by a car. Defar, interviewed in 2008, explained that his brother was injured in a serious fall when 'Satan (evil spirit) pushed him and he fell'. In India, spirits are mentioned to explain illness and injuries (see also Froerer 2007, who notes that offending the spirits is offered as an explanation by children for injuries/death).

Discussion

This mixed method study provides new insights into the phenomena of unintentional injuries in low-income country settings. The findings indicate that injuries are a reality for adolescents in all four countries, and emphasize that these need to be seen in the environmental contexts of poverty. Work injuries were frequent in India and Ethiopia, with poorer adolescents and boys at the greatest risk. Physically demanding work, such as stone-crushing and farm work, expose adolescents to injury risks. Poorer adolescents may be exposed to more dangerous work, or work under more dangerous conditions (Bourdillon *et al.* 2010).

Injuries during sport and recreation were frequent with some country-specific differences in the sources of injuries (e.g. kite flying or cricket in India). Boys were consistently at a higher risk for recreational injuries. Lack of recreational areas and unsafe living environments often featured as the causes for recreational injuries in adolescents' descriptions.

Transport injuries were reported from most countries, but were particularly frequent in Vietnam and India. Boys were more vulnerable to transport injuries than girls. Poor infrastructure, such as roads and unsafe public transport were mentioned as underlying reasons for transport injuries.

The qualitative findings highlight potential long-term consequences of injuries not only for the individual adolescents concerned but also for their wider households as their income-generating capacities are reduced. Delayed medical treatment is exacerbated by poverty because of the lack of affordable treatment and available services, and recourse to traditional healers may aggravate minor injuries.

Consistent with existing research (Peden *et al.* 2008; Kirkwood *et al.* 2010) we find boys were more likely to be injured. Cultural constructions of masculinity may encourage risk-taking (Doyal 2001), but there is a paucity of information in relation to accidental injuries for low- and middle-income countries.

Adolescents who perceived their health status as poor were at a higher risk for injuries in Ethiopia (in relation to work), India (in relation to transport) and Peru (in relation to recreation). The broad finding that self-reported health complaints are associated with injury risk is in accordance with existing findings from high-income countries (Mattila *et al.* 2004). For a better understanding of this association, further exploration is needed of the concept of perceived health among adolescents. Available literature for high-income countries suggests that young people have broad concepts of their health and consider a variety of factors and contexts in their perceptions of health that can include physical as well as mental health and well-being. Among adolescents, perceived health status might also be a somatic expression of life distresses, such as financial difficulties, problems within their families or at school (Goodman 1999; Wade *et al.* 2000; Goodman *et al.* 2007; Boynton-Jarrett *et al.* 2008; Heard *et al.* 2008). Many of these factors can by themselves or in combination appear to increase risk for injuries or risky health behaviours that might expose adolescents to injuries (e.g. alcohol or drug consumption).

Finally, adolescents are aware of risks and try to avoid them. Perceived causes for injuries include bad luck and carelessness and, in some cases, are related to the spiritual world.

Limitations

We flag the following limitations. The analysis presented here is cross-sectional only, limiting conclusions regarding causation. The assessment of injuries relied on self-reports and might have been affected by recall biases. Furthermore, the focus of the qualitative data gathering is on aspects of children's general well-being, and injuries were not the explicit focus of research, so the analysis is based on incidental references to injuries and their effects. A comparison with existing prevalence data on minor to major injuries would be valuable, but prevalence data that we could use to compare our sample are lacking. However, in this context, it is important to remember that the Young Lives samples are not nationally representative, but purposefully collected pro-poor samples. Moreover, Young Lives is not a health survey. Comparison with prevalence data derived from national representative samples may therefore be limited and potentially misleading. Moreover, as pointed out by Patton *et al.* (2012), data coverage on many adolescent health issues (including injuries) is poor, and surveillance systems that routinely collected data on minor to major injury data among adolescents in low-income countries are lacking. Finally, questions used to assess injury prevalence and the recall time-frame varies considerably between studies (see e.g. McClure *et al.* 2002 for a discussion of different indicators to assess injury prevalence).

Implications and future research

There are a number of implications for injury prevention programmes. While standardized data are now being collected on injuries that result in hospitalization in most countries (Hyder *et al.* 2009), this study indicates that health care in low-income countries is often inaccessible to poor people, and they are likely to try lay remedies first. Consequently, estimation based on hospital data might underestimate the burden of injuries among adolescents.

The findings emphasize that injury prevention approaches need to be adapted to differing environments and cultural understandings. This highlights the need to focus on how adolescents conceptualize health risks, to generate locally relevant health messages, working with community norms. Biomedical approaches emphasize child survival, but when poverty underlies the causes and consequences of injuries, a social determinants of health model may be better suited to approach the study of injuries holistically, because it can take into account new physical risks (such as roads and other rapid infrastructural developments) presented by changing socioeconomic environments that characterize many low-income countries.

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