**Fatal injuries among urban children in South Africa: risk distribution and potential for reduction**

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The health and lives of children from the African Region of the World Health Organization (WHO) are threatened not only by nutritional deficiencies and infectious diseases but also by injuries of various kinds. The older the children are, the more injuries they are likely to sustain and the greater the share of their overall mortality and morbidity that will be due to injuries. Regional figures show that in children aged 5–14 years, injuries account for 23% of deaths, with road traffic injuries – predominantly among pedestrians – as leading causes. Additionally, childhood deaths due to violence and wars in the region are almost as numerous as childhood deaths from such causes in the rest of the world combined.

Injuries need to be understood in the context of both historical and current sociopolitical development. Although still largely rural, Africa is experiencing rapid urbanization, fuelled by both natural population growth and massive migration from rural to urban areas. With an urban growth rate of almost 5%, it is urbanizing faster than any other continent in the world. Infrastructure development has not kept pace with this and about 30–60% of urban residents now live in slums and squatter settlements characterized by inadequate housing, poor sanitation, high unemployment and minimal medical and social services.

As in other regions, inequalities in wealth and health both between and within countries are considerable. South Africa, where this study was conducted, is one of the most urbanized and economically developed countries in the region. However, vast socioeconomic disparities exist, manifested mainly – but not exclusively – in disparities between population groups. Despite efforts to redress such inequalities since the government policy of apartheid was eliminated in 1994, high levels of unemployment, violence and crime persist. Against this background, living and commuting conditions are precarious for many children and the risk of childhood injury is high. Yet, we know little about the sociodemographic or geographic risk distribution for the leading injury causes or where the greatest potential for risk reduction lies. Fortunately, with the development in 1999 of the National Injury Mortality Surveillance System (NIMSS) across several regions of the country, data have become available on the demographic characteristics of the deceased, the time and place of injury, and the manner and external cause of death. In this study, these data were used to address the following questions: (i) What are the leading causes of fatal injuries for urban South African children aged 0–14 years? (ii) What are the sociodemographic and geographic distributions of those injuries? (iii) What is the current potential for exposure reduction of fatal injuries among urban South African children?

**Methods**

We obtained data from all cities with full coverage by the NIMSS, 2001–2003. These cities, among the largest in the country, represent 12.9 million people, or 50% of the country’s total urban population. Children aged 0–14 years, who number 3.4 million, comprise 26% of their population. With the names of their historical urban centers and total population size in 2001, these cities are: City of Cape Town Metropolitan Municipality (Cape Town; 2.9 million); City of Johannesburg Metropolitan Municipality (Johannesburg; 3.2 million); City of Tshwane Metropolitan Municipality (Pretoria; 2.0 million); eThekwini Metropolitan Municipality (Durban; 3.1 million); Nelson Man-
The majority are African (65%), with Indian/Asians constituting the smallest population group (6%). A comparison of the top five causes of fatal injury for all cities combined (representing 1857 deaths) in Table 1 shows the distribution of the 2923 fatal injuries considered thereafter across demographic groups, along with the population distribution of these groups extracted from the 2001 national census data. Among children in the six cities, the population is fairly evenly distributed across sex and age groups. The majority are African (65%), with Indian/Asians constituting the smallest population group (6%). A comparison between the proportions of population and of injuries clearly shows an imbalance, with excess proportions of injuries among males, children aged 0–4 years and African children.

We first compared the leading causes of fatal injury in children for each city. We then calculated the age-adjusted rates and population attributable risks (PARs), by sex, population group and city, for each of the top five causes of fatal injury for all cities combined. The PAR was calculated by subtracting the incidence in the unexposed ($I_u$) from the incidence in the total population, exposed and unexposed ($I_p$), and dividing the result by the incidence in the total population:

$$\text{PAR} = \frac{I_p - I_u}{I_p}$$

This allowed us to assess the percentage reduction in fatal injuries that could be achieved among children aged 0–14 if all groups had the same exposure level as the group at lowest risk. In other words, they represent how many lives could be saved if approaches were found to reduce the safety divide.

The study was approved by the Ethics Committee of the Medical Research Council of South Africa.

Results

Approximately two-thirds of all children died from one of the top five causes of fatal injury (Fig. 1). Pedestrian injuries, drowning and burns ranked among the top three causes of death in all cities except Cape Town, where firearm-related deaths outnumbered those due to drowning. For Tshwane and Buffalo City, drowning deaths led, accounting for approximately one in four cases. For the other four cities, pedestrian deaths were most common. Firearm-related deaths were leading causes in Tshwane and Cape Town only, ranking fourth and third respectively. In the other cities, road traffic injuries with an unspecified road user (i.e. with no indication of whether the victim was a pedestrian, passenger or driver) contributed between 8.7% and 13.3% of fatally injured cases. In Buffalo City, sharp objects were among the top five leading causes of childhood fatal injuries (14.4% of cases).

Age-adjusted rates and PARs (expressed as percentages) by sex, population group and city are shown for each of the top five leading injury causes for the six cities combined (representing 1857 deaths) in Table 2. Differences between the rates of fatal injury in males and females varied by cause: they were greatest for drowning deaths, which...
### Table 2. Number of events, \(^a\) age-adjusted death rates\(^b\) and population attributable risks\(^c\) for leading causes of fatal injury in children by sex, population group and city, South Africa, 2001–2003

<table>
<thead>
<tr>
<th>City</th>
<th>Sex</th>
<th>No.</th>
<th>Rate</th>
<th>No.</th>
<th>Rate</th>
<th>No.</th>
<th>Rate</th>
<th>No.</th>
<th>Rate</th>
<th>No.</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>eThekwini</td>
<td>Male</td>
<td>453</td>
<td>9.2</td>
<td>99</td>
<td>2.0</td>
<td>265</td>
<td>5.3</td>
<td>206</td>
<td>4.1</td>
<td>109</td>
<td>2.2</td>
</tr>
<tr>
<td>Nelson Mandela</td>
<td>Female</td>
<td>300</td>
<td>6.1</td>
<td>86</td>
<td>1.7</td>
<td>108</td>
<td>2.1</td>
<td>153</td>
<td>3.0</td>
<td>63</td>
<td>1.3</td>
</tr>
</tbody>
</table>

\(^a\) Total numbers may vary across variables because of missing data for sex and population group.

\(^b\) Per 100 000.

\(^c\) PARs (shown as percentages) are calculated using the group with the lowest rate as the reference, i.e., females for all causes; Indian/Asian children for passenger, drowning and firearm-related deaths; white children for pedestrian and burn deaths; Tshwane for pedestrian, passenger, burn and firearm deaths; Cape Town for drowning deaths. The formula used to calculate PARs was \(\frac{I_u - I_x}{I_u}\), where \(I_u\) is the incidence in the unexposed and \(I_x\) the incidence in the total population (exposed and unexposed).

NA, not applicable; PAR, population attributable risk.

Werenote more than twice as common among males as females (5.3 and 2.1 per 100 000 respectively) but were negligible for motor vehicle passenger deaths (2.0 and 1.7 per 100 000 respectively). Except for the latter, African and coloured children had substantially higher fatal injury rates, especially as pedestrians, than white or Indian/Asian children.

The highest rates for pedestrian and passenger deaths were found in Nelson Mandela (10.0 and 3.1 per 100 000 respectively), while Buffalo City had the highest rates for drowning, burn and firearm-related deaths (9.2, 5.4 and 2.8 per 100 000, respectively). Tshwane had the lowest rates for all fatal injuries except drowning, which was lowest in Cape Town.

PARs for different fatal injuries varied considerably across sociodemographic groups. When sex was examined, the PAR was very low for fatal injury as a motor vehicle passenger but high for death from drowning. If all children had the same exposure rate as girls, drowning deaths would fall by 42.2%. For population groups, PAR values were generally high; they were highest for fatal injury as a passenger (90.4%) and lowest for fatal injury as a motor vehicle passenger. PAR values of 30.9% for fatal injury with a firearm and 39.5% for fatal drowning and 47.5% for fatal burns indicate considerable potential for improvements if children from all population groups had the exposure rates of Indian/Asian or white children, respectively.

The rates of all fatal injuries showed substantial potential for reduction when the city with the lowest fatal injury rate was used as the exposure reference. PARs were higher for traffic injuries affecting pedestrians (67%) and motor vehicle passengers (56.3%); as many as two-thirds of pedestrian deaths could be avoided if all cities had the same exposure level as Tshwane. Even the lowest PAR showed a potential reduction of 40.6% of deaths from drowning if all cities had the same exposure levels as Cape Town.

### Discussion

The five leading causes of fatal injury among children in urban South Africa account for as many as two-thirds of the deaths. Road traffic injuries, particularly those involving pedestrians – whose mode of transportation is characteristic of the poor – are common across cities.\(^{14}\) Also important, although less frequent, are deaths from drowning,\(^{10}\) burns\(^{16}\) and, in some cities, firearm injuries.\(^{16}\) PARs indicate substantial disparities, more so among population groups and cities than between girls and boys. The differences in PARs across injury causes highlight the varying contributions of and interactions between the environmental and social context, and individual attributes related to stage of child development, temperament and behaviour.\(^{17,18}\)

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**Table 2.** Number of events, age-adjusted death rates and population attributable risks for leading causes of fatal injury in children by sex, population group and city, South Africa, 2001–2003.
Safety-for-all prevention strategies

Numerous interventions for the prevention and control of violence and injuries have been evaluated and promoted as effective. These are listed in various reports, including some recently published WHO documents on road traffic crashes and on injuries in general.20,21 Even child-specific measures (e.g. car seats, safe drug packaging) have been compiled.22

One evidence-based safety-for-all approach is that of home safety education and visitation programmes to promote safe practices in the home.23 Applied in South Africa, such programmes have effectively influenced the uptake of a range of safe practices (e.g. cooking safely, storing medicines and cleaning products out of reach of children), with resultant substantial hazard reductions.24 When developing such programmes for economically and socially deprived groups and areas, it may be essential to act on major barriers to the uptake of safe practice, such as the affordability and accessibility of the products suggested and the readability of the instructions provided.25 The distribution of child-resistant containers for the storage of paraffin in South Africa proved effective in reducing paraffin ingestion and provided evidence that families will use such devices when they are provided free of cost.26

Putting less demand on individual practice by reducing exposure to hazards in poor living and commuting environments is imperative. For pedestrian mortality, risk reduction counter-measures can include physical development changes (e.g. traffic separation, traffic calming), infrastructural changes such as improving public transport systems themselves27,28 or offering alternatives to the street by creating attractive places for recreation (e.g. the Harlem Injury Prevention Program).29

Equity oriented measures

Given the magnitude and variability of the burden of fatal injuries in children in South Africa, lowering rates requires not only safety-for-all counter-measures, but also targeted measures aimed at addressing inequalities in both the distribution of injuries among different socioeconomic groups and structural safety in urban living and commuting arrangements.30,31

In South Africa, to strengthen disadvantaged communities a partnership with residents from townships in Johannesburg worked effectively to lobby the local government to provide a pedestrian bridge over a highway.22,29 The South African government has also implemented several equity-oriented policies, including the National Housing Policy (providing over 2 million houses since 1994),30 the National Electricity Basic Support Services Tariff Policy (which makes 50 kWh freely available to low-income households) and legislation that sets standards for kerosene-fuelled appliances.31 A variety of positive effects on child injury reduction and safety enhancement in general can be expected from these measures, but evaluations are needed to fully assess them.

Socioeconomic and infrastructure-related data gathered by the South African Cities Network for several cities, including those in this study, could be highly useful in evaluating the link between contextual factors and injury outcomes. For example, what specifically contributed to the better position of Tshwane for almost all childhood injury causes is unclear, but answering this question could certainly help reduce traffic-related, burn and firearm-related injuries.

Strengths, limitations and future research

This study highlights the leading fatal injuries among children in urban areas of South Africa and, in so doing, presents key targets for prevention. The disparities across groups and areas reflected in the PARs show the potential for improvement within the country. In other words, if approaches were found within and outside the health sector to reduce the safety divide, many lives could be saved. Because of the wide coverage of urban areas in our study, the profile of childhood injuries in such areas, although variable, is likely to be well represented. This is an important issue given rapid urban growth.

While the study has provided broad targets for prevention, future research needs to examine the risk factors associated with each of the leading types of injuries and to move beyond the use of sex and population group as measures of differences between groups. Data gathered at the neighbourhood level could help in this regard. It is also important to consider non-fatal injuries for prevention and public health.

Data reliability and validity are a concern both internationally and locally, especially in South Africa and for certain population groups. This could be a limitation of the current study if the data for some sociodemographic groups were more reliable than for others or if the bias were unevenly distributed across cities. Finally, small caseloads for some groups, particularly Indian/Asian children, reduce the robustness of the results.

Conclusion

The five leading causes of fatal injury among children in urban South Africa include road traffic injuries, drowning, burns and, in some cities, firearm injuries. Among children, a high variability is observed between population groups and cities in the rates of fatal injury from the most common causes. There is a case for a safety agenda that combines safety-for-all counter-measures, aimed at lowering injury rates across the entire population, and targeted counter-measures that help reduce the burden for those at greatest risk. Tackling the five leading causes of fatal injury in childhood in urban South Africa could form part of the greater development agenda that the major cities have undertaken.

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Fatal injuries in children in South Africa

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Resumen
Lesiones mortales en niños de zonas urbanas de Sudáfrica: distribución de los riesgos y posibilidades de reducirlos

Objetivo Determinar las principales causas de lesiones mortales entre niños urbanos de Sudáfrica de 0 a 14 años, así como la distribución de esas causas y las posibilidades actuales de introducir mejoras en la seguridad.

Métodos Obtuvimos datos de vigilancia de lesiones a partir del Sistema Nacional de Vigilancia de la Mortalidad 2001-2003 para seis grandes ciudades de Sudáfrica de diverso tamaño, desarrollo y composición sociodemográfica. Calculamos las tasas de mortalidad ajustadas por edad, sexo, grupo de población y ciudad correspondientes a las cinco causas principales de lesiones mortales, así como los riesgos atribuibles poblacionales (RAP).

Resultados Las causas principales de lesiones mortales en la infancia abarcan los traumatismos causados por el tránsito -entre los pasajeros de vehículos y sobre todo como peatones-, las noyadas, los brûlures et, dans certaines villes, les blessures par arme à feu. De grandes differences ont été observées dans les valeurs du RA en population, notamment entre certains groupes de population et la population des grandes villes concernées. Ces écarts atteignaient une valeur maximale pour les décès résultant de traumatismes chez des piétons, tandis que les disparités entre filles et garçons étaient les plus fortes pour les décès par noyade.

Conclusion Compte tenu des grandes variations relevées entre la population des villes et certains groupes de population dans la fréquence des tipos les plus courants de traumatismes mortels, un programme en faveur de la sécurité devrait combiner des contre-mesures visant la sécurité pour tous, c’est-à-dire la réduction des fréquences de traumatisme pour tous - et des contre-mesures ciblées, destinées à réduire la charge d’accidents pour les plus exposés.

Résumé
Traumatismes fataux parmi les enfants urbains d’Afrique du Sud : distribution des risques et possibilités de les réduire

Objectif Déterminer les principales causes de traumatismes fataux pour les enfants urbains d’Afrique du Sud appartenant à la tranche d’âges 0-14 ans, la distribution de ces causes et les possibilités actuelles d’améliorer la sécurité.

Méthodes Nous avons obtenu des données de surveillance des traumatismes auprès du Système national de surveillance de la mortalité par traumatisme concernant la période 2001-2003 pour six grandes villes d’Afrique du Sud, différant par le nombre d’habitants, le stade de développement et la composition sociodémographique. Nous avons calculé les taux de mortalité ajustés pour l’âge par sexe, groupe de population et ville pour les cinq principales causes de traumatismes fataux, ainsi que les risques attribuables (RA) en population.

Résultats Parmi les principales causes de traumatismes fataux chez l’enfant, figuraient les accidents de la route - comme passagers de...
References


