



2002 Chief Medical Officer of Health Report

Injury: Predictable and Preventable

A Message from Ontario's Chief Medical Officer of Health

This year I have chosen to report on injuries and their impact on all Ontarians. More than 2,000 residents of Ontario are injured daily. This translates into more than one person being injured every minute of every day. The vast majority of injuries are both predictable and preventable and are not just “accidents”.

In the field of injury prevention, injuries are categorized as being unintentional or intentional. Unintentional injuries include injuries sustained from motor vehicle collisions, falls, scalds, burns, drownings, poisoning or suffocation. Intentional injuries include injuries sustained from suicide and violence. For the purposes of this report, I will focus on unintentional injury. Regardless of age, unintentional injury ranks fourth among the leading causes of death, after cancer, circulatory system and respiratory diseases. Additionally, unintentional injury is the leading cause of death for people aged 1 to 34.

Injuries incur significant direct and indirect costs to the residents of Ontario and our provincial health care resources. Direct costs of unintentional injuries are attributed to such things as medical care, hospitalization, rehabilitation and non-institutional care. Indirect costs of unintentional injuries are attributed to both the social and economic productivity losses. In 1996, the combined direct and indirect costs of unintentional injuries were almost \$3 billion dollars. These costs are alarmingly high and highlight the need for a cross-jurisdictional multidisciplinary approach to this significant public health issue.

In this report, the burden of injury in Ontario, multiple risk factors, challenges in prevention, strategies for prevention, and future recommendations will be discussed.



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Why is Injury an Important Public Health Issue?

No one is immune to injury. All Ontarians are at risk of being injured regardless of age, gender, race, income or place of residence. The risk of being injured is present at home, work, school, day care, while commuting, and during leisure and vacation time. The risk of being injured and the incidence of injury are not distributed equally throughout Ontario. A public health approach is essential to understanding and addressing the complexity of injury issues.

Two significant reasons for responding to injury issues are:

- The impact of injury is immense in terms of morbidity, mortality, personal costs and economic costs.
- Most injuries are preventable. We *can* reduce the incidence and severity of injury.

What are the Trends in Ontario Injuries?

It is encouraging to note that the rate of injury fatalities in Ontario has fallen 21 per cent overall in the past five years from 3,958 in 1994-1995 to 3,138 in 1998-1999. This is an annual average decrease of 6 per cent. Demographically, two thirds of these injury deaths were in males with the mean age of death at 53 years. Additionally, the age-standardized injury death rate in 1998-1999 was 2.9 persons per 10,000 population compared to 3.7 per 10,000 population in 1994-1995 (CIHI, 2001).

What is Injury?

Injury encompasses all the ways people can be physically hurt or killed. More specifically, injury involves unintentional or intentional damage to the body resulting from a transfer of energy. Types of energy that cause injury include mechanical (e.g., motor vehicle collision), electrical (e.g., electrocution), thermal (e.g., burn), radiation (e.g., radiation sickness from excessive exposure), chemical (e.g., poisonings), or from the absence of essentials such as heat (e.g., hypothermia) or oxygen (e.g., suffocation). Mechanical injury, including motor vehicle collisions, falls, and assaults are by far the largest contributors to the injury burden worldwide.

Unintentional injuries stem from such causes as motor vehicle collisions, falls, scalds, burns, drownings, poisonings, and suffocation. Intentional injuries include suicide and violence. For the purposes of this report, we will focus on the burden, multiple risk factors, challenges in prevention, strategies for prevention and future recommendations for unintentional injury in Ontario.

Injury Scenarios

- A toddler wanders into the kitchen of her home while dinner is being prepared. Her mother has just finished boiling water in a kettle and the cord dangles over the counter. While the mother's back is turned, the toddler pulls on the cord, bringing the kettle down on herself, scalding her face and upper body.
- A 12-year-old boy living on a farm in rural Ontario is driving an older model tractor, unequipped with rollover protection or seat belts, while his father works in the barn. The tractor hits a large bump; the boy falls off the tractor and is crushed by the rear wheel. He dies before he can be transported to hospital.





- A young father at the end of his busy workday is driving his family to a campground to begin their vacation. His six-month old son is in his car seat in the back seat behind the father. His five-year old daughter, wearing a seatbelt, is seated in the back seat behind the mother. Tired from his busy day, the father dozes off and drives off the road into a ditch. The impact hurls the five-year-old daughter out of her seat belt, throwing her full force against the back of the mother's seat. The girl is killed and the mother is moderately injured. The father and infant survive with minor injuries.
- An 84-year-old woman arises from bed one morning before daylight. Very independent and living alone in a city apartment, she fell several months ago, fracturing her wrist. This morning, she falls again – this time fracturing her hip. A concerned neighbour discovers her later that day. She undergoes surgery for her fractured hip but is no longer able to live independently and has to move into a nursing home.

Who Gets Injured?

While all Ontarians are at risk for injury, there are definite patterns associated with age, gender, geography and socio-economic status. Infants and toddlers are at particular risk for falls, poisoning, drowning, burns, scalds and suffocation. School-age children are most likely to suffer traffic-related and playground injuries. Teens and young adults are at highest risk for injuries related to traffic, sports and the workplace. Older adults are most at risk for serious injuries due to falls.

Young men tend to be bigger risk takers than young women and are associated with a disproportionately high number of motor vehicle collisions. Residents of northern Ontario have higher injury rates than residents of southern Ontario. Rural Ontarians are involved in more motor vehicle collisions than their urban neighbours and Aboriginals have disproportionately high injury rates compared with the rest of the population.

How are the Determinants of Health and the Risk of Injury Related?

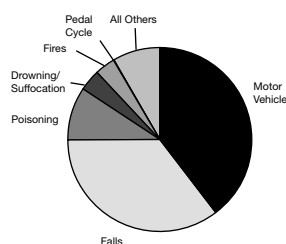
The risk of injury is associated with the determinants of health, which describe health status being influenced by a number of factors. Such factors include: income and social status, social support networks, education, employment/working conditions, social environments, physical environments, personal health practices and coping skills, healthy child development, biology and genetic endowment, health services, gender and culture. Although the mechanisms by which these determinants interact with injury risk are not yet well understood, there is good evidence linking these factors with an individual's risk for many causes of injury.

What are the Facts about Injury in Ontario?

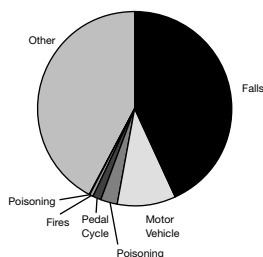
Injury is clearly one of the most pervasive health challenges facing this province. **More than 2,000 people are injured in Ontario every day.** That is more than one person injured every minute.

Across all age groups, unintentional injury ranks fourth among the leading causes of death, after cancer, circulatory system and respiratory diseases. It is also the fourth leading cause of hospitalization. Unintentional injury is the leading cause of death for people aged 1 to 34. Injury is also a very significant contributor to potential years of life lost.

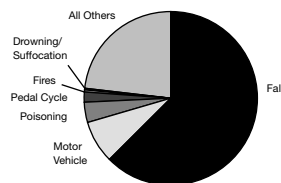
Unintentional Injury
Resulting in Death
Ontario, 1996



Unintentional Injury
Resulting In Non-hospitalization
Ontario, 1996



Unintentional Injury
Resulting In Hospitalization
Ontario, 1996



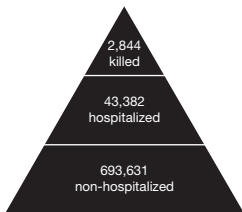
Note: Other includes railway, motor vehicle non-traffic, air and space, recreational and other incidents. Data are drawn from SMARTRISK, *The Economic Burden of Unintentional Injuries in Ontario*, 1999.

- In 1998-99, 3,138 Ontarians died of intentional and unintentional injuries. That is more than eight people per day. Two-thirds were males. The largest percentage of injury deaths (39 per cent) was among persons aged 65 years and older (CIHI, 2001).
- The Northwestern region of Ontario had the highest injury death rate, (6.4 per 10,000 population) followed closely by the Northeastern region (6.0 per 10,000 population). Central East had the lowest injury death rate at 2.4 per 10,000 population, while the Eastern and Central West regions both had rates of 2.8 and the Southwest had a rate of 3.5 per 10,000 population (CIHI, 2001).
- Deaths, however, are truly only the “tip of the iceberg.” For every person killed, 250 are injured but survive (SMARTRISK, 1999). These injuries result in time lost from work or school, disruptions in family life, pain and suffering, and expenses related to hospital care, medical care and rehabilitation.
- In 1996, 43,000 people were hospitalized for unintentional injuries, with nearly two-thirds of those resulting from falls. More than 15,000 people were left with partial, permanent disabilities and 1,100 suffered a total, permanent disability.
- In 1996, more than 690,000 Ontarians were treated for injuries without hospitalization, with by far the largest proportion related to falls.
- Unintentional injuries cost Ontario almost \$3 billion in direct (health care) and indirect (social and economic productivity losses) costs in 1996. In that year, 2,844 people died of unintentional injuries. Motor vehicle collisions claimed the most lives, followed by falls, poisonings, drowning, suffocation and fire.

Injuries Are Not “Accidents”!

Injury is an issue that is poorly understood by many and under-recognized as a health issue. Injury accounts for 11 per cent of the total economic burden of all illness in this country and receives only 1 per cent of health-related research dollars. This may be partly due to the fact that injury generally results from complex factors and encompasses many different kinds of events. There is also the widespread – and mistaken – belief that injuries are unavoidable “accidents” that are an inevitable part of life. While the risk of injury is constant, the tools to manage risk are available to Ontarians. The impetus for injury prevention efforts is the fact that the majority of injuries that occur are predictable and preventable!

The Injury Pyramid: Unintentional Injury in Ontario, 1996



SMARTRISK, *The Economic Burden of Unintentional Injuries in Ontario, 1999.*

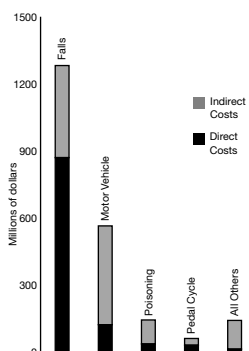
How Can Injuries Be Prevented?

A variety of strategies, some more successful than others, have been utilized by practitioners to tackle the different aspects of injury prevention. Education campaigns (e.g., anti-impaired driving campaigns), legislative changes (e.g., seatbelt and bicycle helmet laws, graduated licensing), and product modifications (e.g., childproof medication bottles, air bags and other safety devices in cars) have all worked to reduce injuries. The number of people killed and hurt in Ontario has fallen steadily, (e.g., the number of unintentional injuries treated in hospitals has fallen by 10 per cent in the last five years) indicating that prevention efforts are making headway (CIHI, 2002). While much remains to be done, improvements appear to be substantial in the area of road safety. The Ontario Ministry of Transportation is working to meet the stated targets in the *National Road Safety Vision 2010*. They are striving to meet the targets of this vision through sustained public education programs, legislative initiatives, enforcement and continued capital investments in our provincial highway system.

It should be noted that the field of injury prevention is in its infancy. There is a great deal to be learned about what constitutes “best practices” to prevent injury. How do people perceive risk? What are the most effective ways to reach different groups of people? What are the safest ways to construct our environments? Our data and available research are limited. Much remains to be accomplished in order to decrease the number of injuries in Ontario.

A major investment in injury prevention would pay off in lives saved, injuries foregone and millions of health care dollars freed up to deal with other pressing needs. **The majority of Ontario’s spending on injury is currently directed at treating injuries, rather than preventing them. Dollars put towards injury prevention research and effective programming need to be viewed as an investment, rather than a cost.**

Total Economic Costs Resulting from Unintentional Injury Ontario, 1996



SMARTRISK, 1996

What is the Burden of Unintentional Injury in Ontario?

Unintentional injury places a heavy burden on Ontarians, both in shared economic costs and personal loss. Injury or death can be expressed in economic terms related to the financial resources needed for treatment and lost productivity. The number of potential years of life lost (PYLL) due to premature death is calculated to quantify the economic losses attributable to injury. **The total estimated costs of all unintentional injury in Ontario amounted to almost \$3 billion in 1996. That is an economic burden of more than \$260 for every person in Ontario.**

Direct Costs

The economic costs of injury can be divided into direct and indirect costs. Direct costs include the medical services and products required for treatment and rehabilitation needs. The direct costs of major unintentional injuries for 1996 in Ontario were estimated to be almost \$1.5 billion. Of that, 60 per cent was for costs incurred outside institutions by people living with permanent disability, 24 per cent was for inpatient costs, including hospital, medical and rehabilitation, and 16 per cent related to non-institutional costs (medical and rehabilitation) not associated with permanent disability.

Falls accounted for the highest portion of the costs, at \$871 million, followed by motor vehicle collisions (\$125 million), and poisonings (\$39 million.) These three types of unintentional injuries comprised 70 per cent of total direct costs.

In Ontario, in 1999-2000: (CIHI, 2002)

- There were 64,925 acute care hospital injury admissions in 1999-2000, representing a rate of 56.1 injury admissions per 10,000 population in Ontario. This number is almost 10 per cent lower than the 71,767 injury admissions in 1995-96. These injuries accounted for 627,553 hospital days with a mean length of stay of 10 days.
- Those aged 65 years and over accounted for the majority (43 per cent) of admissions. The number of injuries among females peaked at around age 80. Peaks in injuries for males were in the late teenaged years, the late 30s and the late 70s.
- Unintentional falls (38,513 or 59 per cent) were the leading cause of injury admission, accounting for 73 per cent of all days spent in hospital due to injury. Nearly two-thirds of those admitted for falls were 65 years and over and 60 per cent were women. Motor vehicle collisions (8,409 or 13 per cent) were the second leading cause of admissions. Males accounted for 61 per cent of these admissions and 1,056 or 12 per cent of these admissions were for those between ages 16 and 20.
- There were 4,084 falls among children and youth under 20 years of age, of which 15 per cent resulted from playground equipment. Cycling injuries accounted for 1,369 (2 per cent) of injury admissions. Nearly half of these injuries occurred among those under 20 years of age.
- There were 1,248 pedestrian injury admissions in 1999-2000.
- There were 7,125 injury admissions with at least one head injury diagnosis and 490 with at least one spinal cord injury diagnosis.

Indirect Costs

Indirect costs include a loss in social productivity due to an individual's inability to perform his or her major activities. The estimated indirect costs of unintentional injury in Ontario relate to losses in productivity, based on estimated wages lost. Total indirect costs for Ontarians injured in 1996 were estimated at close to \$1.5 billion. Motor vehicle collisions accounted for the largest share, at \$441 million, with falls at \$411 million, poisonings at \$107 million and drowning, suffocation and fire each accounting for \$42 million. The remaining \$439 million relates to all other causes. By far, the greatest productivity losses were associated with periods of permanent disability. Tragically, injury claims a high proportion of its victims among the young, particularly through motor vehicle collisions, poisoning and drowning.





The Bottom Line

It is clear that Ontarians bear a heavy economic burden for unintentional injury. Investing in additional preventive measures could reduce this burden.

For example:

- A 20 per cent reduction in falls among Ontarians aged 65 years and over would lead to 3,000 fewer hospitalizations and 700 fewer permanently disabled people over 65. The savings would amount to \$55 million annually. As the population ages, we are likely to see an even greater incidence of falls, unless preventive measures are taken.
- A 20 per cent reduction in the incidence of falls for children aged 0 to 9 would result in almost 500 fewer hospitalized children in Ontario, more than 4,000 fewer non-hospitalized injuries and 185 fewer injuries resulting in permanent disability. The net savings would amount to \$44 million annually.
- A strategy to reduce motor vehicle collisions in Ontario – by achieving a 20 per cent decrease in drinking and driving, reducing speed limits and improving the design, construction and maintenance of roads – could result in fewer deaths, fewer hospitalizations, fewer non-hospitalized injuries and fewer injuries resulting in permanent disability. The net savings would amount to more than \$180 million annually. These changes would need to be carefully evaluated for additional social and economic impacts.

What cannot be quantified, however, is the emotional trauma resulting from the preventable death of a person before the end of his or her natural lifespan. Young people who survive a traumatic injury may be left with a permanent disability, severing them from many work opportunities and altering their future roles in family life and society. For older people, an injury can mean a loss of independent living and the necessity for institutional care.

Let's reflect on the scenario about the toddler who was scalded with hot water. Health care costs include sending paramedics to the scene, the ambulance ride to the hospital and hospital treatment in the early days of her injury and over the years of follow-up surgery and therapy. Because she needs specialized treatment, the toddler is flown from her small northern community by air ambulance to an urban burn centre. Her mother is forced to take days off work to accompany her and to pay for accommodation while the toddler recovers. She continues to take time off work as the toddler grows and needs additional skin graft operations. Her husband is required to find alternative care in the neighborhood for their other two children. As the girl becomes school aged, her scars are an embarrassment. The child becomes withdrawn and her grades suffer. This tragedy could have been prevented along with the resultant social, economic and quality of life costs.

Investing in injury prevention is an excellent strategy for protecting Ontario's human capital. As the Canadian population ages, fewer workers will be increasingly relied on to support larger numbers of retired people. One of the greatest threats to that human capital is injury.

What are the Risk Factors for Injury?

We are all at risk for injury, but not equally so. Certain factors, including age, gender, geography, socio-economic status and the environment can be related to differing rates of injury. There are also personal choices we make that can expose us to higher risks.

Who's At Risk?

Injury risk changes with each stage of life, corresponding with normal human growth and development. Young children, for example, are physically smaller in a world primarily oriented to adults' size. Their limited coordination, poor judgement of distance, coupled with inexperience, naivete and curiosity, places them at higher risk for falls, poisoning, suffocation and drowning.

As they grow, youth begin to tackle new experiences, including driving and working. Their inexperience and sense of invincibility make young people, particularly males, susceptible to injury. Combine lack of experience with alcohol and drug experimentation, and high risk-taking behaviour and the results are often serious – even deadly.

For older adults, increased risk for injury accompanies the normal aging process. Deterioration in vision, hearing, muscle mass and strength combined with slower reaction times and medical conditions all put older adults at higher risk of injury.

Determinants of Health

Although the understanding of how the determinants of health affect injury risk is limited, it is clear that these factors do not operate in isolation of one another. For example, people of lower socio-economic status may live in lower quality physical environments, have lower levels of education and limited knowledge of risk and protective factors. These are all factors that may lead to a greater risk of injury.

- Socio-economic status. A retrospective study of injuries to children in the Kingston, Ontario area in 1996, found strong evidence of a connection between increasing economic disadvantage and higher risk for childhood injury (Faelker, Pickett, & Brison, 2000). The gradients were evident for home, recreation/play and fall injuries but much less so for sports injuries. These findings are consistent with other studies of childhood injury. The authors note that individuals living in poverty have fewer resources for supervised child care or safety measures in the home. Impoverished neighbourhoods may also have fewer safe play areas or they may be closer to busy streets and industrial sites. They note that other studies have demonstrated strong socio-economic gradients for pedestrian and bicycle injuries and fatalities.

Injury death rates among Canadian children in 1991 were 40 per cent higher in impoverished environments. The difference was most significant for deaths from fires, drowning and falls. Economic disparities were even more evident in hospitalizations for injury among children. Hospital admissions for fire, burn and poisoning injuries are twice as high among less fortunate children. Choking and suffocation injuries are almost 40 per cent higher (Health Canada, 1997).

A strong relationship between children's use of bicycle helmets and socio-economic status has recently been demonstrated, even in the presence of Ontario's bike helmet legislation. Helmet use rose among all income groups observed in several Toronto locations in 1995 (when the legislation was passed), stayed high among the highest income groups but has fallen substantially among the middle and lowest income groups. In 2001, 84.5 per cent of children in high-income areas were observed wearing helmets, compared with 50.4 per cent of children in middle-income areas and just 33 per cent of children in low-income areas (Macpherson, Kitchen, Murthy, Macarthur, & Parkin, 2002).

- Physical environment. Factors that relate to housing and the design of communities and transportation systems can all contribute to injury levels. For example, higher child pedestrian injury rates among lower socio-economic groups can be partly accounted for by greater exposure to traffic, at least one study found (Macpherson, Roberts, & Pless, 1998). Researchers discovered that children in impoverished Montreal neighbourhoods had to cross on average, 50 per cent more streets a day than those children in wealthier neighbourhoods.

A study of Canadian playgrounds found a significantly higher proportion of play structures in poorer neighbourhoods were below the standards of the *Canadian Standards Association* than those in wealthier neighborhoods (Canadian Council on Social Development [CCSD], 2001).

- Human biology. Gender is a very strong factor in injury risks. The death rate from unintentional injuries for 5 to 9 year-old boys is 6.8 per 100,000 population, compared to a rate of 4.4 for girls (CCSD, 2001). Among 10 to 14 year-olds, the death rate for boys is twice that of girls – 9.6 per 100,000 compared to 4.7 for girls. The hospitalization rate for younger boys is 1.5 times that of girls and older school-aged boys are hospitalized at twice the rate of girls. This trend continues as boys become young adults. Two thirds of the injury deaths in 1998-99 were in males.

Biology is also associated with injury, which is why older adults are more prone to falls. Impaired vision, diminished reflexes, reduced muscular strength and mass, and decreased bone density can all increase the risk and consequences of falling.

- Culture. In Ontario, substantially higher injury rates are found among Aboriginal people who experience three times the injury death rate of Canadians as a whole (McDonald, 2002). First Nations people are also among the province's poorest.
- Personal health factors and coping skills. Whether or not people become injured is closely related to the choices they make: whether or not they choose to wear protective gear, drive after drinking or trained before attempting risky sports. Not wearing a seat belt, for example, is associated with a much higher risk of serious injury or death in the event of a motor vehicle collision. Although 90 per cent of Canadians routinely wear their seat belts, 40 per cent of fatally injured drivers between 1993 and 1997 were unbelted (Transport Canada, 1999).

The use of alcohol is a key factor affecting injury risk. Alcohol and certain drugs can affect judgment, delay reaction time, impair attention span, and reduce coordination and the ability to problem solve. It is estimated that in 1992, alcohol-related injuries and poisonings in Canada caused 3,359 deaths, 123,119 corresponding potential years of life lost (PYLL), 38,687 hospitalizations and 533,895 hospital days (Robson, Single, Xie, & Rehm, 1998). The cost of these injuries is estimated to have been \$3.9 billion (Robson et al., 1998). Alcohol can also affect those who do not drink. For example, victims of drinking drivers.

How Can Injury Be Prevented?

Because a range of complex factors cause injuries, injury reduction measures require collaboration and coordination among many sectors of society. Government sectors – such as health, transportation, labour, education, sports and recreation, and justice at the federal, provincial and municipal levels can contribute significantly to these efforts. Locally, police, fire, emergency medical services, town planning, traffic management, employers, schools and community groups all play a significant role in injury prevention. It is beyond the scope of this report to provide a detailed answer to the complex question of how injuries can be prevented. Instead, I will outline a general approach to the problem and suggest some promising strategies.

How Can the “Population Health Promotion” Approach be Utilized?

A population health promotion approach can be utilized to guide activities in many areas, including injury prevention. This approach takes into account the full spectrum of factors and their interactions known to influence health. Injuries have multiple causes, involve multiple risk factors and occur in multiple sites. Injuries are best prevented through interventions, including health promotion strategies which take into account the full interrelationship of the determinants of health and associated risk factors.

The illustrated Population Health Promotion Model addresses three questions.

- On what issue should we take action?
- How should we take action?
- With whom should we act?

The answers are that action must be taken on the full range of health determinants, that a comprehensive set of action strategies are required and that action must be taken at all levels within society. The model also illustrates the need for evidence-based decision making to ensure policies and programs are effective. It suggests consulting three sources: research studies, experiential knowledge and evaluation studies. Finally, the model is based on a number of values and assumptions, including that health organizations must analyze the full range of possibilities for action and that health problems may affect certain groups more than others.

The *Federal/Provincial/Territorial (F/P/T) Sub-Committee on Injury Prevention and Control* recently developed an injury prevention model based on these principals. The draft *Report on Proposed National Priorities for Injury Prevention and Control* (2001) identifies three key elements:

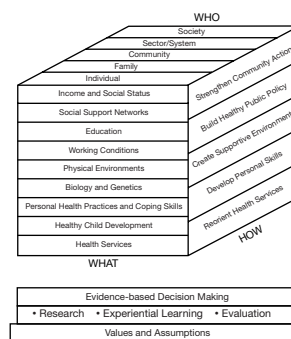
- Injury causes – describing how the injury occurred.
- Priority populations – describing any grouping of people, (e.g., geographical, age, groups, socio-economic status) that experiences a high burden of injury.
- Points of intervention – a continuum of possible points where injuries could be prevented or their impact modified.

According to the authors, some injury prevention practitioners may define the entire cube as their domain of practice. Others may define it by a specific cause, population or point of intervention. The sub-committee calls a population health approach critical to any effective strategy, citing an example of playground fall injuries. Health determinants such as physical and social environments, healthy child development, social support networks, education and income all help determine where injuries are more likely to occur. Effective interventions to control falls need to also come from beyond the health sector, including actions by municipalities, school boards, day care operators, employers, insurers, regulators and enforcement agencies, parents, and caregivers.

What is Haddon’s Matrix?

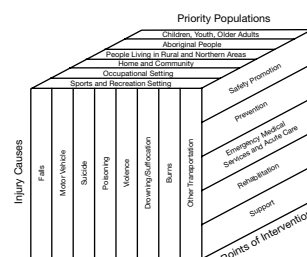
William Haddon, an American physician and engineer, has been referred to as the father of injury prevention. Haddon recognized that there are three elements to an injury: the host (the individual who is injured), the agent (the force(s) that cause the injury) and the environment (physical and social) within which the injury occurs.

Population Health Promotion Model



Hamilton and Bhatti, 1996

F/P/T Injury Prevention Model







Haddon divided these three elements into three phases – pre-event, event, and post-event. Interventions can be aimed at three phases of the injury period – pre-event, before the injury occurs, during the event, to minimize the impact of the injury, and post-event, to maximize the chances for rehabilitation. Injury prevention strategies can be aimed at any of these nine domains (with host, agent, and environment on the Y-axis and pre-event, event, and post-event on the X-axis).

The injury prevention field is primarily concerned with the pre-event stage – that is, preventing the event from occurring in the first place, and secondarily with the event – minimizing its impact. For example, it is preferable to prevent a motor vehicle collision from occurring. But in the event that it does, protective devices such as proper seat belt use, child restraints, air bags, resilient bumpers and roll bars can lessen the severity of the impact.

Passive Versus Active Measures

A useful consideration when planning injury prevention measures is the distinction between active and passive prevention measures. An active measure requires a person to take some sort of action to reduce the potential for injury, such as ensuring a young child does not turn on the hot water and scald him/herself. A passive measure requires no action on the part of an individual, such as water tanks that have the temperature set to prevent scalds. Passive measures are considered to be the most effective strategies for preventing injury because they forfeit the need to rely on human behaviour for protection. In addition, passive measures are most likely to protect all people equally, regardless of their socio-economic status or other determinants of health. Many measures fall in between the two extremes, along a continuum that requires some action at the level of the individual.

Three Important Strategies

Traditionally, injury prevention strategies have been divided into three broad categories, often referred to as the “3 E’s”:

- Education strategies involve skills training or persuading people at risk of injury to alter their behaviour to reduce risk. Examples include anti-impaired driving campaigns, parenting education to improve home safety for children and swimming lessons. Education strategies generally require active measures.
- Engineering strategies involve modifying a product or environment to provide automatic protection against injury. Examples include childproof medicine bottles, air bags in cars and rumble strips on roadsides. These are examples of passive measures.
- Enforcement strategies refer to the passage and enforcement of legislation requiring risk-reducing behaviour. These include measures such as roadside alcohol checks, municipal alcohol policies, severe penalties for drinking and driving, laws requiring the use of seat belts and the installation of smoke detectors in private residences and public buildings. Enforcement strategies fall along the continuum between active and passive strategies.

The most successful injury prevention strategies combine all three approaches and involve a combination of several kinds of interventions, in order to address specific injury causes in a comprehensive and sustained manner.

A large decrease in motor vehicle fatalities over the last 30 years can be attributed to such an approach. Vehicles are now built with many safety features such as seat belts, improved structural design, air bags and anti-lock brakes. Engineering strategies have developed the new Interlock Ignition system. The interlock ignition device is intended to prevent convicted impaired drivers from starting their cars when their breath registers alcohol, for a minimum of one year. Enforcement campaigns – including fines for driving without seat belts, severe penalties for drinking and driving and graduated licensing for new drivers – have shown success, as have education campaigns, including the concept of having a designated driver to reduce impaired driving. Across Canada, motor vehicle fatalities dropped from 6,706 in 1973 to 2,969 in 1999 (Transport Canada, Road Safety Vision 2001). Also in 1999, one third of fatally injured drivers had been drinking, the lowest level in three decades (Traffic Injury Research Foundation [TIRF], 2001).

For many causes of injury, however, prevention efforts have fallen largely into only one of the three “E’s” and many have been less successful as a result. Education strategies are typically the most straight forward to implement. A great deal of effort, advocacy and often a groundswell of support is needed before policy makers are ready to enact legislation, or manufacturers are prepared to alter their products to reduce injury risk.

Knowledge of successful interventions in injury prevention is increasing as the research base grows, but there are still many interventions being practised today that would benefit from rigorous evaluation. Research and evaluation are the only ways to determine whether today’s efforts will lead to the best use of resources in the future.

Revisiting the Scenarios...

All the injury incurred in the scenarios outlined earlier could have been prevented or minimized in a variety of ways, as outlined below. Here, I will focus primarily on the *pre-event phase*, also touching on the event itself.

The Scalding

The toddler’s scalding could have been prevented if the kettle had been made with a short, curly cord that would be less likely to dangle over the edge of the counter. This simple engineering strategy, requiring no action on the part of the individual, could be instituted through legislation or product standards. Without protection from this measure, an education intervention could be used to advise parents of the importance of safely tucking away the kettle cord or preventing the toddler from having access to the kettle when it is in use.

If the injury is not prevented at the pre-event stage, the impact of a scalding can be minimized if the burned skin is immediately immersed in cold water. Thus an educational strategy – first-aid training – for the caregivers would be valuable. Education about a child’s developmental stages is also beneficial for caregivers, since children of this age are too young to understand and avoid the dangers inherent in their environments. Many parents may not realize that it is part of a toddler’s normal growth and development to be curious and investigate his/her environment.

The Tractor Rollover

It may not be widely understood that 12 year-olds lack the ability to safely drive complicated machinery. The *North American Guidelines for Children's Agricultural Tasks*, released in 1999, were developed with the help of farm families and experts in agricultural safety and child development. It offers detailed guidance about what age children should be before they may be expected to safely carry out farm chores, such as working with animals or operating various farm machinery. Farm associations are valuable organizations for disseminating detailed information to their members regarding the age-related risks of operating agricultural equipment. In addition to educating farm families, professionals who work with these families also need to be properly educated about age appropriate operation of farm equipment.

The Motor Vehicle Collision

Various educational initiatives could be useful in preventing collisions from occurring, including instruction on the role of fatigue and other forms of driver distraction in motor vehicle collisions. Driver fatigue is increasingly being recognized as a factor in a substantial number of motor vehicle collisions. The social environment that leads many people to drive while fatigued – including lengthy work shifts – is also a factor.

The physical environment could be engineered to make collisions less likely. Guard rails and rumble strips along the edges of highways can provide alerts for drivers. Technological advances in vehicles might also help protect drivers from falling asleep and better protect occupants in the event of a collision.

During the *event* stage of an injury, a number of things can be done to minimize the effects of a collision. Vehicle occupants for example, can ensure that their headrests are adjusted to the appropriate height to protect the head and neck, that there are no large unrestrained objects in the car, that seat belts are always worn, and that they drive sober and undistracted.

Of great significance in the five-year-old's death in this scenario, is the fact that the child was not sitting in a booster seat. While children grow out of their car seats around the age of 4 1/2 or when they weigh 18 kg (40 lb.), they are not yet ready to wear adult seat belts. One study found that children who weigh under 37 kg (80 lb.) are four times as likely to be seriously injured in a motor vehicle collision if they wear seat belts alone, rather than sit in booster seats (Partners For Child Passenger Safety, 2000). A booster seat lifts a child to ensure that the seat belt fits properly across the shoulder and the lap and is generally recommended for children up to 4 feet 9 inches who weigh 37 kg (80 lb.) or less. As is the case across Canada, Ontario currently has no legislation requiring booster seats for children when they outgrow their forward-facing child restraints. This likely gives many parents the mistaken impression that booster seats are not necessary to protect their children from injury after they weigh more than 18 kg (40 lb.).

In the United States, an incident of a mother whose four-year-old son slid out of his seat belt and died in a rollover successfully advocated that her home state of Washington pass that country's first law requiring booster seats for children. Several other states have followed in adopting similar legislation.

The Fall

One of the most reliable predictors of whether or not an older person will fall is whether he/she has fallen before. The increased frailty of older adults often means falls result in more serious fractures, requiring longer periods of recovery, and greater use of health care resources. An integrated health care system would ensure that upon discharge, the older woman with her arm in a sling would be referred to a community agency that provides a falls prevention program.

Falls often result from a combination of personal and environmental factors. The factors that need to be monitored in individuals who have fallen include: checking and adjusting medication to ensure alertness, assessing for medical disorders which may result in cognitive impairment or postural hypotension, monitoring use of alcohol, checking visual acuity and ensuring adequate nutrition and exercise.

The home should be assessed and may need to be modified for safety, including ensuring adequate lighting, removing clutter, securing rugs and installing hand rails and grab bars in bathrooms. Since many older people cannot afford modifications or are unable to do the modifications themselves, there need to be adequately funded programs in place to make such modifications for them.

Under-utilization or poor maintenance of assistive devices or walking aids may increase the risk of falling. Older adults commonly cite cost as a reason for not using an assistive device. They also may not wish to feel or appear that they are losing their independence or abilities. Finally, older adults need education about wearing appropriate footwear and clothing to prevent falls.

Challenges To Preventing Injuries

There are indeed numerous challenges to both addressing and reducing the burden of injury in Ontario's population. Some of the major challenges include:

- **Prevention versus treatment.** The people who benefit from prevention programs tend to be invisible, since successful prevention programs permit healthy people to stay healthy. Thus, it can be more difficult to draw public support for prevention programs than for treating the traumas that result from injury.
- **Accident.** There is a common tendency to call unintentional injuries "accidents", suggesting that these are unavoidable acts of fate or chance. People who believe injuries are acts of fate tend to believe "it won't happen to me."
- **Research.** Injury prevention practitioners lack enough reliable evidence on which to base their programming. Solid research is also needed to provide a greater understanding of the connections between injury and the determinants of health.
- **Access to data.** Injury data does exist, but it can be difficult to access. The safeguards that rightly keep health information private may also make it difficult for people interested in the issue to access the information.





- **Training.** People working in injury prevention have come to the field through a variety of routes. There are no university programs to train students in a population health approach to injury prevention and very limited continuing education programs. The university programs in Industrial Hygiene and Occupational Health and Safety programs address injury prevention from the perspective of the identification, assessment and control of biological, chemical, physical, ergonomic and psychosocial workplace hazards.
- **Identity and profile.** Injury prevention is not well understood, except in its component pieces, such as drowning prevention, fire prevention and anti-impaired driving strategies. However, if people think about injury prevention only in individual components, it becomes difficult to mobilize support for the issue as a whole. Connected to this issue is the fact that injury prevention has a very low public profile.
- **Resources.** Very limited resources have been directed towards injury prevention to date, especially in relation to its importance.
- **Multi-sectoral stakeholders.** Injury prevention is a diverse field, comprised of many different players using different strategies. Bringing together the various groups and coordinating stakeholders and injury prevention messages is a key challenge.
- **Risk management.** Injury prevention practitioners want people to be aware of the risks of their activities and to take steps to minimize those risks. In many cases, however, they do not want to discourage people from playing sports and engaging in recreational activities that involve injury risks.
- **Determinants of health.** Numerous factors may result in individuals being at greater risk for injury. A greater understanding of the interaction between various determinants and injury risks would lead to improved prevention strategies.

An Agenda for Action:

Recommendations

Ontario's overall rate of unintentional injury has been declining for a number of years but there is still considerable room for improvement. Successful pre-event and event measures include:

- Fewer people are choosing to drink and drive.
- More people are choosing to wear helmets when cycling.
- Cars are being built with more safety features.
- Playgrounds are being constructed with safety as the first criterion.
- Hazardous products are being manufactured in child-resistant packaging.

Nonetheless, preventable injuries still kill and hurt hundreds of thousands of Ontarians each year. There is much work remaining to be done to lower the incidence and severity of injury in Ontario even further.

Recommendations for Policy Makers

- Establish a national injury prevention framework, involving relevant stakeholders. A provincial framework would need to be integrated, coordinated and build upon an adopted national framework. Bench marks for aggressive and achievable provincial injury prevention targets and priorities need to be set.
- Create a provincial strategy to address the role of alcohol in injury, since alcohol is known to be associated with an increased risk of injury. This strategy should address five points: community knowledge, values and mobilization on alcohol-related risks; alcohol sales to underage persons; responsible beverage services; alcohol access; and drinking and driving (Holder, 2002).
- Include the prevention of: 1) falls in older adults; 2) falls in children; 3) motor vehicle collisions in young drivers; and 4) motor vehicle collisions in rural and northern communities in shared national priorities for the prevention of unintentional injuries.
- Strengthen national and provincial injury surveillance capacity, while respecting legitimate privacy requirements. Gaps currently exist regarding the circumstances of fatal injury as well as long-term disability related to those who survive a severe injury. A great deal of data is currently collected by different groups but not adequately shared with people who could benefit from that information. Access to information and critical analysis is needed, as are links between data sets, such as geographic and census data, police, ambulance and hospital data sets.
- Develop a provincial framework for injury prevention through private and public partnerships. A corroborative effort between injury prevention researchers and practitioners is paramount to the development of a functional framework.
- Provide opportunities for public and private investment in research and injury prevention strategies. Emphasize that the corporate sector will benefit from injury reduction. For example, developing safer products would result in fewer costly lawsuits and lower insurance rates. As well, lower injury rates should lead to a lower absentee rate among employees.
- Conduct research on differences in risk factors for injury that are associated with geography, culture, socio-economic status and gender; promising practices and: determining ways for injury prevention practitioners and researchers to collaborate. Provincial funding of injury prevention research initiatives needs to be sustained in order to ascertain the effectiveness of injury prevention programs.
- Invest in proven strategies to reduce the burden of injury and in pilot projects to determine which interventions are the most effective in preventing injury.
- Develop an injury prevention strategy for Aboriginal peoples that complements national injury prevention priorities for this aggregate.
- Advocate for laws at the municipal, provincial and federal levels to reflect best practices in injury prevention. Building codes need to be reassessed periodically by municipalities to determine if they reflect best practices. Municipalities need to regularly assess their by-laws to incorporate the recognized needs of all ages, including such measures as mandating window guard protection in high-rise buildings, grab bars in seniors' residences and four-sided fencing for private swimming pools. Ontario's road safety legislation should optimize passenger safety for all ages. The federal government should strive for the maintenance of optimum product safety standards.

- Invest in public education campaigns to raise awareness that injuries are preventable and are often not “accidents”. “Risk management of injury is a responsibility shared by individuals, families, communities, the private sector and all levels of government” (F/P/T, 2001).
- Protect and strengthen measures to reduce the risk of injury across all levels of income.
- Encourage international collaboration and the pooling of efforts in injury prevention. In particular, the increase in global trade has implications for consumer product safety standards that need to be investigated. All levels of governments must work collaboratively to develop and implement effective healthy public policies.
- Continue to support the development and provision of standardized training for public health injury prevention practitioners in Ontario.

Recommendations for Communities

- Integrate injury prevention strategies into existing programs and methods of working. For example, engineers who design roads, physicians who see patients and manufacturers of products should all consider the risks of injury and how to prevent those risks as part of their work. Injury prevention strategies can also be part of home visit programs by community professionals, including public health, fire and social services.
- Identify and work to reduce barriers to agencies collaborating on injury prevention initiatives. Since injury prevention transcends so many sectors, agencies must work together at the local level.
- Encourage local governments to create safer environments by reducing risks through such measures as creating bicycle paths and municipal alcohol policies.
- Encourage school boards to use the curricula already developed to promote awareness of injury risks and key prevention behaviours among children. Injury prevention can also be integrated into many subject areas (science, math, social studies, physical education) to increase opportunities for education in this area.
- Reduce community risk, in addition to individual risk of injury. The behaviours of others can place us at increased risk for injury (e.g., the impaired driver) and increases the health care burden on everyone.
- Train and educate ambassadors for injury prevention. Many people in the broader community should be advocates for injury prevention: police, fire fighters, school teachers, sports and recreational associations, and product manufacturers.
- Identify and target high-risk populations using local statistics to plan and evaluate programs. Members of the target population should be involved in developing and implementing programs and policies. Consider delivering the messages using recognized community leaders.
- Encourage the media to act more responsibly in the way images about risk are portrayed (e.g., to avoid sending messages that speeding is desirable, being injured is part of the game, etc.).

Recommendations for Health Professionals

- Be well informed about injury prevention as a health professional who regularly interacts with the public and has unique opportunities to provide injury prevention messages.
- Develop comprehensive injury prevention strategies, taking into account the many determinants of health. Use health promotion strategies, combined with a population health promotion approach, to create comprehensive injury prevention programs, including those specifically designed for higher risk populations.
- Analyze the range of possibilities for action, act on the determinants within your jurisdiction, and advocate for other sectors to revise their policies and procedures to enhance injury prevention.
- Use research and evaluation studies to guide practices and track program effectiveness.
- Produce and make available to a variety of groups culturally appropriate educational materials.
- Advocate for and support improved injury prevention policies, standards and legislation, as well as enhanced enforcement. Participate in injury prevention campaigns and events.

Recommendations For Individuals And Families

- Take an active role in learning how to see and manage the risks in your life, considering your vehicle, play, work, school, and home environments. A variety of agencies, both governmental and non-governmental, can provide detailed advice and guidance.
- Get training for new activities, including driving, boating, playing sports and cycling.
- Wear appropriate safety gear for various activities. Parents can model appropriate gear for their children, including wearing helmets, seatbelts and any appropriate protective equipment.
- Supervise your loved ones adequately for their ages and abilities. For example, a six-year-old should not be expected to cross a street by her/himself. An older parent may need help modifying his/her home.
- Follow the *Low-Risk Drinking Guidelines* (Centre for Addiction & Mental Health, 1997) which recommend that people who drink limit themselves to no more than two standard drinks a day, with a maximum of nine per week for women and 14 weekly for men. Develop family policies on alcohol use.
- Understand that alcohol can increase your risk of injury in many different situations, not only while driving a vehicle.
- Be informed and comply with regulations and policies that are designed to prevent injuries and encourage others to do so. Understand that these regulations and policies were designed to keep you safe.
- Follow healthy lifestyle practices; including being active, eating healthy food and getting adequate sleep. This can increase your resiliency and lower your risk of injury.
- Manage the risks in your home. Ensure the rooms are well lit and free of loose rugs and slippery surfaces. Childproof your home if young children are present. Store tools and equipment safely after use. Lower the temperature of your hot water heater to 49 degrees Celsius to avoid scalds.

Conclusion

Unintentional injuries incur a significant burden for Ontario, affecting individuals and families either directly through an injury or death or financially through the economic burden injury places on us all. While everyone is at risk of being injured every day, there are individuals and populations whose circumstances place them at higher risk.

It is important to realize that injuries are not just accidents; they are largely predictable and preventable events. A concentrated effort is required by all three levels of government, health professionals, as well as communities and individuals to reduce the incidence and severity of injuries. Such efforts could prevent many of the tragic scenarios outlined at the beginning of this report.

It is within the power of us all to reduce the tremendous burden injury places on Ontarians. Investing in injury prevention is a strategy that will pay dividends of fewer broken bodies, broken dreams, and significant health care savings to reinvest in other priorities.

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