UNINTENTIONAL CHILDHOOD INJURIES

Children's Health and the Environment
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Unintentional childhood injuries

LEARNING OBJECTIVES

1. What are childhood injuries?
2. Injuries and their classification
3. Burden of injuries among children
4. Environmental risk factors/settings
5. Why has so little action been taken?
6. The public health approach to injury prevention: Haddon's matrix
7. What are effective interventions/measures to prevent unintentional child injury?
8. What can the health sector do?
First, it is necessary to provide some basic definitions. ‘Injury’ is a broad term covering a multitude of types of health problem each of which is associated with different factors and for which different types of interventions are possible. The most basic classification of injuries is according to whether they are intentional or unintentional. An injury is defined as “a body lesion at the organic level, resulting from an acute exposure to energy (mechanical, thermal, electrical, chemical or radiant) in amounts that exceed the threshold of physiological tolerance. In some cases (e.g. drowning, strangulation, freezing), the injury results from an insufficiency of a vital element”. (Baker, 1984)

References:

Unintentional childhood injuries

Injury is the main cause of death and a major cause of ill health and disability in childhood
There are some important principles and definitions that need to be understood and differentiated.

The first, and possibly the most important, principle of injury prevention is that injuries are preventable. Many people are used to thinking that injuries are the result of accidents, which are typically considered to be unpredictable and unpreventable. In contrast, the first principle of injury prevention is that injuries occur as the result of events that can be predicted and prevented.

**Accidents versus injury events**

There has been a move away from use of the term “accident”, in the English language, because of its connotations of inevitability and lack of apparent cause. On the other hand, the term “injury events” has been used to indicate that these are events that can be studied, understood and therefore prevented. An injury event can be characterized as either **unintentional** or **intentional**.

Intentionality distinguishes violence from unintended events that result in injury. However, the issue of intentionality can be quite complex, since the intent to use force may not necessarily mean there was an intent to cause damage. Consequently, there has been a move away from the use of the “intentional” classification in the field of violence prevention.

**Injury prevention**: refers to the actions or interventions that prevent an injury event or violent act from happening by rendering it impossible or less likely to occur.

**Injury control**: refers to actions aimed at reducing injuries or the consequences of injuries once they have occurred.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO – more information and materials available at: www.who.int/violence_injury_prevention/capacitybuilding/teach_vip/en/index.html*
Intentional and unintentional injuries are defined in terms of a series of external cause codes.

Unintentional injuries are typically classified according to the means of their occurrence: poisoning, burns and scalds, drowning, falls and transport-related. Intentional injuries include homicide and interpersonal violence, wars and other forms of collective violence, and suicide and other forms of self-harm.

Injuries have been traditionally been regarded as random, unavoidable ‘accidents’. In the last few decades, a better understanding has changed these attitudes, and injuries - both unintentional and intentional - are now regarded as largely preventable.

When all ages are considered in the European Region the three leading causes account for nearly 50% of all deaths from violence and unintentional injury (800,000 every year):
- suicide (ca. 164,000 deaths/year);
- road traffic injuries (ca. 127,000 deaths/year); and
- poisoning (ca. 110,000 deaths/year).

In the European Region, the burden of injuries makes up 14% of the total burden of disease. Burden is usually measured in disability-adjusted life years (DALYs), which is a composite measure of the years of life lost and those lived with disability from injuries. Although DALYs measure the physical burden of injuries they do not usually measure the psychological suffering of victims of sexual violence, abuse and neglect, which disproportionately affects women and children.

We deliberately avoid use of the term ‘accident’. Even when applied to unintentional injury it suggests that injury is in some way random, as illustrated by the saying ‘accidents do happen’, and by inference the resulting injuries are thought to be less amenable to systematic programmes of prevention than is in fact the case. Finally, for most purposes, injuries can be considered as synonymous with the term ‘external causes’ that is used in statistics of mortality, consistent with the terminology used in the International Classification of Diseases.
- Sometimes it is difficult to distinguish unintentional injuries from intentional and it makes interpretation of data more difficult when making cross country comparisons. Sometimes there may be cultural barriers in classifying injuries as intentional e.g. suicide.
- Death data are usually from Vital Registration systems.

Reference:
There is no single comprehensive and mutually exclusive method for injury categorization. All classifications have merit, and often a combination is chosen. Some categorizations which have been used include:

- severity (level of medical treatment required)
- setting (e.g. home, school, workplace, road)
- activity (e.g. sport, recreation, work)
- mechanism (e.g. fall, burn, dog bite, motor vehicle crash, drowning)
- intent (intentional, unintentional)
- nature of injury (e.g. fracture, burn).

Other categorisations are based on the demographics of injury victims and may include:

- age (child, adolescent, elderly)
- gender
- socioeconomic status
- ethnicity or aboriginality.

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Child injuries are strongly related to social determinants.

The burden of injury on children is unequal. Children in poorer countries and those from poorer families in better-off countries are the most vulnerable. More than 95% of all child injury deaths occur in low-income and middle-income countries. Although the child injury death rate is much lower in high-income countries, injuries still account for about 40% of all child deaths in these countries.

Graph and notes taken from

Injuries represent a large proportion of child deaths, in particular for older children. Child injuries are a growing global public health problem. They are a significant area of concern from the age of one year. Among older children they represent almost half of the deaths.

*Graph and notes taken from*  
About 2270 children die every day as a result of an unintentional injury.

Injury and violence are a major killer of children under the age of 18 years throughout the world responsible for approximately 950,000 deaths. About 90%, or 830,000, of these deaths are categorized as "unintentional". Road traffic injuries and drowning together account for nearly half of all unintentional injury child deaths. In addition to these deaths, tens of millions of children require hospital care every year for non-fatal injuries, many of whom are left with lifelong disabilities.

The next slide goes into more details

<<NOTE TO USER: Include local data and priority issues>>

Graph and notes taken from
Unintentional injuries are leading causes of death for children.

This slide, based on data from countries that report to the World Health Organization, shows how injury problems overwhelmingly affect younger populations. Again, these populations are usually the more economically active.

After the age of 1 year, unintentional injuries, particularly road traffic injuries, drowning and fire-related burns become significant contributors to the leading causes of death among children and teenagers. Road traffic injuries alone are the leading cause of death among 15–19-year-olds and the second leading cause among 5–14-year-olds.

Graph and notes taken from

This picture reminds us of the adverse effects of injuries in the youngest ones.
The injury experience of a population is often presented as a pyramid based on the level of medical treatment, which is a broad surrogate for injury severity. The apex represents the relatively small number of fatal injury cases, and the broader, lower parts of the pyramid represent the more numerous injuries of lesser severity. In descending order of severity, but increasing level of magnitude, one can identify injuries that require hospitalization, ambulatory treatment, injuries that are not emergencies, mild forms of injuries treated by paramedics and the most common which are injuries that are go unreported.

Two points need to be emphasized. First, the availability of injury data is in direct proportion to case severity and in inverse proportion to case frequency. In countries with well-developed vital statistics systems, quite a lot is known about the relatively small number of injury deaths, less about hospital inpatient cases, and still less about cases requiring less medical treatment. While the priorities implied by this hierarchy of information availability may be correct, the importance, in human and economic terms, of ‘less severe’ injuries should not be under-rated.

Second, constructing the pyramid highlights the crudeness of injury case categorization used. For want of more direct measures, hospital admission or attendance at a hospital emergency department tends to be used as a proxy for case severity. This is done despite the fact that:
- clinical criteria for admission may vary considerably;
- economic and other factors may determine which cases go to which service and these factors vary with time and place;
- level of medical treatment is often dependent on the services available.

Improving the ability to measure injury severity (particularly injury that is not life-threatening), rigorously and practicably is a challenge for injury researchers and important for international comparability of injury data.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Having discussed important aspects of how injuries are conceptualised, it is important to define, as a first step, where information on injuries can be obtained. As discussed in the public health model the initial question is directed at identifying the magnitude and characteristics of the problem.

Different types of data are needed for different purposes, including:

• describing the magnitude and impact of injury and violence
• understanding which factors increase the risk of injury and violence
• knowing how effective injury and violence prevention programmes are.

The table presented above shows some of the types of data and potential sources where information on injuries can be obtained.

Mortality data are an important source of information, available in most countries, which provides an indication of the extent of the injury problem. Other types of information are also necessary for describing the magnitude of the injury problem. Since non-fatal outcomes are more common than fatal outcomes and because certain types of injury and violence are not fully represented by mortality data, other types of information are necessary. Such information can help to understand the circumstances surrounding specific incidents and in describing the full impact of injury and violence on the health of individuals and communities.

These types of data include:

• health data on diseases, injuries and other health conditions;
• self-reported data on attitudes, beliefs, behaviours, cultural practices, victimization and exposure to violence;
• community data on population characteristics and levels of income, education and unemployment;
• crime data on the characteristics and circumstances of violent events and violent offenders;
• economic data related to the costs of treatment and social services;
• data describing the economic burden on health care systems and possible savings realized from prevention programmes;
• data on policy and legislation.

Potential sources of various types of information include:

• individuals
• agency and institutional records
• local programmes
• community and government records
• population-based and other surveys
• special studies.

References:
Public Health Approach to Injury Prevention

1) Surveillance
   What is the Problem?

2) Risk Factor Identification
   What are the causes?

3) Develop and Evaluate interventions
   What works?

4) Implementation
   How is it done?
Unintentional childhood injuries

AN ENVIRONMENTAL HEALTH APPROACH TO INJURY PREVENTION?
Public health interventions are traditionally characterized in terms of three levels of prevention, which relate back to the temporal dimension of the Haddon Matrix.

**Primary prevention** includes any strategies aimed at stopping injury events from taking place, and thus relates to the time before injuries actually occur (pre-event phase).

**Secondary prevention** includes any strategies aimed at minimizing the harm that occurs during an injury event (e.g. car crash or event phase). Examples include the protection of motor vehicle occupants in crashes (e.g. seat-belts).

**Tertiary prevention** includes all efforts aimed at treating and rehabilitating injured people or in some cases, the perpetrators of violence. It is concerned with the period after an injury event has occurred (post-event phase).

Another way of defining prevention activities focuses on the target group of interest. This definition groups interventions on three levels.

**Universal interventions** are aimed at groups or the general population without regard to individual risk (e.g. violence prevention curricula delivered to all students in a school or children of a particular age; community-wide media campaigns; seat-belt laws; drinking and driving laws).

**Selective interventions** are aimed at those considered at heightened risk of injury or violence – that is, have one or more risk factors (e.g. driver education for young or elderly drivers; training in parenting for low-income, single parents).

**Indicated interventions** are aimed at those who have already demonstrated risk behaviours (e.g. interventions to curb alcohol consumption among alcohol abusers and avoid drinking and driving; treatment programmes for perpetrators of domestic violence).

Passive versus active interventions

**Passive interventions** are those aimed at preventing injuries where the individual is not required to take any action (e.g. an airbag deploys automatically on impact). They are interventions that are independent of human behaviour.

**Active interventions** are those where an individual's behaviour is involved (e.g. a seat-belt requires the individual to put the belt on). Such interventions require some human involvement for their success.

In the field of unintentional injury prevention there is a strong consensus that passive interventions, aimed at creating a safer environment, are more likely to be successful than active interventions. This emphasis on passive countermeasures parallels the management of other public health problems. For example, the provision of a clean water supply is more successful in preventing disease, than asking people to boil their water before drinking, just as automatic sprinklers constitute a more effective fire protection than reliance on hand held extinguishers.

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Defining characteristics of the public health approach.

- It is population-based.

By definition, public health is not about individual patients but rather is concerned to prevent health problems and extend better care and safety to whole populations.

- It is multidisciplinary.

It draws on knowledge from many disciplines including medicine, epidemiology, engineering, sociology, psychology, criminology, education and economics.

- It is evidence-based.

The public health approach is based on the scientific method.

- It emphasizes collective action.

It has been proved over and over again that cooperative efforts from such diverse sectors as health, education, social services, justice and policy are necessary to solve what are often assumed to be purely “medical” problems.

- It emphasizes prevention.

Above all, public health is characterized by its emphasis on prevention. Rather than simply accepting that injuries happen, its starting point is that injury events and violent behaviour, and their consequences, can be prevented.

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In Haddon's definition, injury occurs when energy is transferred in such ways and amounts and at such rapid rates that persons are damaged. This definition allowed Haddon to develop 10 basic strategies for reducing or preventing the consequences of damage due to this transfer of energy.

- Prevent the creation of the hazard in the first place (e.g. preventing the manufacture of gunpowder or the building of nuclear reactors).
- Reduce the amount of hazard brought into being (e.g. limiting the speed of vehicles, reducing the lead content of paint).
- Prevent the release of hazard that already exists (e.g. destroying the nuclear or conventional armouries of major powers, pasteurizing milk).
- Modify the rate or spatial distribution of release of the hazard from its source (e.g. reduce the slopes of ski trails for beginners, use of parachutes).
- Separate, in time or space, the hazard and that which is to be protected (e.g. pedestrian overpasses on busy roads, lightning conductors to earth lightning strikes).
- Separate the hazard and that which is to be protected by a material barrier (e.g. using helmets, safety spectacles, machine guards).
- Modify relevant basic qualities of the hazard. (e.g. rounding corners on furniture, using frangible posts for lighting and other roadside equipment).
- Make what is to be protected more resistant to damage from the hazard (e.g. tougher standards for buildings in cyclone areas).
- Move rapidly in detecting and/or removing the hazard (e.g. using fire sprinkler and detection systems, using electrical cut-off systems to prevent electrocution).
- Stabilize, repair and rehabilitate the object of the damage (e.g. providing timely emergency medical help at the scene of injury, using appropriate medical procedures such as skin grafting for burns).

The Haddon emphasis on energy damage is particularly appropriate in the industrialized context given the increasingly large amounts of energy used in "man-machine" systems that constitute the basic units of work, leisure and transportation.

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Injuries result as a culmination of a set of circumstances and pre-existing conditions which can be best understood as a chain of events. One important model to understand the causal chain of events involved in injuries is that proposed by William Haddon, commonly known as the **Haddon Matrix**.

This model extends the **epidemiological approach**, to produce a matrix where the causal factors involved in injury can be better understood through the interaction of multiple factors over time. It consists of temporal notions of pre-event, event and post-event phases plotted against the host or person, agent (product) and environmental factors (physical and social) of the epidemiological model. When these two axes (time and other factors) are combined they produce the Haddon Matrix. This is generally a twelve-cell matrix although it can be a none-cell matrix if the physical and social environment columns are combined into one.

Haddon’s model effectively separates out the factors which predispose an injury causing event to occur (pre-event phase) from the actual event itself (event phase) in which energy is transferred to the host in an amount to cause damage. Haddon also added a post-event phase, encompassing transport, emergency care and rehabilitation, which affect survival and ultimate outcome once the energy transfer has occurred.

Combining these phases of injury with the epidemiological model, creates a matrix for the study of both injury causation and prevention. The temporal phases are generally associated with primary (pre-event), secondary (event) and tertiary (post-event) prevention.

The value of this model is that it points out different areas in which interventions can be mounted to prevent or reduce the severity of injuries. The point of intervention is not necessarily early in the chain of events. It should be where the intervention is possible, or ideally, where it is most effective.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Over 30 years ago, William Haddon Jr described road transport as an ill-designed “man-machine” system in need of comprehensive systemic treatment. He produced what is now known as the Haddon Matrix, illustrating the interaction of three factors – human, vehicle and environment – during three phases of a crash event: **pre-crash, crash and post-crash**. The resulting nine-cell matrix models the dynamic system, with each cell of the matrix allowing opportunities for intervention to reduce road crash injury. This work led to substantial advances in the understanding of the behavioural, road-related and vehicle-related factors that affect the number and severity of road traffic injuries.

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INJURIES FROM ENVIRONMENTAL RISK FACTORS

- Road traffic
- Falls
- Burns
- Drowning
- Poisoning
- Animal-related
Unintentional childhood injuries

ROAD TRAFFIC INJURIES DEFINITION

Traffic-related injuries or road traffic injuries (RTI) are injuries due to any crash originating, terminating or involving a vehicle partially or fully on a public highway.

Information from TEACH VIP manual, kindly provided by VIP/WHO
Road traffic injuries are the leading cause of death among 10 to 19 year olds.

More than 260,000 children and teenagers die from a road traffic injury each year. That is about 718 children per day. Approximately 10 million more are non-fatally injured. In high-income countries most children killed are occupants of vehicles (except in some like the Netherlands where bicycle riding is commonplace) while in low-income and middle-income countries they are usually pedestrians or cyclists.

Graph and notes taken from

Over 50% of the global mortality due to road traffic injuries occur among young adults aged between 15–44 years. Consequently, road traffic injuries contribute the greatest years of potential life lost (YPLL) than any other cause of death.

Many of these young adults are economically active so there are considerable economic costs, at the family and societal level, related to road traffic injuries.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
The risks associated with road traffic injury are many and can co-exist simultaneously. At the individual level some of the risks include male gender, young age, and behaviours such as substance abuse, speeding or not wearing helmets or seat-belts. The use of devices that distract drivers such as mobile phones has also been associated with increased risks for road traffic injuries and their use in conjunction with speeding or substance abuse creates even higher risks.

Physiological conditions such as sleep disorders, certain medications and advanced age may also impair the individual’s ability to function safely in the traffic environment. Other conditions such as reduced conspicuity of pedestrians and lack of experience can also contribute to increased risks of injury.

At the level of the vehicle, the absence of safety features such as seat-belts or airbags, roadworthiness, poor conspicuity, vehicle size and height of the centre of gravity are also related with varying risks of injury. Larger vehicles also constitute a higher risk for pedestrians and for smaller vehicles.

Environmental conditions such as speed cameras, traffic congestion, signage, engineered safety barriers and traffic calming devices also contribute to modulating risks.

*Slide adapted from TEACH VIP manual, kindly provided by VIP/WHO*
Experience shows that with political will and a commitment to achieve effective safety management, a rapid and significant reduction in road injuries can be achieved. The efforts required include (3, 4) a scientific approach to the topic:

- the provision, careful analysis and interpretation of good data;
- the setting-up of targets and plans;
- the creation of national and regional research capacity;
- institutional cooperation across sectors.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
These are the definitions used for fall injuries. The International Classification of Disease (ICD) coding system used by WHO is applied almost universally.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Falls among children are the leading cause of presentation to an emergency department. Nearly 47,000 children and teenagers die from falls each year – that is approximately 129 children per day. But that is just the tip of the iceberg. For every fatal fall there are about 690 children who miss school or cannot work. In addition, non-fatal falls are the most common reason for children to be taken to an emergency room and a leading cause of long term disability.

Graph and notes taken from
While most horse-related injuries (80% in Victoria) occur while the horse is being ridden (equestrian injuries), the remainder occur during horse handling activities or unrelated activities around horses. Of hospitalised equestrian injuries in Victoria, 29% are to the head and face, 26% upper limb, and 4% spine. Fractures are the most common injury, especially to the upper limb.

_Slide from TEACH VIP manual, kindly provided by VIP/WHO_
Most horse-related injuries are falls (reports vary from 63% - 90%) and the likelihood of injury in a fall is increased by the height of the fall - generally over one metre. Whilst risk of injury may not be much greater for horse falls than for other sports, the severity of injury is high. Girls have a higher risk of injury than boys do, due to their greater exposure to horses and horseback riding.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
This slide describes the different developmental characteristics of children of different ages that put them at particular risk for injuries, including fall injuries. For example, as infants and toddlers increase their mobility they frequently trip and fall. If they have access to stairways, falls can be deadly. Cognitively, infants and toddlers are not yet able to follow many directions and caregivers cannot rely on verbal commands or instructions alone to avoid injuries.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
This slide presents the same type of information for older children. You can see that as skills and independence increase, which is a natural part of childhood, exposure to hazards and fall risks increase. Children, such as the ones we saw playing on the roof in Nepal, explore their environment, are often unsupervised and not always aware of or responsive to the risks associated with their behaviour.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Here are some of the important environmental characteristics associated with falls. Stairs, windows, recreation areas, and bicycles are most important to consider for preventing falls among children.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
There are many ways to prevent fall injuries among children. For example, falls out of windows can be prevented by using window guards, opening windows from the top only, and keeping furniture that children can climb on away from the windows. Obviously, for all injuries, close supervision of children is recommended, for example, on balconies, stairs and elevated surfaces such as during feeding or dressing. This slide also lists some of the barriers and facilitators that caregivers and others in a community may experience in implementing many of the prevention measures. For those prevention measures that require funding or products (e.g., resurfacing play areas; installing window guards), it is essential that programs include ways to raise funds and reduce the costs of the products. Simply telling people what they need to do or get, without making it easy and inexpensive for them to do so, will reduce the effectiveness of your program. Community action may be required to advocate for safety improvements e.g. for maintenance, adequate lighting and rails for stairs in communal areas.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
These are the definitions used for burn injuries. The available data are most accurate for fire-related burns.

Slide from TEACH VIP manual, kindly provided by VIP/WHO
Burns are the only child injury which occur more commonly in girls than boys. More than 95,000 children and teenagers die from burns each year – that is approximately 262 children per day. Burns is the only injury which is more common among girls than boys. Burns are particularly prevalent among teenage girls in the Eastern Mediterranean and South-East Asia regions. Burns can result in significant long-term consequences which - in the absence of a comprehensive and coordinated rehabilitation programme – can leave children scarred physically and psychologically for the rest of their lives.

Graph and notes taken from

Children’s skin is more vulnerable to injury than that of an adult. This table illustrates the amount of time it takes to produce a serious burn in adults compared to children for different water temperatures. In some countries, hot water heaters are often set at 140 degrees Fahrenheit (60 degrees Celsius), which can produce a serious burn in a child in 2 ½ seconds, whereas it would take twice as long to produce a serious burn in an adult. By turning down the temperature of the hot water to 120°F (49°C) degrees (the temperature recommended by safety experts), the time increases to 3 minutes for children. This added time may mean the difference between life and death for a small child. It is best to turn the temperature setting down at the source (i.e., on the water heater). However, you still need to test the temperature of the bath water for all young children.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Cooking pots kept in the open living area can be particularly hazardous to young children who run and play in the same space.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*

*Pictures copyright pending.*
Here are some of the important environmental characteristics associated with burn injuries. Children’s exposure to open fires and hot liquids is particularly problematic in some cultures. In others, for example, urban areas in middle and upper income countries, lack of smoke alarms is a particular problem. The relative importance of these risk factors will depend on the particular country, culture, and age group.

It is difficult (if not impossible) to purchase domestic smoke alarms and child resistant cigarette lights in many developing countries, including the countries that manufacture these items for markets in high-income countries.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Here are some strategies to address the risk factors reviewed in the previous slide. Preventing burns to children requires that we look at the environment and the products that they are exposed to and modify them to reduce risk. For example, separating children from open flames and hot cooking equipment is a particularly important strategy for countries whose living arrangements typically include these hazards. In urban areas of middle and upper income countries, lack of functioning smoke alarms is one of the most important risk factors to be addressed.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Drowning is the process of experiencing respiratory impairment from submersion or immersion in liquid. Drowning outcomes are classified as death, morbidity and no morbidity.

This definition of drowning was adopted following the World Congress on Drowning, held in Amsterdam in 2002. Agreed terminology is essential to describe the problem and to allow effective comparisons of drowning trends. Thus, this definition of drowning should be widely used.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Among the various age groups, children under five years of age have the highest drowning mortality rates worldwide. Canada and New Zealand are exceptions, where adult males have the highest rates.

Drowning is the leading cause of injury death to children aged 1-14 years in China. In Bangladesh, 20% of all deaths in children aged 1-4 years are due to drowning. Drowning was the second leading cause of unintentional injury death in children aged 1-14 in the United States in 2000. Drowning is the leading cause of unintentional injury death in children aged 1-3 in every Australian state. Drowning in young children is often associated with a lapse of supervision.

Text from: Facts about injuries: Drowning. WHO, VIP.
Drowning is the leading cause of child death in many countries in the Western Pacific and some countries in South-East Asia.

More than 175,000 children and teenagers die from drowning each year – that is approximately 480 children per day. Children under the age of 5 years are most at risk. Most child drowning events happen in and around the home. In low-income and middle-income countries drowning usually occurs in open bodies of water or water collections systems during everyday activities like playing, washing or collecting water. In high-income countries most drowning occurs during recreational activities in swimming pools or the sea.

Graph and notes taken from

Age as a risk factor for drowning

Among various age groups, children under 5 years of age have the highest drowning mortality rates worldwide. Canada and New Zealand are exceptions, where adult males have the highest rates.

Drowning is the leading cause of injury death to children aged 1–14 years in China.

In Bangladesh, 20% of all deaths in children aged 1–4 years are due to drowning.

Drowning was the second leading cause of unintentional injury death in children aged 1–14 years in the United States in 2000 (18.1%).

Drowning is the leading cause of unintentional injury death in children aged 1–3 years in Australia.

Drowning in young children is often associated with a lapse in supervision.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Major environmental risk factors for drowning include:

**Floods**
- Large numbers of drowning deaths are associated with floods worldwide, including thousands of deaths in single countries (e.g., China);

**Transportation**
- Vessels, which may be unsafe or overcrowded (including refugee boats), and poor weather conditions are associated with large but unknown numbers of drowning deaths every year;
- 90% of Canadian boating victims of drowning were not wearing a flotation device.

Also: water containers and bathtubs, as well as recreational waters.

Major risk factors for drowning include:

**Gender**
- Males are more likely to experience drowning deaths or morbidity than females;
- Males in Africa and the Western Pacific have the highest drowning-related mortality rates worldwide;
- Studies suggest males have higher drowning rates than females due to increased exposure to water and riskier behaviour such as swimming alone and drinking alcohol whilst swimming alone.

**Occupation**
- The occupational mortality rate in Alaskan commercial fishermen is 116/100,000, approximately 90% of these deaths are from drowning;
- Fishing for subsistence using small boats in low-income countries is associated with many drowning deaths.

**Alcohol**
- A literature review shows that between 15-86% of all drowning victims had positive blood alcohol levels, depending on the country reported;
- Alcohol or drug use was implicated in 14% of unintentional drowning deaths in Australia in persons greater than 14 years, of whom 79% were male.

**Epilepsy**
- Children with epilepsy are at significantly greater risk of bath and pool drowning compared to children without epilepsy;
- In Sweden, drowning was the cause of death in approximately 10% of persons with a history of epilepsy (1975-1995);
- In Canada, most epilepsy-associated drowning deaths occur in adults in bathtubs.

**Socioeconomic status**
- Ethnic minority groups generally have higher drowning death rates, possibly due to differences in opportunities to learn to swim;
- In Bangladesh, children whose mothers had only primary education are at significantly greater risk of drowning compared to children whose mothers had a secondary or higher education.

*Slide adapted from TEACH VIP manual, kindly provided by VIP/WHO*
Although many high-income countries have reduced their drowning rates dramatically during the 20th century, there is little documented evidence of how this was achieved. There is evidence in the published literature for the effectiveness of the following interventions.

**Remove the hazard**
- Drain unnecessary accumulations of water (e.g. baths, ponds and buckets).

**Create barriers**
- Build flood control embankments in flood prone areas;
- Implement and enforce mandatory isolation fencing for swimming pools;
- Where possible, fence around rural fishponds, construction ditches where filled with rainwater and other bodies of water around houses and in the community;
- Encourage fencing of homes in close proximity to water (e.g. farmhouses);
- Build safe bridges across ponds and streams;
- Encourage the use of grills over water wells.

**Protect those at risk**
- Promote learn to swim programmes for primary school children (especially in low- and middle-income countries), as swimming and water safety skills are associated with significant drowning reductions;
- Increase awareness of need to supervise children inside and outside the home and establish parent groups or other childcare mechanisms in rural communities (especially around harvesting);
- Educate children to not enter fast-flowing streams and not to swim alone;
- Educate and/or legislate on the use of personal flotation devices in boats;
- Train lifeguards for regular deployment in supervised swimming locations;
- Internationally harmonize the flags and symbols used for beach safety and educate the population about their significance;
- Increase access to supervised public swimming pools to promote learning to swim;
- Educate or legislate against consuming alcohol while boating or around large bodies of water;
- All boats and larger vessels should be checked regularly for safety and safety equipment, and should never exceed the maximum passenger capacity for which they were designed.

**Counter the damage**
- Train the general community in resuscitation, as timely resuscitation initiated by layperson bystanders assists the survival prospects of the paediatric drowning victim.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
This lesson focuses on poisoning in young children aged 0-4 years. This is the highest risk age group for unintentional poisoning in childhood, and involves widely different death rates between countries and substantial morbidity. For global deaths and hospital admissions in high-income countries, a second smaller incidence peak occurs in older children aged 10-14 years.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Substances found in and around the home are most commonly involved in childhood poisoning.

Over 45 000 children and teenagers die from poisoning each year – that is approximately 123 children per day. Many millions of calls are made to poison control centres, most of which are resolved over the phone. Children under the age of one are at greatest risk of fatal poisoning, particularly in low-income and middle-income countries. The most common poisons are over the counter medications, prescription drugs, paraffin, household products and pesticides.

*Graph and notes taken from*

**WHO. World report on child injury prevention. 2008.**

Further improvements to injury data systems and research to identify specific agents and risk factors is required, particularly for low and middle-income countries. For older children (aged 10-14 years), attention to coding is required to ensure that deaths and non-fatal poisonings within this age group are reliably coded as 'unintentional.' Higher hospital admission rates have been reported in rural versus urban hospitals (e.g. Australia), though this may reflect differences in medical practice rather than in actual poisoning rates.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
The remainder of this lesson focuses on children aged 0-4 years. Many pharmaceuticals are attractive to children because of their colour and their resemblance to candy or sweets.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*

*Picture: Joan Ozanne-Smith. Used with copyright permission.*
The agents involved in child poisoning vary widely between countries and over time within countries. This appears to relate to exposure patterns, including medical prescribing habits. Previously common poisoning agents, such as kerosene and paraffin, are no longer a significant problem in high-income countries, as they have been replaced by other energy sources for light and heat.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
A number of factors related to the way in which poisons are packaged contribute to safety. These range from limiting the amount or concentration of the agent, to warning labels and innovative design solutions. A number of these countermeasures are illustrated in the slides that follow. Relying on labels is limited by literacy levels in the population and by immigrants who might be unfamiliar with the language.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
This slide illustrates several aspects of child resistant packaging of pharmaceuticals. Packaging smaller amounts (bottle 2) limits the available toxic dose. However smaller volumes may be more concentrated as for is common in the packaging of paediatric 'Paracetamol.'

All three of the bottles use cognitive/physical barriers known as child resistant closures. These closures operate on the premise that children in the “at risk” age range are not of the developmental level needed to successfully open these closures. However, these bottles are classified as child-resistant rather than child-proof. The infant formula (bottle 3) is supplied with a child resistant lid. The dropper provided for administration of the medication also has a child resistant closure.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*

*Picture: Joan Ozanne-Smith. Used with copyright permission.*
Design solutions to for the packaging of toxic domestic chemicals include child resistant closures for cleaning agents, bait stations for rodenticides (rodenticide embedded in paraffin block beyond the reach of a child’s finger), and plastic cages for naphthalene blocks (moth balls).

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*

*Picture: Joan Ozanne-Smith. Used with copyright permission.*
Poisons should be stored in a safe place with a locking mechanism. Not only are children able to climb and reach high places (such as the top of the fridge and cupboards), but they can also easily access handbags. An ideal storage space is a designated cupboard or cabinet which is self-locking and requires an adult to operate the latch. In the slide above, an object that is roughly the length of an adult finger is required to operate the latch on this cupboard.

Slide from TEACH VIP manual, kindly provided by VIP/WHO
Picture: Joan Ozanne-Smith. Used with copyright permission.
Careful assessment of children following possible toxic ingestion is essential. The potential amount ingested and its toxicity should be assessed according to the child’s mass and by consulting toxicology databases, Poison Information Centres or other relevant guides. While the child may be asymptomatic, the potential for delayed effects require a period of observation. Pre-hospital and in-patient best practice protocols are provided by major teaching hospitals such as the Royal Children’s Hospital, Melbourne, Australia. (www.rch.org.au)

Slide from TEACH VIP manual, kindly provided by VIP/WHO
Unintentional childhood injuries

Haddon’s matrix

<table>
<thead>
<tr>
<th>PREVENTION</th>
<th>Host</th>
<th>Agent</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-event</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-event</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<<NOTE TO USER: Have the audience consider how to fill it in, in relation to childhood poisoning.>>

Slide from TEACH VIP manual, kindly provided by VIP/WHO
## Unintentional childhood injuries

### Haddon’s matrix

<table>
<thead>
<tr>
<th>Pre-event</th>
<th>Host</th>
<th>Agent</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teach children not to help themselves to food or drink</td>
<td>Package small volumes</td>
<td>Parental, caregiver, professional education re: poisoning prevention</td>
<td></td>
</tr>
<tr>
<td>Package low concentrations</td>
<td>Child resistant closures</td>
<td>Safe storage places</td>
<td></td>
</tr>
<tr>
<td>Other child resistant designs</td>
<td>Label clearly to avoid dosage errors</td>
<td>Toxicology databases updated and readily available to relevant professionals</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seek advice from label, Poisons Information Centre, doctor or Emergency Department</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Post-event</th>
<th>Host</th>
<th>Agent</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information from package and amount remaining identified</td>
<td>Details of poisoning events detailed in injury surveillance databases</td>
<td>Doctors, pharmacists, retailers warn of toxicity to children</td>
<td></td>
</tr>
</tbody>
</table>
The problem of animal-related injuries is largely unrecognised on a global scale. The recent availability of good quality injury data has identified the scale of relevant problems (such as dog bites, horse-related injuries and bee and wasp stings) in high-income countries. In the United States, between 1979-1990, there were 718 venomous deaths (most were hymenoptera – double winged insects such as bees and wasps) and 1,164 non-venomous deaths related to animals.

Published literature on animal-related injuries remains very limited, particularly for low- and middle-income countries. Sparse literature reports identify snakebites as an enormous cause of fatalities in some countries, including Brazil, Costa Rica, Sri Lanka, Cameroon, Nigeria, French Guiana, Senegal, Gabon, Colombia, and the Ivory Coast. They are also listed as a source of permanent disability in some countries.

*Slide adapted from TEACH VIP manual, kindly provided by VIP/WHO*
Many risk factors have been identified for dog bites and dog attacks, particularly in high-income countries. They have been categorised as those related to the victim, those related to the dog and those related to the environment. Children are particularly vulnerable to dog attacks, due to their size and the proximity of their face to that of the dog. Dog attacks are frequently associated with interaction (which may be provocative) with the dog prior to the attack. Statistical data is required from effected countries to determine the precise dimensions of the rabies problem following dog attacks.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
In Vietnam in 2001, there were 360,000 children bitten by animals at a rate of 1,105/100,000, with no fatalities reported. Of all animal bite injuries, 79.5% were caused by dogs, and 83.3% occurred whilst the animal was being fed. Geographic differences were observed with snakebite, which was most common in the Central Highland region, while fish bites were most common in the Mekong River Delta. Almost one-fifth of animal bite victims required hospitalisation. Of these, 61% were caused by dogs and 21% were caused by snakes/centipedes.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
The risk factors identified in slide 14 are reported widely in many studies reviewed in 2001. Deaths associated with dog attacks are uncommon in high-income countries (<0.1/100,000 population) and tend to involve young children and the elderly. Other risk factors for death include:

- More than one dog involved
- Owner’s property
- History of dog aggression
- Sleeping infant
- Child’s unauthorized access to fenced yard or yard with leashed dogs
- Dog escaping enclosure or restraint and
- Certain dog breeds

For non-fatal attacks, risk factors associated with the victim include:

- Child, especially under 5 years
- Male
- Victim known to the dog
- Interaction prior to attack (provocation reported in up to 50%).

Factors associated with the dog include:

- Male dog
- Over-representation of some breeds
- Leashed dog

Environment factors include:

- Home location;
  - Especially for children, approximately equally child’s home versus other home,
  - Dog’s home (one report of 85% of attacks).

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Further research is required to identify additional effective countermeasures. Additional interventions recommended in the published literature include:

- strict controls on high risk breeds,
- neutering of male dogs,
- constraining measures such as leashing,
- “user pays” liability insurance,
- dog training,
- education of dog owners and families, and
- informed pet selection.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Many other countries are affected by venomous snake-bites, but the literature is sparse. Risk factors include rural areas, the rainy season, agricultural and rain-forest workers and being male. Delays to medical treatment are reported for Colombia and Senegal where traditional practitioners/healers are often consulted initially (93% of cases in Senegal).

Snake bites are most common to the lower extremities. In cases of envenomation, neurological signs generally occur within 6 hours. Anti-venoms are widely available and anti-venom toxicity is reported to be uncommon or negligible.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Death and disability due to snakebites are now uncommon in high-income countries with venomous snake populations. Important factors influencing different bite rates and their consequences include:

- mechanized farming methods,
- use of protective footwear and clothing,
- availability of anti-venom,
- access to medical care, and
- community awareness of snakebite management.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Envenomation from snakebites is a major health concern in some developing countries. Rural agricultural workers and their families are most vulnerable. Traditional treatment methods for snakebites used in some communities are ineffective and sometimes harmful, and delay the administration of effective antivenom therapy. Snakebite occurs more frequently in Sri Lanka than anywhere else in the world. Public education campaigns were undertaken by the National Poisons Information Centre, Colombo, Sri Lanka, stressing the need to attend hospital without delay after a snake bite, teaching people that pharmaceuticals are more effective than traditional medicines for treating snake bites. The Centre used radio broadcasts and also produced printed educational materials for doctors and the public about snakebite treatment and about the work of the Centre. Public education campaigns over a ten-year period, from the mid 1980s to mid 1990s, were associated with a five-fold increase in hospital admissions due to snake bites, a reduction in mortality from 3.7% to less than 1%, and a reduction in morbidity.

Scorpion envenomation effects the cardiovascular and the central nervous systems and deaths tend to occur within 30 minutes of the sting. The lower limb is the most frequent site for bites to children (Niger). A Brazilian case study series of 76 bites and stings by venomous creatures reported 44% by snakes, 21% by scorpions and 17% by centipedes.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
A prevention programme undertaken by the Moroccan Centre Anti Poisons was concerned with prevention of scorpion stings, the most frequent cause of poisoning reported to the Centre (28% of enquiries). Scorpion venom acts very quickly (within 24–48 hours), and most stings occur in rural areas, a long way from health services. At the time, there was no effective antivenom, and physician's undergraduate training did not include consideration of the most effective treatment for scorpion stings. The Centre organized training programmes addressed to health professionals. It also produced and distributed a leaflet for the public describing how to prevent stings and what action should be taken in case of sting. Prospective studies and retrospective studies of poisoning cases were undertaken in the main cities affected.

Other syndromes associated with the ingestion of fish are out of the scope of this lesson.

Slide from TEACH VIP manual, kindly provided by VIP/WHO
More studies are needed on preventive measures for animal-related injuries, including those related to farm animals and other high-risk exposures.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
The ICD 9 and ICD 10 coding systems, now in use in most large countries (including China), include quite specific categorizations for animal related injuries. Specific codes are available, for example, for dog bite, contact with venomous snakes and lizards, contact with hornets, wasps and bees, bitten or struck by crocodile or alligator, etc. Countries need to move progressively towards utilizing these specific codes for all hospital-admitted cases and for deaths. The application of the full range of available ICD codes to all injury related hospital admissions and deaths is potentially the most important step that could be taken to progress injury surveillance globally. Coded hospital admission data using these codes (or even more sophisticated modifications) are collected routinely in some high-income countries (eg Australia, New Zealand).

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Where identification may be important, the animal involved should be caught if it is safe to do so. Medical treatment should be sought with minimal delay. When cleaning wounds, beware of the potential for retained foreign bodies. Antibiotics and anti-tetanus vaccination may be required prophylactically.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Both fatal and non-fatal animal-related injuries are under-recognized public health hazards. Improved collection and reporting of deaths and hospital treated cases is fundamentally important for future prevention and monitoring.

Protective footwear and clothing is required for all workers in high-risk areas for snake and scorpion bites and stings. Anti-venom for poisonous snake and scorpion bites and stings should be available for high-risk populations and public education is required for the seeking of prompt and appropriate medical treatment.
Not only are data hidden by place of occurrence, age and sex if these data are not collected and not disaggregated, but there are differences in data availability at a European, Regional, National, or even local level.

There is a lack of acknowledgement of what can be done because many policy workers and practitioners do not realize that injuries can be prevented through a public health approach, as is being advocated here.

To rectify this relative neglect, there is a need for government commitments and priority setting based on evidenced good practice.
Unintentional childhood injuries

STRATEGIES OF INJURY INTERVENTION

- Environmental, engineering designs
- Enforcement, legislative mandates
- Education, behaviour
- Economic incentive, equity
- Empowerment
- Evaluation
Larger proportions of injuries that are not fatal are associated with severe and permanent disabilities. The most notable and common disabilities are those to the extremities, traumatic brain injuries and spinal cord injuries. The rehabilitation of persons with these disabilities can be costly and sometimes difficult to access by people with poor economic resources. This highlights the importance for primary and secondary prevention efforts aimed at reducing the occurrence of injuries and numbers of disabling injuries and at reducing the burden to healthcare, social and judicial services.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*
Unintentional childhood injuries

STRATEGIES OF INJURY INTERVENTION

Cost benefit analyses have shown that injury prevention is value for money (European data):

• € 1 spent on smoke alarms saves € 69;
• € 1 on child safety seats saves € 32;
• € 1 spent on bicycle helmets saves € 29;
• € 1 spent on prevention counselling by paediatrician saves € 10

Reference:
Many approaches, one goal

As seen throughout this course, injuries can affect populations in many ways, places and at any point in people’s lives. The approaches to understanding and controlling, or preventing, injuries have come from a number of disciplines. It is relatively recently that serious and institutionalised efforts to link these disciplines and approaches have begun.

*Slide from TEACH VIP manual, kindly provided by VIP/WHO*

Safer environments for children do not pose “injury” risks.
The inter-disciplinary nature of injury studies
Different disciplines that have provided major inputs to the field of injuries include the fields of environment, education, engineering, law, health sciences, social sciences and economics. The knowledge derived from these disciplines is applied by various sectors in the development of policy and interventions designed to prevent or control injury.

*Slide adapted from TEACH VIP manual, kindly provided by VIP/WHO*
The role of government: What governments can do

- Institutional development
  Make road safety a political priority.
  Appoint a lead agency for road safety, give it adequate resources, and make it publicly accountable.
  Develop an inter-disciplinary approach to road safety.
  Set appropriate road safety targets and establish national road safety plans to achieve them.
  Support the creation of safety advocacy groups.
  Create budgets for road safety and increase investment in demonstrably effective road safety activities.

- Policy, legislation and enforcement
  Enact and enforce legislation requiring the use of seat-belts and child restraints, and the wearing of motorcycle helmets and bicycle helmets.
  Enact and enforce legislation to prevent alcohol-impaired driving.
  Set and enforce appropriate speed limits.
  Set and enforce strong and uniform vehicle safety standards.
  Ensure that road safety considerations are embedded in environmental and other assessments for new projects and in the evaluation of transport policies and plans.
  Establish data collection systems designed to collect and analyze data and use the data to improve safety.
  Set appropriate design standards for roads that promote safety for all.
  Manage infrastructure to promote safety for all.
  Provide efficient, safe and affordable public transport services.
  Encourage walking and the use of bicycles.

The role of industry: What vehicle manufacturers can do:

Ensure that all motor vehicles meet safety standards set for high-income countries – regardless of where the vehicles are made, sold or used – including the provision of seat-belts and other basic safety equipment.

Begin manufacturing vehicles with safer vehicle fronts, so as to reduce injury to vulnerable road users.

Continue to improve vehicle safety by ongoing research and development.

Advertise and market vehicles responsibly by emphasizing safety.

What donors can do

Highlight the improvement of road safety outcomes as a global development priority.

Include road safety components in grants for health, transport, environmental and educational programs.

Promote the design of safe infrastructure.

Support research, programs and policies on road safety in low-income and middle-income countries.

Make funding for transport infrastructure projects conditional on the completion of a safety audit and any follow-up required.

Set up mechanisms to fund the sharing of knowledge and the promotion of road safety in developing countries.

What communities, civil society groups and individuals can do

Implementing proven interventions could save MORE THAN 1000 children's lives per day
Encourage governments to make the roads safe.
Identify local safety problems.
Help plan safe and efficient transport systems that accommodate drivers as well as vulnerable road users, such as bicyclists and pedestrians.
Demand the provision of safety features, such as seat-belts, in cars.
Encourage enforcement of traffic safety laws and regulations, and campaign for firm and swift punishment for traffic offenders.
Behave responsibly by:
- abiding by the speed limit on roads;
- never drinking when over the legal alcohol limit;
- always wearing a seat-belt and properly restraining children, even on short trips;
- wearing a crash helmet when riding a two-wheeler.

Slide from TEACH VIP manual, kindly provided by VIP/WHO
Applying key approaches will save children's lives. There is no single blueprint for success, but a number of basic principles underlie most of the successful child injury prevention programmes around the world, these are:

- Legislation, regulation and enforcement
- Product modification
- Environmental modification
- Education, skills development and advocacy
- Emergency care and rehabilitation

In countries where the greatest reductions have been recorded, a combination of these approaches has been employed. In addition, countries that encourage a culture of safety and display strong political commitment have made great progress in reducing their child injury burden.

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Notes and picture taken from

Unintentional childhood injuries

POINTS FOR DISCUSSION

❖ What data sources could you use to determine the injury burden in your country?

❖ What sectors would you involve in setting up an injury prevention plan?

❖ Is Haddon’s matrix useful in developing prevention programmes?

❖ What role does civil society have to play and how could you help them get involved?
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