



Juan lives with his mother, father, four younger brothers and two younger sisters in a small village outside Merida, in Mexico. Aged 14 years, Juan no longer goes to school, as he has to help his father selling fruit at the roadside.

The reason that he left school is related to a terrible accident that the youngest in the family, Martha, suffered 18 months ago.

Martha – six years old at the time – had fallen into the water well in the back yard of the family house, while trying to retrieve a toy that she had dropped into it. Juan was the first onto the scene of the incident and had called for his father who was further up the road selling fruit. The two of them ran to the nearest clinic holding Martha, who was limp and not crying. The doctors managed to resuscitate her but she remained in a critical condition and needed to be transferred to a larger hospital in Merida, where she stayed for many weeks.

Juan went to visit his sister once in hospital, but did not like it there as he said that the hospital had a strange odour. He preferred to stay at home with his grandmother and help with the other children while his mother stayed at the hospital with Martha.

Martha is a beautiful girl, who is now mentally disabled and needs assistance with all her daily needs.

Juan is still very affected by this incident. He feels responsible for Martha's fall into the well, convinced that it would not have happened if he had been there. At the same time, he is proud to show visitors the wooden construction he and his father made to put over the well, to prevent a similar incident occurring.

Chapter 1

Child injuries in context

Background

Every child in the world matters. The landmark Convention on the Rights of the Child, ratified by almost all governments, states that children around the world have a right to a safe environment and to protection from injury and violence. It further states that the institutions, services and facilities responsible for the care or protection of children should conform with established standards, particularly in the areas of safety and health. Safeguarding these rights everywhere is not easy, but it can be achieved by concerted action. Children are exposed to hazards and risks as they go about their daily lives and are vulnerable everywhere to the same types of injury. However, the physical, social, cultural, political and economic environments in which they live differ greatly. Their particular environments are thus very important.

This chapter provides an overview for the report. The first section sets the scene, examining why child injury is important, how the issue relates to other concerns about children, and why there is an urgency to tackle it. The second section examines major features of the problem: the multiple types and causes of injury to children, and the associations between injury and age, gender and a range of socioeconomic factors. The third section seeks to show that child injury is preventable. It describes the principles of injury prevention, the types of approaches that are successful and the problem of adapting proven interventions to different settings. It also discusses the cost and cost-effectiveness of interventions to prevent child injury. The final section summarizes some of the obstacles in this field and the approaches to overcoming them.

What is an injury?

Throughout the report, an injury is defined as “the physical damage that results when a human body is suddenly subjected to energy in amounts that exceed the threshold of physiological tolerance – or else the result of a lack of one or more vital elements, such as oxygen” (1). The energy in question can be mechanical, thermal, chemical or radiated.

As discussed in the introductory section, the focus of this report is on *unintentional* injuries: traffic injuries, drowning, poisonings, burns and falls. For more information on *intentional* injury, see the *World report on violence against children* (2).

Who is a child?

This report uses the definition of the United Nations Convention on the Rights of the Child, Article 1: “a child means every human being below the age of 18 years” (3). Other concepts related to children, though, are more fluid. “Childhood” is a social construction, whose boundaries shift with time and place (4, 5) and this has implications for vulnerability to injury. A 10-year-old in one country may be protected from economic and domestic responsibilities, but in another country these tasks may be the norm and considered beneficial for both the child and the family (6). Thus, childhood and developmental stages are intertwined with age, sex, family and social background, school, work and culture (6, 7). Rather than being rigidly measured, they should be viewed through “context, culture and competences” (8).

Why is child injury important?

Childhood injury is a major public health problem that requires urgent attention. Injury and violence is a major killer of children throughout the world, responsible for about 950 000 deaths in children and young people under the age of 18 years each year (WHO Global Burden of Disease: 2004 update). Unintentional injuries account for almost 90% of these cases. They are the leading cause of death for children aged 10–19 years. Table 1.1 shows the contributions that the various types of unintentional injuries make to the leading causes of death among children. Road traffic injuries alone are the leading cause of death among 15–19-year-olds and the second leading cause among 10–14-year-olds.

In addition to the deaths, tens of millions of children require hospital care for non-fatal injuries. Many are left with some form of disability, often with lifelong consequences. Table A.2 in the Statistical Annex shows the leading causes of disability-adjusted life years (DALYs) lost for children aged 0–14 years, with road traffic crashes and falls ranking in the top 15 causes.

The burden of injury on children falls unequally. It is heaviest among the poor with the burden greatest on children in the poorer countries with lower incomes (see Table A.1 and A.2 in the Statistical Annex). Within all countries, the burden is greatest on those from low-income families. Overall, more than 95% of all injury deaths in children occur in low-income and middle-income countries. Although the child injury death rate is much lower among children from developed countries, injuries are still a major cause of death, accounting for about 40% of all child deaths (WHO Global Burden of Disease: 2004 update).

TABLE 1.1

Leading causes of death in children, both sexes, World, 2004

Rank	Under 1 year	1–4 years	5–9 years	10–14 years	15–19 years	Under 20
1	Perinatal causes	Lower respiratory infections	Lower respiratory infections	Lower respiratory infections	Road traffic injuries	Perinatal causes
2	Diarrhoeal diseases	Diarrhoeal diseases	Road traffic injuries	Road traffic injuries	Self-inflicted injuries	Lower respiratory infections
3	Lower respiratory infections	Measles	Malaria	Drowning	Violence	Diarrhoeal diseases
4	Malaria	Malaria	Diarrhoeal diseases	Malaria	Lower respiratory infections	Malaria
5	Congenital anomalies	HIV/AIDS	Meningitis	Meningitis	Drowning	Measles
6	Pertussis	Congenital anomalies	Drowning	HIV/AIDS	Tuberculosis	Congenital anomalies
7	HIV/AIDS	Protein–energy malnutrition	Protein–energy malnutrition	Tuberculosis	Fire-related burns	HIV/AIDS
8	Tetanus	Drowning	Measles	Diarrhoeal diseases	HIV/AIDS	Road traffic injuries
9	Meningitis	Road traffic injuries	Tuberculosis	Protein–energy malnutrition	Leukaemia	Pertussis
10	Measles	Meningitis	HIV/AIDS	Self-inflicted injuries	Meningitis	Meningitis
11	Protein–energy malnutrition	Fire-related burns	Fire-related burns	Leukaemia	Maternal haemorrhage	Drowning
12	Syphilis	Pertussis	Falls	Fire-related burns	Falls	Protein–energy malnutrition
13	Endocrine disorders	Tuberculosis	Congenital anomalies	War	Poisonings	Tetanus
14	Tuberculosis	Upper respiratory infections	Epilepsy	Violence	Abortion	Tuberculosis
15	Upper respiratory infections	Syphilis	Leukaemia	Trypanosomiasis	Epilepsy	Fire-related burns

Source: WHO (2008), Global Burden of Disease: 2004 update.

Injuries are not inevitable; they can be prevented or controlled. In the Organisation for Economic Co-operation and Development (OECD) countries, for example, the number of injury deaths among children under the age of 15 years fell by half between 1970 and 1995 (9). Until recently, little attention had been paid to the issue of injuries in low-income and middle-income countries. The lack of awareness of the problem, compounded by the particular circumstances that these countries face, has meant that proven measures have not been implemented to the same extent as they have in high-income countries.

Countries face many competing priorities and injury interventions need to be properly assessed for their effectiveness. However, a great deal more is known about preventing child injury and death than has been acted upon. Research continues to shed new light on the scale of the problem as well as on the potential that exists for saving

lives and preventing injuries. For example, the analyses of the South and East Asian community surveys of injury (see Statistical Annex, Table B.1) show just how significant child injury is. Injury is responsible for 30% of deaths in 1–3-year-olds, with the figure approaching 40% in 4-year-olds and 50% to 60% among those aged 5 to 17 years (10).

How does child injury relate to other child health concerns?

As injury is a leading cause of death and disability among children worldwide, preventing child injury is closely connected to other issues related to children's health. Tackling child injury must be a central part of all initiatives to improve the situation of child mortality and morbidity and the general well-being of children (see Box 1.1).

In recent decades, programmes related to child survival targeted infectious diseases and nutritional deficiencies in infants and children. Campaigns were conducted for

BOX 1.1

International contributions towards improving child health

Convention on the Rights of the Child

In November 1989, the United Nations Convention on the Rights of the Child set a new international standard for respecting children and their rights (3). The Convention stresses the responsibilities of society to protect children (from birth up to the age of 18 years) and provide them with appropriate support and services. It further states that children have the right to the highest attainable level of health and the right to a safe environment, free from injury and violence.

World Health Assembly resolutions

The World Health Assembly, the annual meeting of the world's health ministers, has strongly promoted, through its resolutions, the recommendations contained in WHO's *World report on violence and health* (11) and *World report on road traffic injury prevention* (12). These include Resolution WHA 56.24 on violence and health (13) and Resolution WHA 57.10 on road safety and health (14). Children are frequently mentioned in these and other resolutions as a special target group for interventions.

Millennium Development Goals

In September 2000, the General Assembly of the United Nations adopted a series of Millennium Development Goals. The fourth goal is to reduce, by two thirds, the mortality rate of children under the age of 5 years, between 1990 and 2015 (15). Because of the large number of deaths of children under the age of 1 year from infectious diseases and neonatal causes, injury is responsible for only around 1.5%–2.0% of deaths in this age group. However, for children aged between 1 and 4 years, injuries are a more significant cause of death, accounting for just over 6% of all deaths. United Nations Member States are committed to meeting all eight Millennium Development Goals by 2015. Not all countries will meet the fourth goal if they do not include injury prevention in their programmes.

A World Fit for Children

In May 2002, the United Nations General Assembly held a Special Session on children, from which a document, *A world fit for children*, was produced. This sets out a number of health goals for children. One of these, specific to injuries, calls on all Member States to "reduce child injuries due to accidents or other causes through the development and implementation of appropriate preventive measures" (16).

Child survival

Child survival has become an important issue globally, as part of a broader and growing concern for the health and well-being of children and young people. Indeed, child survival has been described as "the most pressing moral dilemma of the new millennium" (17). The Bellagio papers provide new estimates of the numbers and causes of child deaths, including injuries, and suggest that two thirds of the nearly 11 million annual deaths among children under the age of 5 years can be prevented by implementing a set of 23 proven and cost-effective interventions (18). To be most effective, child injury prevention efforts should be integrated into broader child health initiatives.

breastfeeding, growth monitoring, immunization and oral rehydration therapy. Millions of lives were saved, and the lives of many more children were improved. However, unless injury prevention is included in such programmes, as these children grow up and are subjected to injuries, the impact of the large investments in immunization, nutrition and maternal and child health care may be lost (19).

"If we are ultimately going to meet the Millennium Development Goal to reduce child mortality, it is imperative that we take action to address the causes of childhood injury" Anupama Rao Singh, Regional Director of UNICEF East Asia and Pacific.

Child injuries and the changing world

Over fifty years ago, one child injury expert declared that: "it is now generally recognized that accidents constitute a major problem in public health" (20). A report of 1960 from the World Health Organization Regional Office for Europe shared this view: in high-income countries, it announced, injury had become the leading cause of

death in children older than one year (21). However, the acknowledgement that childhood injuries are a significant problem in developing countries has been more recent.

With improvements in other areas of child health and better methods of collecting data, it is now clear that injury is a leading cause of child death and ill-health in low-income and middle-income countries (22, 23). The full extent of the problem of injuries in many countries, though, is still not fully understood. Recent large-scale community-based surveys in five countries in South and East Asia (Bangladesh, China, the Philippines, Thailand and Viet Nam) of overall child mortality, have found much higher levels of death from injury – both before and after the age of five years – than had been previously thought (19). This approach has complemented hospital-based and clinic-based health information systems, which often miss many injury deaths since, for example, a drowned child is almost never taken to a hospital or local clinic. Drowning, although unrecognized as a major cause of child death in earlier estimates, accounted for around half of all child injury deaths in each of the countries surveyed (19).

Tackling the injury problem is possible. Experience and research have both shown that most child injuries, and deaths from injuries, are preventable in all countries (9, 24, 25).

Globalization

Globalization involves a set of socioeconomic, cultural, political and environmental processes that intensify the connections between nations, businesses and people (26–28). The more rapid dissemination of ideas and knowledge of injury prevention (29), and the growth of a global civil society (26) involving networks of formal and informal groups, can have a positive influence on injury issues. However, there are also negative effects (see Box 1.2). With greater freedom of movement of capital across national boundaries, the production of goods – often a hazardous process – can more easily shift to regions of cheaper labour (28). This, in turn, can lead to increased transport in places where road safety is poorly developed (30). Centres of cheap production often have weaker controls on occupational health and child labour.

Whether globalization will increase or decrease the amount of child labour has been the subject of debate (31). According to the International Labour Organization, in 2004 there were still 218 million child labourers under the age of 15 years. However, over the past four years, there has been a global fall in the number of children working, particularly of those working in hazardous occupations (32). In some places, though – such as Gujarat state in India – economic growth has led to more children working, which is likely to lead to a greater number of injuries (33, 34).

Urbanization

Urbanization, much of it unplanned and ill-resourced, is accelerating children's exposure to risk (35). Over the next two decades, a large part of the world's population growth will be in urban areas. The proportion of the global population in urban areas is predicted to rise from around 50% today to over 60% by 2030 (36). Most of this growth will be in Asia and Africa (37).

Urbanization can promote positive attributes for health (38, 39). Medical care for injuries may be easier to provide in urban than in scattered rural areas and there are economies of scale in providing better housing and services. However, as a result of natural growth and migration, cities may expand beyond the capacity of resources to cope adequately (40, 41). Urban slums and squatter camps pose high risks of injury for children across the world (42, 43).

Motorization

The increase in motorization is related to trends in globalization and urbanization, yet it is worth examining separately because of its significant impact on child injury.

BOX 1.2

The effects of globalization on child injuries

Valli was devastated. She had left her small daughter alone for a few minutes, to go out to fetch water from the communal tap. On her return, she found the child had drowned in just 10 cm of water. Valli usually carried water from the tap in the traditional *kodam*, but stored it in the new plastic buckets that are now cheaply available in India.

With increasing globalization and a fast-expanding Indian middle class, the country's use of plastic has soared. Plastic is everywhere – in products, packaging and bags for carrying home goods. Unlike many other countries, though, India recycles almost half of all plastic goods, converting them into other cheap plastic products such as water buckets, that are often sold without lids. Local bucket-making factories buy plastic from recycling shops for about 35 rupees (less than one US dollar) a kilogram and make cheap containers of various shapes and sizes from the processed plastic.

Drowning can occur in even just a shallow amount of liquid at the bottom of a bucket. Given the shape, size and stability of these buckets, they may not tip over when a child leans into one and falls inside. The older and safer practice of storing water in a *kodam* – with its narrow opening that kept water cool and dirt-free and prevented drowning – has been discarded in favour of a cheaper plastic solution.

A similar problem of drowning in buckets was observed by the Consumer Product Safety Commission in the United States some 15 years ago. The Commission subsequently recommended a performance standard, a ban on this type of bucket and an information and education campaign.



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Roads have always been dangerous places for children. However, the rapid increase of traffic and the shift of transport systems around the world to roads make the issue especially pressing. Deaths and injuries from road traffic crashes are forecast to rise across the world by 67% between 1990 and 2020 (12).

Improved transport and a good road infrastructure are usually considered crucial for overall development (44, 45). The OECD Development Co-operation Directorate's Task Team on Infrastructure for Poverty Reduction (46) has pointed to benefits for the poor who need better

transport to access markets, job opportunities, education and health facilities. In Morocco, for instance, paved roads have helped increase school attendance substantially (44). A major increase in road infrastructure has been proposed for Africa by the Commission for Africa (47) as part of the efforts to achieve the Millennium Development Goals. It would be ironic, though, if pursuing the Millennium Development Goals – without strictly considering health and safety issues – led to an increase in death and injury among children from road traffic crashes or as a result of increased pollution.

Environmental change

The scale and impact of environmental risks may well be accelerating, induced by the global effects of climate change. The Intergovernmental Panel on Climate Change has predicted an increase of between 1.5 °C and 6 °C by 2100, depending on future carbon emissions (48). The causal pathways by which climate change could affect children's health are not clear; they are often indirect and their consequences may be felt at different times (49–53). Children may be exposed to risk of injury through an increase in extreme weather conditions that pose direct hazards – such as flooding, cyclones or mud flows from heavy rains. They may also be exposed through longer-term degradation of environments – such as droughts, desertification or rises in sea level (54, 55). Children in low-income countries face the greatest problems. Squatter and other makeshift urban settlements are often highly vulnerable to flooding, and health systems in these places are generally less able to cope (56). Both extreme and long-term environmental change can lead to migration, with people ending up living in marginal, unsafe conditions.

The characteristics of child injury

Unintentional injuries are one of the leading causes of death, hospitalization and disability across the world. However, the pattern and aetiology of injuries and their outcome vary substantially within populations and across countries. Epidemiologic analysis has long identified broad factors that, within specific environments, pinpoint the types of injury and the groups of children most at risk (21, 57).

In high-income countries, research has identified risk factors and protective factors for individual types of child injury (58, 59). Detailed work on child injury in low-income and middle-income countries began more recently and is now indicating priorities for prevention.

The characteristics of children susceptible to injury vary greatly by age, gender, race and socioeconomic status. These factors are dealt with in the following section and in greater detail in the individual chapters in this report.

The child-injury pyramid

Death is the most notable measure of injury but it is neither the only outcome nor the most common. Injury is often graphically represented as a pyramid, with the smallest group, that of death, at the top, hospitalized injury in the middle and the largest group, non-hospitalized injury, at the base. The first study of the sizes of these groups was carried out by the Child Safety Network in the United States in the early 1980s. Their analysis showed that for every one child under 19 years of age who was fatally injured, 45 children required hospitalization and a further 1300 were seen in an emergency department and discharged (60).

This pattern has been confirmed by detailed work in other regions and countries, although the exact ratios are affected by the local provision of services and the degree of access to hospital care. UNICEF and the Alliance for Safe Children have examined health histories for two and a quarter million people in five countries of South and East Asia (10). The combined data show that, for children under 18 years of age, for each death there are 12 children admitted to hospital or permanently disabled and 34 children who needed medical care or missed school or work because of an injury.

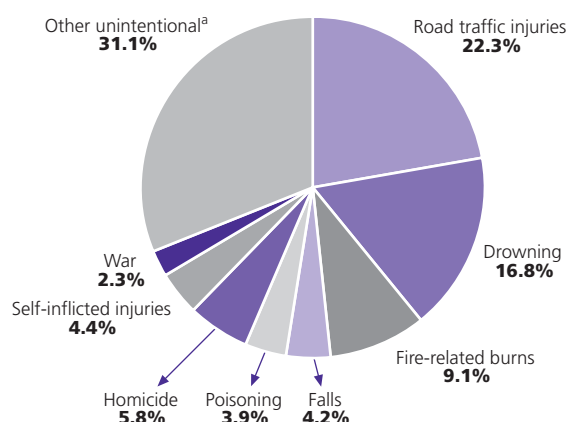
Children are not only affected by injuries to themselves, but also by injury to others. This applies particularly to the loss or disability of parents or caregivers through injury, and indeed of other members of the family, and they are affected by expenses and loss of income within the family as a result of injury (61, 62). In Jiangxi Province in China, for instance, for children of primary school age or younger, about half of parental deaths are associated with injury (63).

Fatal child injuries

In 2004, approximately 950 000 children under the age of 18 years died of an injury. The majority of these child injuries were the result of road traffic collisions, drowning, burns (fire or scalds), falls or poisoning (see Figure 1.1). These five categories, classified as unintentional injuries, make up 60% of all child injury deaths. A further category, labelled “other unintentional injuries”, includes smothering, asphyxiation, choking, animal or snakebites, hypothermia and hyperthermia. This group accounts for 23% of childhood deaths, a significant proportion.

The rate of child injury death is 3.4 times higher in low-income and middle-income countries than in high-income countries, but there are large variations according to the category of injury death. For fire and flame deaths, the rate in low-income countries is close to 11 times higher than in high-income countries, for drowning it is six times higher, for poisons four times and for falls around six times higher (see Table 1.2).

FIGURE 1.1
Distribution of global child injury deaths by cause, 0–17 years, World, 2004



^a "Other unintentional" includes categories such as smothering, asphyxiation, choking, animal and venomous bites, hypothermia and hyperthermia as well as natural disasters.

Source: WHO (2008), Global Burden of Disease: 2004 update.

TABLE 1.2
Unintentional injury death rates per 100 000 children^a by cause and country income level, World, 2004

	UNINTENTIONAL INJURIES						TOTAL
	Road traffic	Drowning	Fire burns	Falls	Poisons	Other ^b	
HIC	7.0	1.2	0.4	0.4	0.5	2.6	12.2
LMIC	11.1	7.8	4.3	2.1	2.0	14.4	41.7
World	10.7	7.2	3.9	1.9	1.8	13.3	38.8

^a These data refer to those under 20 years of age.

^b "Other" includes categories such as smothering, asphyxiation, choking, animal or snakebites, hypothermia and hyperthermia as well as natural disasters.

HIC = High-income countries; LMIC = low-income and middle-income countries.

Source: WHO (2008), Global Burden of Disease: 2004 update.

The association of age with injury type is found in both rich and poor countries. As can be seen in Table B.1 in the Statistical Annex, the combined results of the South and East Asian community surveys show that, in that part of the world, the main cause of injury death in children under 1 year of age is suffocation. In children under 5 years it is drowning, for those aged between 5 and 9 years drowning is joined by road traffic injuries and animal bites, while among children aged 10–17 years, road traffic deaths are the most significant unintentional injury. However, there are great differences between rich and poor countries. While drowning is the leading cause of injury death among children under 5 years in both the United States and Asia, the rate of death per 100 000 children is 30 times higher in Asia (19, 62).

Table 1.3 shows that rates of injury death vary substantially by age in high-income countries with the highest rate, that for 15–19-year-olds, being four times the lowest rate, that for 5–9-year-olds.

TABLE 1.3
Unintentional injury death rates per 100 000 children by age and country income level, World, 2004

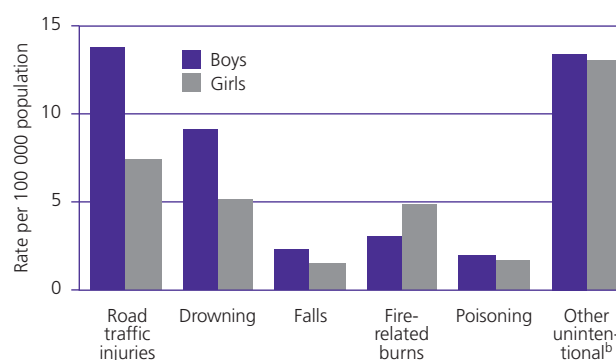
	AGE (in years)					
	Under 1	1–4	5–9	10–14	15–19	Under 20
HIC	28.0	8.5	5.6	6.1	23.9	12.2
LMIC	102.9	49.6	37.6	25.8	42.6	41.7
World	96.1	45.8	34.4	23.8	40.6	38.8

Source: WHO (2008), Global Burden of Disease: 2004 update.

In an analysis of child death rates by sex, the rate of male deaths exceeds that of female deaths in nearly all categories of injury, with the exception of fire-related burns (see Figure 1.2). The female excess in fire-related burns is particularly noticeable in certain parts of the world, such as the WHO South-East Asia Region and the low-income and middle-income countries of the Eastern Mediterranean Region, where deaths of female adolescents can exceed those of males by up to 50% (see Statistical Annex, Table A.1).

In most regions and countries, the gender gap for fatal injuries increases with age. At the global level, injury death rates among children under the age of 1 year, as well as those aged 1–4 years, are about the same for males and females. However, in children aged 5–9 years, male death rates are a third higher than female rates, a discrepancy that increases to 60% among those aged 10–14 years. Adolescents aged 15–17 years show an adult profile, with males in that age group accounting for more than 86% of all injury deaths, particularly in high-income countries.

FIGURE 1.2
Unintentional injury death rates per 100 000 children^a by cause and sex, World, 2004



^a These data refer to those under 20 years of age.

^b "Other unintentional" includes categories such as smothering, asphyxiation, choking, animal and venomous bites as well as natural disasters.

Source: WHO (2008), Global Burden of Disease: 2004 update.

Non-fatal child injuries

The types of injury associated with child death are different from those that cause non-fatal injury and can again be different from those that cause long-term effects. The community surveys conducted in South and East Asia have shown up the relative significance of non-fatal injury and how it differs from fatal injury. Similarly, in Brazil, for children under 15 years of age, the leading causes of unintentional injury death are associated with traffic-related injuries and drowning, while more than half of all non-fatal injuries are the result of a fall (64). These findings also come out in the 28-country Global School Health Survey, where in all countries, except one, falls are the leading causes of non-fatal injury but account for only a small proportion of fatal child injuries (see Statistical Annex, Table A.3). Focusing on death data alone, therefore, may result in injury prevention strategies ignoring frequent injuries that are also costly to the health care system.

Injuries and subsequent disability

Head injuries are the single most common – and potentially most severe – type of injury sustained by children. Among minor injuries incurred by children, cuts and bruises are those seen most frequently. However, the most common category of unintentional injuries suffered by children under 15 years and requiring hospital admission are various types of fractures to the arms and legs (see Table 1.4).

In addition to mortality, hospital admissions, emergency department attendances and days lost from school can all be used as markers of injury severity. There are also more specific scoring methods, including notably, the Injury Severity Score, the Revised Trauma Score and the Paediatric Trauma Score. A review of the different types of measures currently used indicates that there is no standard method to determine the severity of an injury in a particular child (65). Each type of measure has its drawbacks and may vary according to the cause of injury or access to care. Measures of disability also tend to be non-standard.

TABLE 1.4
Nature of unintentional injuries sustained^a by children under 15 years, World, 2004

Type of injury sustained	Rate per 100 000 population	Proportion of all unintentional injuries (%)
Intracranial injury ^b – short-term ^c	419.4	16.3
Open wound	316.9	12.3
Poisoning	282.4	10.9
Fractured ulna or radius	209.3	8.1
Burns <20%	152.7	5.9
Fractured clavicle, scapula or humerus	133.8	5.2
Internal injuries	129.3	5.0
Fractured femur – short-term ^c	115.8	4.5
Fractured patella, tibia or fibula	81.1	3.1
Fractured hand bones	70.1	2.7
Fractured face bones	60.1	2.3
Fractured skull – short-term ^c	55.2	2.1
Fractured vertebral column	54.5	2.1
Fractured ankle	34.8	1.4
Injury to eyes – short term	34.3	1.3
Sprains	33.7	1.3
Injured nerves – long-term ^d	26.1	1.0
Other dislocation	24.1	0.9
Fractured foot bones	23.2	0.9
Intracranial injury ^b – long term ^d	21.0	0.8

^a Requiring admission to a health facility.

^b Traumatic brain injury.

^c Short-term = lasts only a matter of weeks.

^d Long-term = lasts until death, with some complications resulting in reduced life expectancy.

Source: WHO (2008), Global Burden of Disease: 2004 update.

Data from the Global Childhood Unintentional Injury Surveillance conducted in four cities showed that nearly 50% of children under the age of 12 years who had suffered an unintentional injury severe enough to warrant presentation to an emergency department were left with some form of disability (Statistical Annex, Table C.1). Among children who had suffered a burn, 8% were left with permanent disabilities, while children injured in traffic crashes were significantly more likely to be left with some form of disability (Table 1.5).

Many young people who survive major trauma are left with ongoing disabilities, with a major impact on their own lives as well as on the lives of their families. These disabilities may be physical, mental or psychological. Some of the problems encountered in the years following injury include an inability to attend school, find suitable work or engage in an active social life. There are also other more basic problems such as having to cope with continued pain. Support for these young people most often falls on their close family and friends (66).

Child injury and age

Injury prevention strategies need to take into account child development in different and sometimes changing contexts. Adolescence, for example, has become a more significant developmental stage in many low-income countries, whereas before there had been a more direct transition from childhood to adulthood (67). Childhood is also changing at earlier stages in some places. In parts of sub-Saharan Africa, HIV/AIDS is creating parentless households. With young children forced to take on adult responsibilities (68) the nature of childhood in these areas has changed radically (69).

Exposure to injury risk for children also depends on the particular set of laws that are in place and the degree to which these are enforced. These laws include the legal ages for entering the formal workforce, for driving, and for drinking alcohol. There are often considerable differences between countries.

- Alcohol can be legally consumed at 15 years in Belgium, but not until the age of 20 years in New Zealand.
- A car can be legally driven in New Zealand at the age of 15 years. In Sweden the legal driving age is 18 years (70).

What makes children particularly susceptible to injury?

Children are not just small adults. Their physical and cognitive abilities, degrees of dependence, activities and risk behaviours all change substantially as they grow older (50, 71–75). As children develop, their curiosity and wish to experiment are not always matched by their capacity to understand or to respond to danger (76).

At about 3 months of age children will start to wriggle and roll, at about 6 months they will sit up, and they will start crawling at around 9 months. Objects are reached for, grasped and put in their mouth. At 18 months they are mobile and exploring the world. Child development and behaviour is therefore highly associated with particular injuries. Poisoning, for example, is linked to the grasping and drinking behaviour of children aged 1–3 years, while falls are related to the stage of learning to walk.

Analysis of injury using age ranges in years can be too broad to detect the rapid change in development and injury risk among very young children. By using 3-month age brackets, one study showed that falls were the leading cause of injury in children aged under 3 years, but that the particular items that caused their falls – such as furniture,

TABLE 1.5

Injury severity and estimated long-term effects of unintentional injuries among children^a presenting to emergency departments in four countries^b

	TYPE OF UNINTENTIONAL INJURY					Total
	Road traffic injuries (n = 350)	Falls (n = 913)	Burns (n = 210)	Poisoning (n = 66)	Drowning (n = 20)	
	Injury Severity Score (ISS)					
Lowest score	0	0	0	0	0	0
Highest score	75	75	75	16	75	75
Median ISS	4	4	3	1	4	4
Mean ISS ^c	10	5	5	3	11	7
	Disability					
No significant disability	38%	53%	51%	80%	65%	56%
Short term temporary disability (< 6 weeks)	43%	39%	24%	12%	20%	40%
Long term temporary disability (≥ 6 weeks)	17%	8%	17%	8%	5%	12%
Permanent disability	3%	1%	8%	0%	10%	2%

^a aged under 12 years.

^b Bangladesh, Colombia, Egypt, Pakistan.

^c to nearest whole number.

Source: see Statistical Annex, Table C1.

stairs and playground equipment – were important at different ages. The study also showed that poisoning injury started to rise at the age of 9 months, continuing up to 21 to 23 months, and then declined. Burns from hot liquids were substantially higher among those aged 12 to 18 months (73).

The small stature of children increases their risk in a road environment. They are less visible than adults and if hit by a vehicle, they are more likely than an adult to sustain a head or neck injury (77). At the same time, small children have difficulty seeing over vehicles, judging the speed of oncoming vehicles and discerning the distance of a vehicle from the sound of its engine (78).

Other physical characteristics make children vulnerable to injuries. The skin of infants burns more deeply and quickly and at lower temperatures than the thicker skin of adults (77). Smaller airway size increases the danger of aspiration (24). In addition, certain physical characteristics of young children may affect injury outcomes. For example, children's larger ratio of body surface area to volume means that not only will the size of a burn – for a given volume of hot liquid – be greater than for an adult, but also that there will be more fluid lost from the burnt area, thus complicating the management of the injury (79). Similarly, a given amount of a poisonous substance will more likely be toxic for a child than an adult because of the child's smaller mass. Children's smaller size also creates a risk of entrapment of body parts, most dangerously for the head. Many products and settings do not properly take these risks into account.

Studies of children in road traffic have shown that young children may lack the knowledge, skills and levels of concentration needed to manage the road environment, no matter how benign the road conditions (80). Their physical abilities may not be matched by cognitive abilities. For instance young children, in the process of exploring their world, may fall from heights because their climbing ability is not matched by their ability to balance or reason (77).

Children's worlds

Young children's behaviour differs from that of adults. A vivid illustration of this is in the home environment. “[They] crawl about the floor, climb onto the window ledge, squeeze through stair balustrades, slide down the stair handrail, swing on the gate, run from room to room and ride bikes inside as well as out, making use of their houses in ways that seem to them reasonable, but have not apparently been foreseen by the designer” (81).

Physical and mental stages are important, but children are especially vulnerable to injury because they live in a world in which they have little power or control. The vulnerability of children is exacerbated by their lack of power and status (6). They find themselves in urban and rural environments constructed by and for adults (82). Their voices are seldom heard and only rarely are places designed in consultation with children (83).

Urban planners and policy-makers know little of children's concerns and often assume change will benefit all (84). For example, improving water supplies to a neighbourhood may result in young children – often the family water carriers – having to travel an increased distance to a standpipe to fetch water, with possible damage to their head, neck and spine (85). New products are often designed without taking into consideration their possible use by children and the consequent harm.

Child injury and gender

Boys tend to have both more frequent and more severe injuries than girls (1, 76). Sex differences in injury rates appear within the first year of life for most types of injury (86). According to WHO data, in children under 15 years, there are, on average, 24% more injury deaths among boys than there are among girls.

Data from developed countries indicate that, from birth onwards, males have higher rates of injury than females, for all types of injury (87). The pattern is less uniform in low-income and middle-income countries, but the overall gender differential is clear, with injury death rates around one third higher for males under 20 years of age than for females.

A number of reasons for these differences in injury have been put forward and investigated. One study found that sex differences were not completely explained by differences in exposure to risk and that differences in injury rates begin to appear at the same age as differences in behaviour (86).

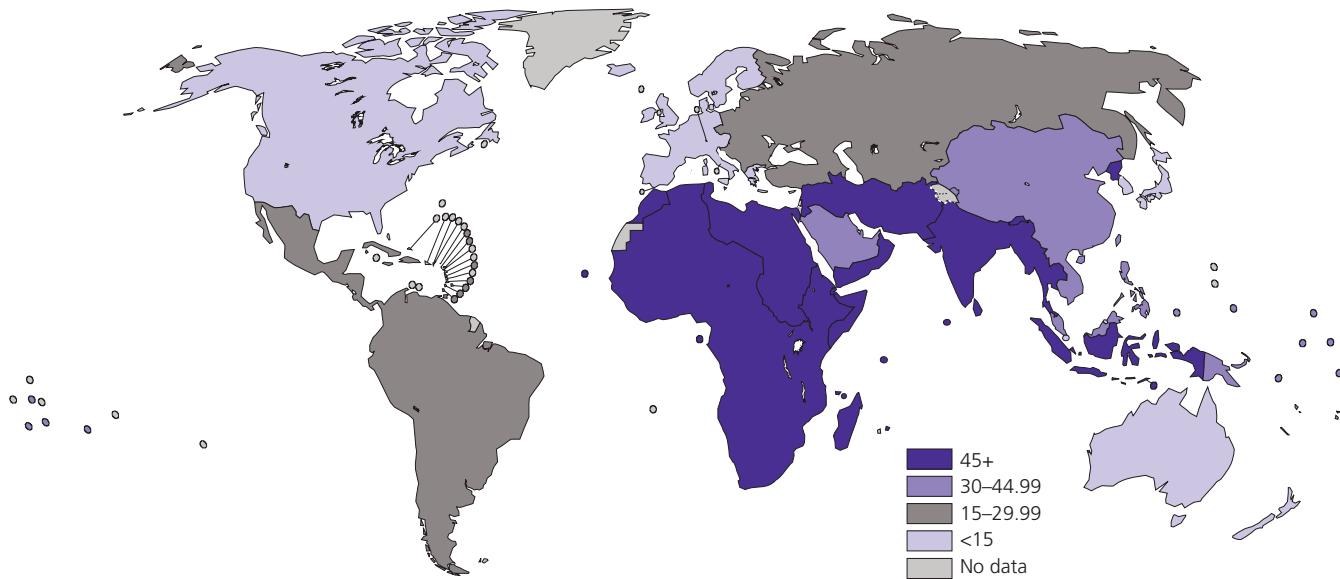
Various theories have been proposed for the difference in injury rates between boys and girls (88). These include the idea that boys engage in more risk taking than girls (89), that they have higher activity levels (90), that they behave more impulsively. Also included are the suggestions that boys are socialized in a different way from girls and are less likely to have their exploration restrained by parents (91), that they are more likely to be allowed to roam further (92), and that they are more likely to be allowed to play alone (93).

Child injury and socioeconomic factors

As can be seen in Figure 1.3, most of the childhood injury burden rests in low-income and middle-income countries, and within these countries, poor children are disproportionately affected (94). Some of the most vulnerable groups are those who live in chronic poverty (95). They are a heterogeneous group, often living in remote rural areas or conflict zones or else displaced. In the Islamic Republic of Iran, for example, a community-based survey has shown that the majority of fatal unintentional injuries to children under the age of 15 years occur in remote or rural areas (96). The chronic poor have few buffers against shocks – such as income and social networks (97). The first target of the Millennium Development Goals is to halve, between 1990 and 2015,

FIGURE 1.3

Rate of unintentional injuries per 100 000 children^a, by WHO region and country income level, World, 2004



Africa		Americas		South-East Asia	Europe		Eastern Mediterranean		Western Pacific	
LMIC	HIC	LMIC		LMIC	HIC	LMIC	HIC	LMIC	HIC	LMIC
53.1	14.4	21.8		49.0	7.9	25.4	41.6	45.7	7.8	33.8

^a These data refer to those under the age of 20 years.
HIC = High-income countries; LMIC = low-income and middle-income countries.

Source: WHO (2008), Global Burden of Disease: 2004 update.

the proportion of people living on less than one US dollar a day.

Definitions of poverty

There are two broad categories of poverty: “absolute poverty” and “relative poverty”. The former relates to the minimum requirements needed for physical survival or subsistence, the latter to the prevailing living standards of a society. It has been suggested that poverty goes beyond mere subsistence, involving also what in a particular society are considered the minimum conditions of well-being (98).

The injury field abounds with different operational definitions of poverty and related socioeconomic factors. These variations have made it difficult to consistently collect comparable data on important demographic factors such as the socioeconomic status of parents, family income and education, as well as on the characteristics of particular areas, schools, medical centres and childcare centres. There is a great need for standardization of definitions and methods to improve the quality and usefulness of information.

Socioeconomic factors and risk for injury

A broad range of socioeconomic factors associated with injury risk has been identified (74). These factors include:

- economic factors – such as family income;
- social factors – such as maternal education;
- factors related to family structure – including single parenting, maternal age, numbers occupying the household, and number of children;

- factors related to accommodation – such as type of tenancy, type of housing, level of overcrowding and various factors describing the neighbourhood.

Socioeconomic factors affect injury risk in a number of ways (74).

- In poor households, parents may not be able to:
 - properly care for and supervise their children, who may need to be left alone or in the care of siblings (see Box 1.3);
 - afford safety equipment, such as smoke alarms or safety helmets.
- Children living in poverty may be exposed to hazardous environments, including:
 - a high volume of fast-moving traffic;
 - lack of space and facilities for safe play;
 - cramped living conditions, with no proper kitchen and open cooking fires;
 - unprotected windows and house roofs, and stairs without handrails.

Access, or the lack of it, to good-quality medical services is an important explanatory factor for variations in mortality rates. In a Nigerian study, 27% of 84 children admitted to hospital for a burn injury died as a result of their injury (79), in contrast with a similar study from Kuwait, where 1% of a sample of 388 children died (99). This discrepancy, though, may also be related to differences in the severity of burns seen.

BOX 1.3

Child supervision

Supervision is widely recognized as vital to protecting children from harm. Some estimates suggest that 90% of injuries to young children occur in or around their home when they are supposedly being supervised by a caregiver. Despite the beliefs that childhood injury is often related to a lack of supervision, evidence to support this premise is limited.

There have been few attempts formally to define the term “supervision” in the context of injury prevention. A reasonable definition, consistent with existing evidence, is that supervision refers to behaviours that are related to *attention* (watching and listening) and to *proximity* (touching, or being within reach). Furthermore, these behaviours are judged by how *continuous* they are (whether constant, intermittent or not at all).

What some researchers are finding, though, is that caregivers exhibit a spectrum of patterns of supervision – ranging from almost total neglect to extreme vigilance. While there are many parallels between good parenting skills and good supervision practices, there does not seem to be any agreed-upon supervisory style that is uniformly protective. In addition, the effectiveness of supervision will be affected by whether the caregiver becomes distracted, and by the caregiver’s mental health status, use of alcohol or drugs, complacency or overconfidence.

Models of supervision have focused on:

- the need for supervision based on a child’s age, developmental status and exposure to possible hazards;
- the supervisor’s judgement, skills and ability to influence the child;
- the physical proximity of the supervisor to the child, taking into account the setting and the characteristics of the child;
- the degree of verbal and physical interventions with the child;
- how much of the time the supervisor is actively supervising.

Tools are needed to measure these various constructs more accurately.

There is considerable *indirect* evidence that associates supervision with a child’s risk of injury. This risk increases substantially when the child lives with a single caregiver, in a home with multiple siblings, or with a substance-abusing caregiver – all of which can compromise the ability of a caregiver to attend closely to the child. In large families, supervision of younger children by older children may be common, but is usually inadequate.

Good child supervision is likely to be an important intervention to protect children from injury. However, the role of supervision and guidelines for its age-appropriate application in various settings of injury risk need further investigation. Research to improve the effectiveness of supervision as an injury prevention strategy should include efforts to define and measure different types of supervision. Models of good supervision should be developed, and cultural influences on the ways supervision is conducted should be examined. Interventions to influence the behaviour of caregivers also need to be considered. A final critical step is to evaluate different supervision strategies and measure their impact on reducing injuries.

A few studies in developed countries have attempted to look at the association between childhood injuries and socioeconomic status.

- In England and Wales, a study examined injury mortality data by occupational group of the parents for children aged 1–15 years over two time periods – 1979–1983 and 1989–1992 (100). All childhood injury deaths had declined between the two periods of study, but the associations of injury deaths with socioeconomic factors had become stronger. Social gradients were particularly steep for certain types of injury such as homicide, fire burns and pedestrian injuries.
- A recent study in New South Wales confirmed that the association between relative socioeconomic disadvantage and non-fatal injury risk among children in this Australian state was strongest for transport-related injuries, burns and poisoning (101).

There are even fewer studies from developing countries that have examined childhood injuries according to socioeconomic group.

- A study in South Africa explored the incidence and causes of injury across socioeconomic and environmental settings in six neighbourhoods in a poor area of Johannesburg – two informal settlements, two neighbourhoods of council houses and two of

council-built apartment buildings (102). The informal settlements reported higher rates of injury than the other types of neighbourhood.

- A survey on the economic impacts of injury in rural Viet Nam showed that poverty was a significant risk factor for injury, and also that children in poor households had higher rates of injury sustained in the home than better-off children (103).

Injuries as a cause of poverty

Poor populations are particularly vulnerable to a range of calamities, which can trigger a further decline in family resources. Crises brought about by ill-health, a road traffic crash or an episode of flooding may push people into poverty (104).

- A study in Bangalore, India and in Bangladesh found that the burden from road crashes had pushed many households into poverty. In Bangalore, 71% of households in urban areas and 53% in rural areas were not poor before the crash; in Bangladesh the comparable figures were 33% in urban areas and 49% in rural areas (105).
- In Viet Nam, the cost of injury to poor households was estimated as equivalent on average to 11 months’ income. The risk of a poor household falling below the poverty line was 21% higher among those that had had an injury than among those that had not (106). Health-

care costs and the loss of income were the main factors contributing to this effect.

Children are a particularly vulnerable group, either directly through being injured themselves or indirectly through the loss of their parents.

- In a Bangladesh slum, 40% of malnourished children came from households where the breadwinner had been incapacitated by illness or injury (107).
- In Ghana, a study of the economic consequences of injury within the family found that in rural households, 28% of families reported a decline in food consumption following an injury (108).
- A study in Bangladesh found that injury was the leading cause of children losing a parent, with about 7900 fathers and 4300 mothers dying each year (61).

Certain groups of children have higher than average rates of injury. These rates may be associated with the specific circumstances and environment of the children – for instance, being refugees or being homeless. The groups that stand out most clearly with respect to their higher injury rates are indigenous populations, who also tend to experience greater relative poverty than their compatriots (109).

- Injury is a major cause of death and morbidity among the Maori population in New Zealand (110).
- In the United States and Australia, injury death rates in indigenous people are two to three times the rates for non-indigenous people (111).
- The death rate from road traffic injuries among indigenous Australians under 15 years of age, is two and a half times that for non-indigenous young Australians (16.7 per 100 000, compared to 6.6 per 100 000) (112).

The preventability of child injury

The principles of injury prevention

Injuries can be prevented or controlled. Because of their many causes and the close interrelationship between them, a wide range of prevention approaches is called for. Various prevention models have been proposed, but for the purpose of this report the classic model is used, including:

- primary prevention: preventing new injuries;
- secondary prevention: reducing the severity of injuries;
- tertiary prevention: decreasing the frequency and severity of disability after an injury (see Box 1.4).

The contribution of Haddon

William Haddon Jr developed a scheme (known as the “Haddon Matrix”) in the 1960s to apply the principles of public health to the problem of road traffic safety (117, 118). It has since been used as a means of developing ideas to prevent injury of all types. The matrix consists of 12 cells. These are arranged in a table of four columns relating to the host, agent/vehicle, physical environment and social environment, and of three rows relating to the periods

before, during and after the injury (corresponding to primary, secondary and tertiary prevention).

The resulting matrix provides a means to identify, cell by cell:

- strategies and priorities for injury prevention, in terms of their costs and effects;
- existing research and research that needs to be undertaken;
- the allocation of resources in the past and the future, and the effectiveness of such allocation.

Haddon went on to describe 10 strategies to accompany the matrix, which describe the ways in which the harmful transfer of energy can be prevented or controlled in some way (119) (see Table 1.6, where Haddon’s 10 strategies have been applied to child injuries).

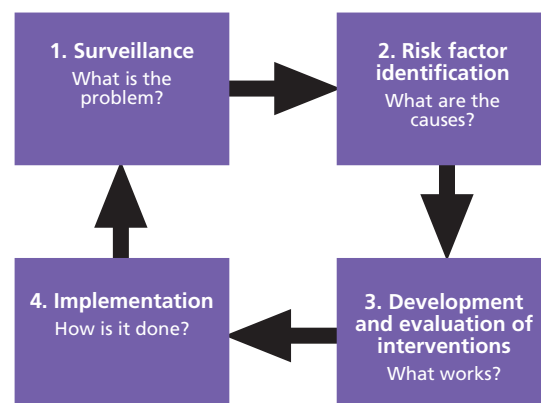
The significance of the Haddon Matrix and Haddon’s 10 injury prevention countermeasures is that they highlight the fact that not only can society intervene to reduce injury, but that such interventions can occur at different stages (120).

Public health approaches

As has occurred with several other health issues, the emphasis has shifted over recent years from the individual to the environmental context in which an injury occurs. Along with this shift of emphasis, there has also been a realization that single-cause explanations of injury are incomplete and that models using a range of causes are needed instead. The public health model is therefore useful as it approaches the issue in a systematic and coordinated way, following four logical steps (Figure 1.4) – all of which call for good evidence on which to base activities. It is a model that can reveal important emerging issues in child injury prevention (see Box 1.5).

FIGURE 1.4

The public health approach to injury prevention



A public health perspective also allows for a holistic approach to the issue of child injury. Such an approach can bring together, as partners, the diverse range of national and local agencies and organizations involved in injury prevention, and coordinate actions under a single umbrella (120).

BOX 1.4

Access to care

Much can be done to lower the burden of death and disability from injury by strengthening trauma care services across the spectrum from pre-hospital care through hospital care to rehabilitation. The chain of survival starts at the scene of the incident. Prompt, quality pre-hospital care can save many lives after an injury. Where formal emergency medical services (usually with ambulances) exist, their performance can be improved by standardizing equipment, training, infrastructure and operations. Where they do not exist, starting new formal emergency medical services can be a reasonable option, especially along busy roads with high rates of crashes. However, these services can be costly. In any circumstance, and especially where there are no formal emergency medical services, pre-hospital care can be improved by building upon existing, informal systems of pre-hospital care and transport. In many cases this involves drawing upon resources in the community to train and possibly equip those whose job it is to be the first on the scene of an emergency. These may be members of the lay public, members of organizations such as the Red Cross and Red Crescent societies, or members of national emergency services, such as the police and fire services.

A good example of the effectiveness of such an approach is a project, creating a two-tier system, that operated in northern Iraq and Cambodia. Several thousand villagers, forming the first tier, were trained in basic first aid. When needed, a second tier of more highly trained paramedics was called upon. This system sharply decreased mortality rates among victims of mine explosion and of other trauma, and is a good example of how pre-hospital care can be improved at low cost without developing ambulance systems (113). Similar examples can be found in WHO's *Prehospital trauma care systems* (114).

The treatment that an injured child receives on reaching the hospital is another point in the chain of survival where lives can be saved. Improving the organization and planning of trauma care services is an affordable and sustainable way to raise the quality and outcome of care. This includes defining a set of essential trauma care services, which every injured child should receive, as well as the required resources, both human and physical, to assure such services. Continuing education courses on trauma care should be introduced, along with quality improvement programmes, and the system for referrals between different parts of the health care system should be strengthened through inter-hospital transfer agreements.

The essential elements of trauma care need not be expensive. However, the cost of care can be a barrier to access, especially where users are asked to pay in advance of receiving emergency services. It is therefore essential to ensure that the essential trauma care services can be delivered to all who need them irrespective of the ability to pay, with cost recovery coming only after the treatment is given. More detailed recommendations on strengthening trauma care at hospitals and clinics can be found in WHO's *Guidelines for essential trauma care* (115).



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A visit to the emergency department after an injury is often the first encounter that children have with a hospital. The experience can add to their physical distress if there is a lack of understanding or information or if they feel lonely or frightened. When treating children who have been injured, health-care personnel should provide information, communicated in a manner appropriate to the child's age, and seek to make the hospital environment less intimidating and inhospitable (116). In short, both hospitals and their health-care staff should do their utmost to be child-friendly.

Finally, many injured survivors lead lives of disability. Much of this disability could be avoided with improved rehabilitation services. This would involve improving services in health care facilities and as well as access to community-based rehabilitation. Assessments have shown that such rehabilitation services are poorly developed globally and are in fact among the least developed within the spectrum of trauma care services. Strengthening such rehabilitation services will reduce the extent of disability following an injury and help those with persistent disabilities to achieve their maximum potential and lead meaningful lives.

TABLE 1.6

Ten countermeasures and examples of child injury prevention

	Strategy	Example related to child injury prevention
1	Prevent the creation of the hazard in the first place	Banning the manufacture and sale of inherently unsafe products
2	Reduce the amount of energy contained in the hazard	Speed reduction
3	Prevent the release of the hazard	Child-resistant medicine containers
4	Modify the rate or spatial distribution of the hazard from its source	Use of seat-belts and child restraints
5	Separate people in time or space from the hazard and its release	Bicycle and pedestrian pathways
6	Separate people from the hazard by interposing a material barrier	Window bars, pools fencing, covering wells
7	Modify the relevant basic qualities of the hazard	Softer playground surfaces
8	Make the person more resistant to damage	Good nutrition for children
9	Counter the damage already done by the hazard	First aid treatment for scalds – "cool the burn"
10	Stabilize, repair and rehabilitate the injured person	Burn grafting, reconstructive surgery and physical therapy

BOX 1.5**Dog bites: injury data reveal significant public health problem**

Dog-bite injury has been the subject of very few scientific publications. It was only after the introduction of external cause coding of hospitalized injury cases and the setting up of emergency department injury surveillance systems that population-based rates of dog bites could be estimated. With greater injury surveillance and more country-wide or province-wide household surveys of injuries, the real burden of dog-bite injury is now becoming apparent. Death registration and injury surveillance data in high-income countries show that dog bites are a potentially serious injury and a frequent cause of hospitalization, but that they are only rarely fatal.

Children are particularly vulnerable to dog attacks as a result of their size and the fact that their face is usually close to that of the dog. Bites to the head and neck are common in small children and decrease with age (121).

The table below summarizes the most common circumstances resulting in a dog bite.

External circumstances of dog bites	
<i>Circumstance</i>	<i>%</i>
Playing with or near the dog	28
Passing the dog (walking)	14
Cuddling the dog	10
Feeding the dog	8
Passing the dog (cycling)	4
Disturbing the dog while eating	4
Surprising the dog	2
Pulling the dog's tail	2
Interfering during a dog fight	2
Unknown	26

Source: reference 122

In high-income countries, examples of reported fatality rates from dog bites include:

- Australia: 0.04 per 100 000 population;
- Canada and the United States: 0.07 per 100 000 population.

In these countries, children are over-represented. They account for 36% of dog-bite fatalities in Australia and between 70% and 80% in the United States (123). Similarly, published rates for hospitalization or emergency department visits in these high-income countries, as well as in some other places, highlight the over-representation of children, with those aged 0–4 years, followed by those aged 5–9 years, the most vulnerable (121, 124).

There are fewer reports specifically on dog-bite injury from low-income and middle-income countries. Recently, UNICEF and The Alliance for Safe Children (TASC) collaborated with partner institutions in five Asian countries on community injury surveys. Such surveys supplement injury surveillance, and record more minor cases of bites and as well as those that are treated outside the hospital system by local practitioners, traditional healers or family members. These community surveys have revealed the previously unrecognized burden of animal-related injury, especially of dog bites, among children in low-income and middle-income countries. From these surveys, TASC has also estimated the number of days lost from school or work, following an injury, for children aged between 0 and 17 years. Data for this age group from surveys in five countries estimate the animal-related injury rate at 380 per 100 000 population, second only to falls as a leading cause of time lost from school or work (19).



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The 2001 community survey in Viet Nam showed that around 360 000 Vietnamese children suffer animal bites each year, with dog bites accounting for almost 80% of these. Every day, some 30 children in Beijing suffer animal bites, 81% of them caused by pet dogs. While two decades ago dog ownership was not allowed in China, it is now common. The cost of treatment of such bites in Beijing has been estimated at US\$ 4.2 million annually (19).

Dog bites in poor countries come with the added risk of rabies. In countries where rabies is endemic – including India, China and many parts of Africa – a dog bite that may not otherwise be serious can lead to death. Rabies is the tenth most common cause of death from infection worldwide. More than 99% of the 55 000 annual worldwide deaths from rabies occur in Asia and Africa (125). There is evidence that between 30% and 60% of the victims of dog bites in endemic areas of canine rabies are children under 15 years of age (126).

- A study in New Delhi estimated the rate of rabies from animal bites at 80 per 100 000 population, and significantly higher for 5–14-years-olds, with bites from stray dogs accounting for 90% of cases (127).
- A study of 2622 Thai children with rabies exposure found that 86.3% of the cases were related to dog bites (128).
- A Ugandan study found that the majority of dog bites were to children under the age of 15 years and that these children were at greater risk of developing rabies, in the absence of treatment, due to the location of the bites they had suffered (129).
- A study from the United Republic of Tanzania showed that significantly more children aged 5–15 years are bitten by a suspected rabid dog than are adults (130).



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Most children who die from rabies were either not treated or else received inadequate post-exposure treatment. Many bite victims do not receive rabies immunoglobulin because of a perennial global shortage. Its high price makes it frequently unaffordable in countries where canine rabies is endemic (126). In addition to human vaccination, an estimated 50 million dogs are vaccinated against rabies worldwide, either privately or through government-organized campaigns (125). In some countries – including China, the Islamic Republic of Iran, Thailand, South Africa and much of Latin America – a sustainable reduction in dog rabies has been achieved by programmes of improved post-exposure treatment of humans and of control measures against dog rabies. In others, including Morocco, Sri Lanka and Tunisia, such activities have at least led to rabies being contained. However, in some African and Asian countries, vaccination coverage has reached only 30%–50% of the dog population, a level insufficient to break the disease transmission cycle.

In addition to training school-aged children, it is advisable to teach dog owners and parents to be alert when children are close to dogs. The blame for a dog attack should not be placed on the children. The table below summarizes some of the behaviours older children can be taught in order to minimize attacks by dogs.

Code of behaviour to prevent dog bites	
Characteristics of dogs	Instructions to children
Dogs sniff as a means of communication.	Before petting a dog, let it sniff you.
Dogs like to chase moving objects.	Do not run past dogs.
Dogs run faster than humans.	Do not try to outrun a dog.
Screaming may incite predatory behaviour.	Remain calm if a dog approaches.
Dogs may regard infants, especially new members of the family into which the dog already feels integrated, as intruders or as subordinate.	For infants and small children, do not hug or kiss a dog.
Direct eye contact may be interpreted as aggression.	Avoid direct eye contact.
Dogs tend to attack extremities, face and neck.	If attacked, stand still (with feet together) and protect neck and face with arms and hands.
Lying on the ground provokes attacks.	Stand up. If attacked while lying, keep face down and cover the ears with the hands. Do not move.
Fighting dogs bite at anything that is near.	Do not try to stop two fighting dogs.

Source: reference 122

In conclusion, dog-bite injury is a widespread and hitherto poorly-documented global problem, disproportionately affecting children and adolescents. Good data collection systems are vital for identifying the characteristics of injuries such as dog bites. Only when good data become available can the extent and nature of such injuries be appreciated and proper prevention measures set up.

Learning from places with good safety records

Experience from countries with the best safety records shows that positive leadership, together with widespread, multisectoral efforts to provide safer physical and social environments can produce sustained reductions in injury mortality and morbidity (131). In addition, those countries which have a designated government focal point with overall responsibility for addressing injury have made significant advances (132).

Sweden was the first country to recognize the importance of injuries as a threat to child health and to tackle the problem in a coordinated manner (133). In the 1950s, Sweden had death rates from child injury higher than those in the United States. Since the late 1980s, it has had the lowest child injury death rates of any country in the world. Factors contributing to its success have included (134):

- good surveillance data;
- a commitment to research;
- regulations and legislation for safer environments;
- broad-based safety education campaigns involving partnerships of different agencies;
- committed leadership on safety issues.

In addition, Sweden was one of the few countries that followed WHO's recommendations to set up policies for safety, to organize a national multisectoral safety promotion programme and to allow academic institutes to participate in public health policy-making (135). A sense of corporate responsibility in Sweden has greatly helped in allowing the protection of children to become a major goal of society.

There have been relatively few systematic attempts to examine factors that might explain differences between countries in child injury rates. One example is the OECD study of road safety policy and practice. This used mortality data, demographic and socioeconomic indicators, exposure surveys and surveys based on questionnaires addressed to the leading informants in transportation departments in OECD countries. The study identified the pivotal role of good data. The best-performing countries in the study – those with the lowest injury rates – had a comprehensive, coordinated policy on road traffic injuries and had adopted a holistic approach (136). The importance of international networks of researchers has also been identified to encourage the rapid dissemination of ideas between countries (137).

Which approaches work?

Interventions to prevent unintentional injuries have traditionally been considered in terms of the “three E’s”: education, enforcement and engineering – and within the framework of the Haddon matrix discussed before. While randomized controlled trials are considered the

gold standard for assessing the effectiveness of injury interventions, such trials are still relatively rare in relation to child injuries. Many trials would be impractical or unethical to implement because their benefits are obvious. A recent publication on disease control priorities in developing countries included a chapter on the prevention of unintentional injuries in low-income and middle-income countries (138). Although the interventions suggested as promising or proven are for all ages, many are applicable to the prevention of child injuries.

“Evidence is the foundation for setting priorities, crafting policies, and measuring results. Evidence can have great persuasive power at the policy level” Dr Margaret Chan, WHO Director-General.

The sections below summarize the approaches that have been adopted in a number of countries. Examples are given for each approach, along with evidence, where available, from systematic reviews, using the Cochrane database of systematic reviews and other reviews.

Legislation and enforcement

Legislation is a powerful tool in the prevention of injury. It can be regarded as a “test of commitment to the cause of child safety” (9). There is evidence that legislation has increased the uptake of preventive measures and reduced childhood injuries in a number of areas. These areas include:

- In the road environment:
 - child passenger restraints (139);
 - seat-belts (140);
 - bicycle helmets (141);
 - motorcycle helmets.
- In the home environment:
 - smoke alarms (142);
 - hot water temperature legislation (143);
 - child-resistant containers (144).
- In the leisure environment:
 - isolation fencing of swimming pools (145).

There is some evidence of the beneficial effect of legislation on the use of booster seats (restraints in cars for children who have outgrown child seats), though this was mainly from uncontrolled before-and-after studies (146). A systematic review (147) found legislation on bicycle helmets to be effective in increasing helmet use, particularly in the younger age group and in areas with previous low rates of use (148), and in reducing head injuries (141).

As well as the introduction of new laws, how consistently they are applied and how rigorously enforced are important. The UNICEF league table report compared the legislative record for seven areas of injury legislation in 26 OECD countries. Only three countries

had legislated in at least six of the seven areas assessed: Australia, Canada and the United States (9).

Many countries have specific standards or regulations – some mandatory – for a wide range of goods and services, including:

- toys and nursery furniture;
- playground equipment;
- items designed for childcare – such as nail clippers and hair brushes;
- safety equipment such as helmets;
- furniture and furnishings – such as the provision of baby gates at the top of stairs.

There are also usually regulations and standards related to construction work on buildings, as well as to health and safety generally in the workplace. All these standards and regulations have an important bearing on the extent to which child injury can be prevented.

Since, for many products, standards often do not exist, and the introduction of standards for individual products can be a slow process, a useful approach is to identify the particular hazards for a product and the measures and mechanisms that reduce risk. So-called “vertical standards” based on hazards compile this information so that manufacturers and regulators can identify known hazards in products and reduce them to acceptable levels. This approach is the one adopted, for instance, in *ISO/IEC Guide 50: Safety aspects: guidelines for child safety* (149). Risk reduction here is meant to cover the way people actually use the products and it should be for the life of the product. In 2007, for example, there was a worldwide recall of toys that had been found to contain hazardous levels of lead paint.

In developed countries, the way in which legislation is enforced varies considerably. Because of a frequent lack of structures and resources, enforcement in developing countries is even more difficult. In Karachi, a study of bus safety showed that legislation was not likely to produce much effect, but that instead increases in bus drivers’ wages and small changes to the vehicles were potentially more effective (150).

Product modification

Changing the design and manufacture of products can:

- *reduce the risk* of an injury – for instance, by manufacturing staircase railings with the gap between the upright banisters sufficiently narrow to prevent small children putting their heads through;
- *reduce access* to a hazard – an example being the use of child-resistant closures for medicines;
- *reduce the severity* of an injury – for instance, by modifying the design of the caps on pens to reduce the risk of fatal choking in the case of a cap being inhaled.

Product modification has contributed to preventing childhood injuries. However, often a series of small

changes is made in products and it is difficult to attribute a reduction in injuries to any one specific change. There is considerable evidence that the introduction of child-resistant closures has been effective in reducing the number of childhood deaths from poisoning (151). An evaluation of an intervention in South Africa involved the distribution of child-resistant containers for the storage of paraffin. This strategy proved an effective means of reducing paraffin ingestion and provided evidence that families will use such free devices when they are provided (152).

Modification of basic cooking and heating products may also offer considerable possibilities. About half the world’s population still relies on solid fuels – including wood, animal dung, crop residues and coal for every day energy needs – and a high proportion of households burn the fuel in open fires (153). In rural Guatemala, an improved wood-burning stove, the *plancha* (an enclosed combustion chamber and cooking surface out of reach of young children), has been introduced. The stove has the potential to reduce not only acute lower respiratory tract infections in children, but also burns and scalds. Preliminary results have been promising for young children (153). Reducing the number of open fires would have a beneficial impact in places such as sub-Saharan Africa, where 80% to 90% of rural homes use open fires.

“Adapting the environment to the characteristics of children and integrating safety into the design of products are among the most successful child injury prevention strategies” Wim Rogmans, Director, Consumer Safety Institute.

Environmental modification

Modifying the environment to make it more user-friendly has become an important approach in injury prevention, benefiting people of all ages, not just children, in the passive protection that it affords. Area-wide engineering solutions can lower the rate of injuries in pedestrians, cyclists and car occupants. One review examined whether traffic-calming schemes reduced rates of crash-related deaths and injuries, for all age groups (154). It concluded that traffic calming in towns did indeed have the potential to reduce the rate of injuries. As regards modification of the home environment, there is at present insufficient evidence from trials to show that such changes reduce the number of injuries (155).

In high-income countries, there has been considerable progress in making the transport infrastructure safer, including around schools and kindergartens. But in low-income countries, such expensive options may not be possible. In most low-income countries, pedestrians, cyclists, cars, animals and buses share the same road space. The conflicting requirements of non-motorized vehicles need to be addressed using various models of

traffic safety, including the separation of different types of road user (156).

Supportive home visits

Home visiting by paediatric nurses to families at high risk of injury has been used for a wide range of purposes. These include: to improve the home environment, to prevent problems of child behaviour or supply and explain safety equipment. A review of the effects of home visits in early childhood has shown substantial positive effects for the prevention of child maltreatment (157). The greatest impacts were for programmes using professional visitors and for programmes of a longer duration. Home-visiting programmes have been shown to be associated with an improvement in the quality of the home environment as a means to reduce unintentional injuries (158).

Safety devices

The promotion of safety devices can lead to a fall in injuries and increased compliance in using the device. A variety of approaches has been used, including professional counselling, to encourage the use of safety devices, supported by a range of media. Some programmes have included rewards or coercion, such as fines, to encourage compliance. The positive effects from such programmes diminish one or two months after the intervention and more intensive programmes produce more positive results (159).

- Wearing a bicycle helmet dramatically reduces the risk of severe and fatal head injuries and facial injuries for bicyclists involved in a crash involving a motor vehicle (148). Community-based projects that provided free helmets along with an educational component led to an increase in the observed wearing of helmets (160). A study in Canada has shown that, despite less wearing of helmets in low-income areas, population-based bicycle helmet campaigns can still have an impact in these areas in cutting the risk of injury (161). The WHO helmet manual (162) provides a number of examples of good practice, such as the *Helmets for Kids* safety campaign in Viet Nam.
- Motorcyclists are also at high risk in traffic crashes, particularly for head injury. A review of studies concluded that helmets reduce the risk of head injury by around 69% and death by around 42% (163).
- Fires detected with smoke alarms are associated with lower death rates. However, one review found that programmes to promote smoke alarms only, without legislation, function modestly, if at all, and have not yet demonstrated a reduction in fires or fire-related injuries (142).

Education, skills and behaviour change

The value of educational programmes as a form of injury prevention has been subject to debate in the field of child

injury. Clearly, education underpins many other strategies – such as legislation, the promotion of safety devices and home visiting. Education on pedestrian safety can result in an improvement in children’s knowledge and can change observed behaviour of crossing roads. Whether, though, this reduces the risk of injury or of a pedestrian suffering a collision with a motor vehicle is unknown (164). The focus of education should extend beyond the immediate caregivers of children, to include health professionals, policy-makers, the media and the business community (120, 165). Novel ways of introducing safety messages into television programmes should be explored. These might include a person testing the water temperature before bathing a child, portrayals of swimming pools surrounded by fencing, and characters in dramas putting on their seat-belts in a car (166).

The PRECEDE-PROCEED model (a planning model for health education and health promotion programmes) provides a comprehensive structure to assess people’s health and quality-of-life needs. It also helps in the design, implementation and evaluation of health promotion programmes and other public health programmes to meet those needs (167). These principles have been further elaborated in a guideline on generic behaviour change. This guideline recommends collaboration between individuals, communities and organizations to plan interventions and programmes (168).

Community-based studies

Injury prevention, with its broad range of injury types and possible countermeasures, lends itself to community-based approaches. It is important to have long-term strategies, effective and focused leadership, collaboration between a range of agencies, appropriate targeting and sufficient time to develop local networks and programmes (169). The use of multiple interventions, repeated in different forms and contexts, can lead to a culture of safety being developed within a community.

There is some evidence that the WHO Safe Communities model is effective in reducing injuries in whole populations (170). However, the countries that have evaluated their Safe Communities with a sufficiently rigorous study design are among the wealthier countries and have lower injury rates than most other countries. No evaluations are available yet from other parts of the world.

Universal and targeted interventions

There have been a considerable number of systematic reviews of child injury prevention. However, “the evidence on its own does not provide a complete recipe for success, or an imperative for action” (171). The findings of research need to be translated into practice, so that they are tailored to local contexts and circumstances (172). Proven interventions in developed countries may not be readily transferable across all social groups or to other

contexts within developed countries. They may also not be transferable to developing countries. Caution is needed here, because of the very different environments in some low-income countries (173). In these places, childhood drowning, for instance, does not generally take place in swimming pools and bathtubs as in developed countries, but in natural bodies of water such as ponds, lakes and rivers, as well as cisterns, wells, irrigation ditches and paddy fields.

Closing the childhood injury gap

As stated previously, within all countries, the burden of child injury falls most heavily on those from the most disadvantaged groups. The gap in injury rates between the most affluent and the most disadvantaged provides “some measure of preventability and shows that there is considerable scope for improvement and intervention and a yardstick of what is achievable” (74).

There is a range of interventions known to be effective in preventing and reducing injuries (see Chapter 7). What is less well known, though, is how such approaches can be applied to close the socioeconomic gap with regard to childhood injuries. It is partly in response to this problem, where active strategies have not yet been successful, that passive solutions – that is, design solutions – may be most successful. In the broader field of health promotion, four broad approaches to tackling socioeconomic inequalities in health have been suggested (174):

- strengthening individuals;
- strengthening communities;
- improving access to services;
- encouraging macroeconomic and cultural change.

Approaches for strengthening individuals can include targeting children and their carers.

- Prevention initiatives for parents on drowning can be integrated into existing child survival and development programmes – particularly for the period, from nine months of age onwards, when children are entering into the ‘window’ of drowning risk (61).
- A study conducted in a deprived community of Scotland, a high-income country, that reviewed a training programme in practical road-safety skills, found improved skills in 5–7-year-old children in crossing the road (175).

Strengthening communities is an approach adopted by many organizations working on safety issues, and is the leading strategy employed in the Safe Communities network.

- The Waitakere Community Injury Prevention Project in New Zealand included a range of programmes targeting different indigenous and ethnic groups (176). For one of these programmes, the coordinator employed was a Maori, with experience of the culture and perspectives of the target group, and injury prevention was incorporated into a holistic view of health.

- The Safe Block project, based in a poor African-American inner-city community in Philadelphia, PA, USA, used a network of community volunteers. The project involved making simple modifications to homes to prevent injuries, inspecting homes and providing information on home hazards, and educating people – with the use of cascade training – on specific injury prevention practices (177).
- A partnership with residents from townships in South Africa worked effectively to lobby the local government to provide a pedestrian bridge over a highway (102).

There are various ways in which *improving access to services* can help prevent child injuries.

- New roads can contribute to improving access to a range of community services, including to health care, education and leisure facilities.
- Electrification can reduce exposure to more hazardous fuels such as kerosene.
- Removing dangerous debris and improving waste collection can directly reduce injuries to children.
- Providing sanitation can help children avoid having to walk in darkness to toilet facilities.

Encouraging macroeconomic and cultural change includes:

- broad land-use policies, such as locating schools away from busy roads;
- transport policies that take into full account the needs of pedestrians;
- the promotion of walking as a healthy activity;
- the design of communities, to include safe outdoor play facilities.

Financial problems and poor living conditions have been found to preoccupy adults, with the result that they spend less time supervising children (24, 76). Policies targeting poverty reduction could reduce childhood injuries in the long term, but need to be accompanied by more short-term and medium-term measures.

Most researchers believe that packages of policies and intervention, rather than single policies and interventions, are needed to substantially reduce socioeconomic inequalities in health.

Transfer of knowledge

One study in low-income countries looked at successful interventions to prevent transport and home injuries (25). It also evaluated injury interventions developed in industrialized countries that might be usable in low-income countries. The conclusion was that several interventions could be imported by low-income countries and should be considered, including:

- vehicle seat-belts, bicycle helmets and motorcycle helmets;

- speed limits;
- pedestrian crossing signs;
- adequate road lighting;
- the separation of pedestrians from vehicles;
- measures to enhance conspicuity, such as the use of reflective products;
- simple safety equipment;
- packaging of items to prevent poisoning.

The importance of transferring knowledge in a sensitive and context-specific manner has been repeatedly stressed. The Commission for Global Road Safety (44), for instance, has stated: “Public acceptance and support, based on information and knowledge and evidence of effectiveness, will be achieved only if road safety messages are seen to be appropriate and targeted at local needs”.

Interventions that appear most effective are those encompassing a variety of strategies, including legislation, environmental modification and education (178, 179). There is a general need for more interventions to be evaluated and for research experiences to be shared worldwide. Many of the principles of injury prevention can be transferred, but interventions need to be tailored to the social and physical environments of those localities. Interventions should reach across different sectors, build on existing networks and involve communities.

Cost and cost-effectiveness

The costs of injuries are enormous. In developing countries, road traffic injuries alone account for 1%–2% of gross domestic product (about US\$ 100 billion) each year, or twice the total development aid received worldwide by developing countries (180). There are no global data on the cost of unintentional child injuries, but a recent evaluation in the United States has shown that the medical costs and losses in productivity as a result of all injuries to 0–14-year-olds are in the range of US\$ 50 billion (181). There is thus a great need for cost-effective and well-targeted responses.

Costs of safety

Not much research has been carried out on the availability, price and affordability of child-safety or family-safety devices, and this is especially the case in low-income and middle-income countries. Data from 18 economically diverse countries have been compared for four effective devices: child safety seats, booster seats, child bicycle helmets and smoke alarms (182). The prices of these devices varied widely and in many countries they were very expensive. A factory worker in a low-income country had to work 11 times as long as a counterpart in a high-income country to buy a bicycle helmet, while for a child safety seat 16 times as many hours’ work were required. Low-income countries manufacturing devices for export did not generally use spare plant capacity to produce devices for local consumption.

Cost-effectiveness of interventions

There are very few analyses in low-income and middle-income countries of the cost-effectiveness of injury prevention measures (183). There is also scarce data on injury epidemiology and the efficacy of interventions in these countries. One study attempted to model the costs and effectiveness of five interventions for which there were data on effectiveness in a low-income or middle-income country (184). Four out of the five interventions related to the road environment: vehicle speed control, treatment of dangerous junctions, bicycle helmet legislation and motorcycle helmet legislation. The fifth was on the home environment, and involved child-resistant containers to reduce poisoning from paraffin.

In the United States, a survey conducted in the late 1990s on the costs of childhood unintentional injuries and the cost-effectiveness of interventions to prevent them showed that approximately 15% of medical spending resulted from an injury (185). The same study found that seven child injury safety measures – child safety seats, bicycle helmets, zero tolerance of alcohol for young drivers, provisional licensing, smoke detectors, childproof cigarette lighters and poison control centres – had similar cost-effectiveness ratios to other well-accepted strategies to prevent childhood illness. The implementation of these strategies, though, is not yet widespread (185). As can be seen from Table 1.7, many cost-effective strategies for unintentional injury can save not only lives but costs to society as well.

TABLE 1.7
Financial savings from selected injury prevention interventions

Expenditure of US\$ 1 each on:	Savings (US\$)
Smoke alarms	65
Child restraints	29
Bicycle helmets	29
Prevention counselling by paediatricians	10
Poison control services	7
Road safety improvements	3

Source: reference 186.

Cost and cost-effectiveness analysis of interventions to reduce or mitigate child injuries is urgently called for. Such evidence can have a strong impact on policy-makers and persuade them to invest in the appropriate primary prevention interventions.

Overcoming the obstacles

Although considerable progress has been made during recent decades to reduce the rates of child death and injury in developed countries, more needs to be done. In

developing countries such efforts are just beginning. This section examines some of the fallacies, limitations and other obstacles that efforts to prevent child injury face.

“Injuries are due to fate”

If injury is considered to be the result of random, uncontrolled factors and that chance and bad luck or fate are the main factors, then there is little that can be done to prevent injury.

However, injuries *are* preventable. The public health approach to injury prevention involves data collection, risk factor analysis, intervention, evaluation and the widespread implementation of proven prevention methods. Scientific research and evidence underpin this approach.

The wide range of injury types

The nature of injury presents problems. Injuries fall into a wide range of categories that occur in many different environments. They can therefore be the responsibility of a number of separate agencies or government departments, each of which may favour a different approach.

Injuries need to be viewed collectively as a single “disease”, with broadly similar approaches being used to prevent them. Collaboration between a range of agencies is necessary, with some form of principal agency to coordinate activities.

Limitations of data

Data on the scope and patterns of injury are essential for identifying priority issues, understanding the causes of injury and identifying groups at high risk of injury. With limited data it is difficult to convince policy-makers and others that there is an injury problem. It is also impossible to decide how to prioritize and develop effective programmes.

It is estimated that, of the 193 WHO Member States, only 109 currently provide usable vital registration data to WHO in coded form, using the International Classification of Disease taxonomy. Unfortunately, the quality of the data tends to be weakest where the problems are greatest. In developing countries, data coverage is particularly poor in relation to child drowning, burns, poisoning, road traffic injuries and bites and stings. Data on the evaluation of interventions and the cost of injuries are also largely absent or – at best – are weak in these places. High-quality data relating to hospital usage are similarly skewed. They are available in some high-income countries, but rare in countries with the highest injury rates.

The general lack of data on health care, in particular on high-cost hospital admissions and trauma care, results in the burden of injury being underestimated in many countries. It also prevents a proper analysis being made of the groups receiving such expensive and scarce health care and of the nature of their injuries. A high proportion

of trauma deaths occur outside hospital in developing countries, so that many deaths – and other injuries – are not counted in data collection systems in these countries.

An important goal in injury prevention is thus to establish reliable estimates of the level and pattern of child injury and death, especially in low-income and middle-income countries. To this end, the volume, quality and availability of national and regional data needs to be increased. This should be done through a combination of better data collection systems, improved hospital surveillance, more community-based surveys and other appropriate research.

Lack of political commitment and understanding

The significance of child injury in absolute and relative terms is not always widely appreciated and the possibilities of prevention are often underestimated. This lack of understanding inhibits the allocation of resources to prevention efforts and also the political and organizational will that are necessary for change.

Injury must become an issue for concern and debate at all levels, not just at the global level, but at national and local levels as well. One example of high-level political commitment that led to immediate and observable reductions in injury was in France, where in 2002 the president declared road safety a national priority. This led to the formation of an interministerial committee and a national action plan (131). Between 2002 and 2004, a 34% reduction in road traffic deaths was reported, as a result of the coordinated implementation of a range of preventive measures, including: speed reduction, traffic calming, control of drinking and driving, and increased seat-belt use (187).

Effective and inexpensive interventions must be developed (188). The aim should be to develop measures that give as much return on money invested as immunizing children against measles, polio or tetanus.

Limited capacity

All countries face limitations in their capacity to prevent injury, to provide emergency and continuing care following an injury, and to provide appropriate rehabilitation services. This is particularly the case in countries where the burden of child injury is greatest. The training of more injury prevention practitioners and researchers across the world is urgently needed, and particularly in low-income and middle-income countries. For low-income countries, incentives may be necessary to encourage professionals to remain in their country of origin and not emigrate to high-income countries.

The content of training courses also needs to be carefully planned. Such syllabuses generally include principles and concepts that further knowledge and understanding. Competencies, though, also need to be taught, including skills in group work, community development, collaboration across sectors and lobbying.

Difficulties of implementation

As already stated, the main aim in child injury prevention is the adaptation of proven prevention measures to local circumstances. In areas of the world where substantial progress has already been made, efforts are required to apply effective interventions more widely. A recent analysis conducted in the United States showed that child injury deaths could be reduced by one third if practices that had proved effective in certain states were adopted in other similar states (189).

Lack of funding

Funding levels need to reflect the importance of injury as a major cause of death and ill-health in children. “Those who control the purse strings must be persuaded that most injuries are truly preventable and that the cost of failing to do so greatly outweighs the relatively small costs of prevention” (190).

Conclusion

Despite the many and complex obstacles, injury prevention nevertheless offers opportunities. The public health significance of road traffic injury and of violence has increasingly been recognized in recent years. There has been much experience and understanding developed on all aspects of injury prevention. These developments can create a strong basis to bring about significant and sustainable reductions in child mortality and ill-health throughout the world.

All countries need to urgently investigate the full extent of the problem of child injuries. Their results should be used in developing an action plan, coordinating the activities of different sectors – including nongovernmental organizations, academic institutions and industry. Measures that are known to work should be implemented everywhere, with adaptations where necessary to suit local circumstances.

Resources devoted to child injury prevention must be appropriate for the size of the problem. More investment is needed for such activities as data collection, community-based injury surveys, capacity building, programmes aimed at local communities, and evaluations of the costs of injuries and of the cost-effectiveness of prevention measures.

Child survival initiatives have been highly successful. At the beginning of the “child survival revolution”, more than 75% of the world’s children lived in countries where child mortality was high – while now, only 30 years later, less than 20% of children do so. Further improvements in child health, though, will require broad programmes for injury reduction and control for children up to the age of 18 years.

Now is the right time to address this avoidable harm to children and to society. While there is much research that still needs to be carried out, there is already considerable information available. This information is quite sufficient

to make a substantial impact in bringing down the incidence of child injury death and morbidity.

Every child lost to injury or severely disabled will cost the future economy of that country. Putting into practice what is known about reducing child injury will help meet the Millennium Development Goals. It will reduce costs in the health care system, improve the capacity to make further reductions in injury rates, and will most importantly protect children.

Chapters 2 to 6 of this report will discuss the five leading causes of unintentional injury. These will focus on the magnitude of the problem, the risk and protective factors for each type of injury, as well as interventions and recommendations for primary, secondary and tertiary prevention.

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