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Introduction

Purpose
The purpose of this document is to inform Ontario public health professionals and their community partners of evidence-informed practice in Sport and Recreation Injuries in preparation for the implementation of the Prevention of Injury and Substance Misuse standard of the new Ontario Public Health Standards and Protocols, released October 31, 2008.

This document is based upon earlier systematic literature reviews conducted by the Ontario Injury Prevention Resource Centre staff in 2007-2008. These reviews are available by request from the Resource Centre.

The model upon which this synthesis document is based is contained in Safe Kids Canada’s (2006) Safer Homes for Children: A Guide for Communities report.

Structure
The document follows the general public health program planning stages and is thus divided into several sections. The first gives a brief overview of the magnitude of the issue of injuries resulting from sports and recreational activities, based upon analysis of recent hospitalization and emergency department visits in the province of Ontario, as well as a review of the existing literature on this topic. The second section briefly reviews what is known about risk factors for injuries among those participating in sports and recreational activities. The third section provides the synthesis of best available evidence for effective practices to reduce injuries associated with sports and recreation. In keeping with the purpose of this document, this information is provided in plain language and easy to follow bulleted recommendations.
Magnitude of the Problem

Every day, people of all ages are engaging in various sports and recreational activities. Regardless of the level of involvement, injuries remain common. Recognizing the unique risk factors and most prevalent injuries amongst individuals, both male and female, and of different age groups, prevention techniques can be implemented to reduce the risk and to allow these people to fully engage in and enjoy sports and recreational activities.

For the purpose of this synthesis document, sports and recreation related injuries include those occurring while participating in skiing/snowboarding, to-bogganing, hockey, football/rugby, soccer, and baseball. In addition, injuries occurring while participating in cycling as well as those sustained while participating in activities involving nonpowered watercrafts such as kayaks, sailboats or canoes, were included. Water skiing injuries as well as drowning incidents (not occurring on a motor boat) were also included in the analysis. In addition, the ICD 10 (The International Classification of Diseases) codes are limited with respect to the coverage of activities. Therefore, injuries occurring while participating in sports such as basketball and lacrosse were not included as a relevant code does not exist.

During the 2005/2006 fiscal year, there were a total of 127,365 emergency department visits and 2,982 hospitalizations for injuries resulting from participat-
ing in sports or recreational activities for all ages. These numbers translate into provincial rates of 1,071.1 per 100,000 for emergency department visits and 24.5 per 100,000 for hospitalizations (See Figures 1 and 2, for reference, see Data Sources on Page 9).

Males, overall, accounted for close to 75% of all emergency department visits and approximately 80% of all hospitalizations. In particular, males 15 to 19 years of age had over three times the number of emergency department visits in comparison to females in that age range. In addition, males 10-19 had approximately three times the number of hospitalizations in comparison to females in that age range.

Injury rates varied by region with the highest overall rate of emergency department visits and hospitalizations reported in the northern region of Ontario.

For emergency department visits and hospitalizations, injuries to the head were the most common, accounting for 25% and 19% of all injuries respectively (See Figures 3 and 4). However, as illustrated in Figure 4, when all four categories of injury to the lower limb, which include injuries to the ankle, foot, knee, lower leg, hip, and thigh, are combined, it appears as though injuries to this broad region are the more common cause for hospitalizations. Injuries to the wrist and hand were also frequently presented in emergency departments, accounting for 20% of all injuries.

Table 1 - **Regional Comparison of Sports and Recreation Related Injuries** (Ontario, 2005/06)

<table>
<thead>
<tr>
<th>South West</th>
<th>Central South</th>
<th>Central West</th>
<th>Central East</th>
<th>Toronto</th>
<th>East</th>
<th>North</th>
<th>Ontario</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emergency Department Visits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>20,144</td>
<td>12,441</td>
<td>19,757</td>
<td>24,345</td>
<td>15,686</td>
<td>19,724</td>
<td>13,258</td>
</tr>
<tr>
<td>Rate per 100,000&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1,330.4</td>
<td>1,100.3</td>
<td>844.6</td>
<td>1,120.7</td>
<td>656.6</td>
<td>1,264.7</td>
<td>1,626.4</td>
</tr>
<tr>
<td><strong>Hospitalizations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>390</td>
<td>358</td>
<td>488</td>
<td>504</td>
<td>455</td>
<td>423</td>
<td>300</td>
</tr>
<tr>
<td>Rate per 100,000&lt;sup&gt;a&lt;/sup&gt;</td>
<td>25.4</td>
<td>31.1</td>
<td>20.8</td>
<td>22.9</td>
<td>18.3</td>
<td>26.0</td>
<td>35.8</td>
</tr>
</tbody>
</table>

<sup>a</sup> Age-standardized rate per 100,000 population. Note: Region of residence unknown/outside of Ontario for 2,010 emergency department visits and 64 hospitalizations.
The type of injury also varied by age group. For emergency department visits, children under 10 years of age and all those over 15 years of age were most often seen for an open wound of the head. For youth 10 to 14 years of age, fracture of the wrist or hand were most common. For hospitalized cases, individuals under 19 years of age and over 45 years of age were most often admitted for an intracranial injury. And finally, the remaining age groups (20 to 44 years of age) were most commonly admitted for a fracture of the skull and facial bones. The cause of the sports & recreation related injury leading to the emergency department visit or hospitalization also varied by age group (Table 2). For example, the majority of children under nine years of age and adults over 50 years of age, seen at an emergency department for a sports and recreation related injury, had fallen from a bicycle. Youth 10 to 14 years of age were most frequently seen in an emergency department for a fall involving skates, skis, sport boards, or inline skates. Injuries while snowboarding (a type of sport board) were the most common in this category. Teenagers 15 to 19 years of age were seen most often for injuries sustained from striking against or being bumped into by another person during a sport.
And finally, adults 20 to 49 years of age were most commonly seen for having been struck with sports equipment such as a ball or hockey puck.

For hospitalized cases, children under 15 years of age and adults over 30 years were most often admitted for injuries sustained after falling from a bicycle. The majority of individuals over 14 years of age and under 30 years of age, were seen for an injury from striking against or being bumped into by another person during a sport, such as in hockey, soccer, or football/rugby. Hockey was the most common sport during which injuries were sustained in this category.

Over 90% of individuals who visited an emergency department for a sports and recreation related injury were discharged to their place of residence. For hospitalized cases, over 85% of patients were discharged home. An additional 10-12% were either discharged home with support services or transferred to another facility providing inpatient care. Fewer than 1% of individuals died after arrival in the emergency department or after hospital admission. The 2,982 hospitalized cases accounted for more than 9,425 days in acute care hospitals with an average length of stay of 3.16 days.

Table 2 - Injury Resulting in Hospitalization and Emergency Visit by Age Group

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Cause of Fall (Hospitalization)</th>
<th>Cause of Fall (Emergency Visit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants &amp; Toddlers (0-3)</td>
<td>Fall from a bicycle</td>
<td></td>
</tr>
<tr>
<td>Children (4-9)</td>
<td>Fall from a bicycle</td>
<td></td>
</tr>
<tr>
<td>Pre-teens (10-14)</td>
<td>Fall from a bicycle</td>
<td>Fall involving skates, skis, sport boards, or inline skates</td>
</tr>
<tr>
<td>Teenagers (15-19)</td>
<td>Striking against or bumped into by another person during a sport.</td>
<td></td>
</tr>
<tr>
<td>Young Adults (20-29)</td>
<td>Striking against or bumped into by another person during a sport.</td>
<td></td>
</tr>
<tr>
<td>Adults (30-64)</td>
<td>Fall from a bicycle</td>
<td></td>
</tr>
<tr>
<td>Seniors (65+)</td>
<td>Fall from a bicycle</td>
<td></td>
</tr>
</tbody>
</table>
It is important to note that there are limitations when reporting on injuries sustained from participating in sports and recreational activities. For example, many injuries in this category are unreported as, often, they do not receive medical attention. In addition, these injuries may be under-coded in hospitals. And finally, the codes are limited with respect to the coverage of activities. For example, specific codes do not exist for injuries sustained in many sports activities (e.g., lacrosse, martial arts, etc.)

**Data Sources**

Emergency department data were obtained from the National Ambulatory Care Reporting System and acute care hospitalization data were obtained from the Discharge Abstract Database at the Canadian Institute for Health Information for the 2005/06 fiscal year. ICD-10 coding was used to isolate all injuries from sports and recreation resulting in emergency department visits or hospitalizations. Note that some persons were seen in an emergency department and then admitted to hospital; however, persons can be admitted to hospital without visiting an emergency department. It is also important to note that emergency department visits and hospitalizations represent only one dimension of the issue. There are numerous additional cases of sports and recreation related injuries that are not represented in this analysis, as many incidents go unreported or do not require medical attention in the hospital setting. Regions were defined according to place of residence using the Ontario Ministry of Health Region Codes. Deaths occurring outside of the hospital setting were not included in this analysis.
Risk Factors

Risk factors are those variables which influence the probability of the injury occurring. For example, playing sports and not having the finances to buy safety equipment increases the chance of injury. Modifiable risk factors are those which one has control over. For example, one can change or modify one’s risk by wearing protective gear, learning proper skills, and warming up muscles before physical activity. Non-modifiable risk factors are those which one cannot change and include age, gender, and family history.

In relation to sports, risk factors vary by age group and gender and consist of both modifiable and non-modifiable portions. Female athletes have anatomical risk factors (e.g., looser ligament structure, wider pelvis) which are not modifiable. One way to compensate for this, is for females to ensure they have appropriate footwear for the sport.

By focusing on the various, often differing, risk factors for each category, interventions can be established to reduce the risk of injury among athletes as well as the active general population.

Risk Factors for Childhood & Adolescent Injury (19 years and younger)

1. The bones, muscles, tendons, and ligaments of young athletes are still growing, which makes them more prone to injury than adults.

2. Lack of a full understanding with respect to the need for certain rules in sport, in addition to low skill level in some cases, make young athletes susceptible to injury.

3. Due to differing developmental stages, physical size and skill level among players may vary greatly. Those who are smaller, not as strong, or are less skilled/less coordinated are at a higher risk of injury.

Risk Factors for Adults 20 to 64 years

1. Because of time restraints during the week, some adults resort to doing all their physical activity on weekends. This may put them at an increased risk for injury as they may overcompensate for the fact that they have had little activity throughout the week, and therefore push themselves too hard.
2. Adults who are obese and, often unfit, are at an increased risk for injury in sport related activities as their bodies may have more difficulty handling the stress put on the bones and joints as a result of continuous movement.

3. Intense exercise in women increases the risk of experiencing the female athlete triad, which consists of: disordered eating, amenorrhea, and osteoporosis.

4. Conditioning, structural differences of the knee and thigh muscles, fluctuating estrogen levels, fit of athletic shoes, and the way women jump, land, and twist, have all been associated with increased risk of injury among female athletes.

Risk Factors for Older Adults 65+ years

1. The increased risk for injury in older adults is often due to a lack of compensation for the physical changes of aging. These include visual changes and hearing changes (impairment).

2. A general slowing of reaction time/response to features in the environment, and changes in agility and mobility tends to increase the risk of injury for older adults.

3. Declines in flexibility, strength, speed of execution, fine motor control, and hand-eye coordination can also increase the risk of injury in this age group.

Environmental Risk Factors

The risk of injury while participating in sports or recreational activities extends beyond those inherent to the individual (age, sex, and physical ability). The physical, political, and social environment are also factors contributing to the risk of injury.

1. The physical environment in which sports and recreational activities take place can greatly affect injury risk. For example, in some low income areas, parks and fields may not be well maintained and therefore may have uneven surfaces, large holes in the ground, poor lighting, or even sharp surfaces or glass. This lack of a safe playing environment can greatly affect injury risk. In addition, the layout of the physical environment in any area can have a strong impact on injury risk. For example, the presence of trees in areas where individuals to-boggan can increase the risk for serious injury.
2. The political and social environment, which has a strong impact on the implementation of policies, standards, and regulations, in turn, affects the risk of injury for individuals participating in sports or recreational activities. For example, safety standards regarding sports equipment, as well as regulations requiring individuals to wear the appropriate protective gear while participating in these activities, are often policy driven and can impact the risk of injury. This topic is further discussed in the ‘Implementation and Evaluation’ section, beginning on page 28 of this document.

**Violence and Injury**

Violence is another cause of injury in sport and recreational activities. Violent injury in sport is defined as any injury resulting from physical force by one or more persons with the intent of causing harm, injury, or death to another person. (Conn JM, Annest, J.L., Bossarte, R.M., 2006)

Much of the data available on violent injury suggests they are acquired through competitive, contact sports, rather than non-contact sports or recreational activities. Studies have found that high school athletes who participate in non-contact sports (e.g., tennis, baseball, soccer, cross-country, track, or swimming) were less likely to be involved in an assault than those who engage in contact sports (e.g., football, basketball, wrestling, and hockey). (Conn JM, Annest, J.L., Bossarte, R.M., 2006)

While the nature of a contact sport may incite violence, some research suggests there may be a behavioural component that may predispose an athlete to act out violently.

Finally, anger has been found to be strongly associated with intentional injuries inflicted by another person in both men and women. (Vinson DC, & Arelli, V., 2006)
Evidence-Informed Practice Recommendations

Evidence-informed practices are interventions that have been cited by researchers who have conducted a systematic review of relevant literature.

For the purposes of this document, a systematic review was done using key descriptors. They included:

- Sport/recreation and injury
- Team sports and injury
- Sports injuries
- Safe sports equipment
- Sport/recreation best practices
- Canada and sports equipment

Using the above descriptors, a computerized search of the English-language literature on PsycINFO, Cochrane Database, Web of Science, and Medline, was carried out to identify practices and systematic reviews on the topic of injuries associated with sports and recreation. A search of bibliographic references of recent and relevant journal articles, literature reviews, and reports was also conducted to ensure inclusion of all potentially suitable studies. All articles identified were reviewed and included only if they contained data that was relevant to the Canadian population and discussed injury as a result of physical activity. Articles were sought to include research on all ages.

Preventing sport and recreational activity related injuries is unique in that it goes beyond the implementation of specific structural or educational interventions. Sports and recreational safety promotion relies on setting precedents and the implementation of wider campaigns in order to achieve success. It is for this reason that it is important to partner with coaches, parents, caregivers and provincial partners, when doing prevention work in this area.

Prevention targeted at compliance with the use of protective gear and modification of the physical features of the playing environment have been shown to be effective. But, in general, injury associated with sports and recreational activities can be prevented by focusing on age specific initiatives and/or sport specific activities with the active general population. Initiatives will be outlined according
to these categories. Any injury prevention materials, produced as a result of the following recommendations, could be made available in various languages in order to engage all members of society.

In addition, it is always important to consider the three E’s of injury prevention when implementing preventive measures:

❖ **Education**: aim is to influence a range of stakeholders (individuals, communities, health professionals, policymakers, businesses, and the media), by increasing their knowledge, altering their attitudes and, in combination with environmental changes and enforcement of legislation, changing their behaviours. Overall, education, as a part of a multifaceted approach, plays an important role in laying the foundation for an effective injury prevention approach.

❖ **Environment** (design/modification of): aim is to ensure that the environment is designed or modified to be safer for individuals to use in everyday living.

Examples:

1. 'Kiss’n’ride’ zones (drop off zones for sporting events) at schools and subway stations

2. Installing play equipment at an appropriate distance away from bodies of water without barriers.

❖ **Enforcement** (of legislation and policies): this, combined with penalties for not following the requirements, is used to influence the behaviour of individuals, organizations and businesses to reduce risk and injury.

Example:

Bicycle helmet use, enforcement and penalties for non-use in certain areas.

**Note**: A combination of these strategies are more effective than any single strategy on its own.

**Injury Prevention with Children & Adolescents**

Since children and adolescents are still growing (e.g., bones, muscles, tendons, ligaments), it is important to involve parents, caregivers, and coaches to ensure that smart choices are taken when being physically active.
Public health practitioners and their affiliates could work with community partners and stakeholders (e.g., community organizations, coaches, parents, teachers, policy makers, media, etc.) to:

*Interventions that increase parents/caregivers’ knowledge about injuries and developmental stages could be planned:*

- Raise awareness about the risk factors associated with injury in children and youth who participate in sports and recreational activities.
- Educate parents and caregivers that children should not be pushed too hard into activities which they do not like or are not physically capable of doing.
- Raise awareness about the physical and developmental capacities of children and encourage engagement in age-appropriate activities.
- Educate all stakeholders involved with playgrounds about CSA standards. For more information on injuries in the playground, please refer to *Falls Across the Lifespan-Evidence-Based Practice Synthesis Document.*
- Educate parents about the importance of children and youth taking lessons to learn proper technique, skills, and etiquette.
- Enroll children and youth in sports programs which have certified community based national coaching certification programming (NCCP) or equivalent trainers. Individuals under these programs should be trained to prevent, recognize, and give immediate care to sports injuries.
- Ensure coaches have proper certifications, including first aid training, and are aware of the rules of the sport activity.
- Ensure adequate supervision by parents and caregivers when children are participating in recreational activities.
- Promote appropriate use of protective gear in both sports and recreational activities.
- Educate parents about the importance of reinforcing early messages about safety practices.
The Planning of interventions that improve standards for injury prevention in sports:

❖ Engage key stakeholders (e.g., community members, parents, coaches, Ontario Physical & Health Education Association - OPHEA, municipal recreation centres, Sport and recreation organizations) in the next steps towards implementing a sports injury prevention policy. Points to include:

❖ Group young people according to skill level, experience, age, and size.

❖ Ensure participants have a good base level of physical conditioning. Participants should know their limits and take a break when tired.

❖ Ensure time is set aside to warm up and cool down at each game and practice.

❖ Ensure players are aware of and follow the rules. Players should also be aware that foul play is not acceptable.

❖ Promote fair play and ensure that everyone involved adheres to rules. (e.g., coaches, players, spectators).

❖ Encourage mandatory usage of protective equipment.

❖ Ensure participants report any pain or injury to coach. Playing through pain is not encouraged.

❖ Ensure that injured players receive advice from a health professional before returning to play. Do not permit participation when injured.

❖ Ensure participants are in control and respectful to others.

❖ Ensure good condition of playing surface; holes filled, bare spots repaired, and debris removed.

❖ Ensure coaching staff are experienced and qualified. Seek training if required.

It is important to instill good sportsmanship at a young age, as this quality will remain relevant and useful to them throughout their lives.

Injury Prevention with Adults

Exercising is important for health and well-being. The benefits outweigh the risks; however, participants need to be aware of the measures which can be taken to reduce the risk of injury and enjoy their activities to the fullest. Interventions could focus on education, training, use of equipment and policy/regulations.
Plan interventions that educate adults about reducing their risk of injury:

❖ Educate about the importance of wearing the necessary equipment, clothing, and protective gear during organized sports games, practices and recreational activities.

❖ Raise awareness about the importance of taking lessons to learn proper techniques and etiquette when starting a new sport.

❖ Promote the physical activity guidelines which have been shown to prevent injuries.

❖ Encourage the individual to warm up before exercise and cool down after.

❖ Promote the benefits of maintaining a moderate level of activity throughout the week.

❖ Educate the individual about the importance of increasing the level of exercise gradually and modifying activities as necessary to compensate for any physical limitations.

❖ Encourage striving for a total body workout, consisting of cardiovascular, strength training, and flexibility exercises. Cross training reduces injury while promoting total fitness.

❖ Encourage individuals who participate in a certain sport or type of exercise three or more times a week to wear shoes designed for that activity (e.g., choosing to wear footwear with smooth soles when running).

❖ Encourage women to follow the physical activity guidelines with an increased emphasis on muscle strength and conditioning.

Plan interventions that improve safety policies and regulations for individuals involved in competitive athletics as well as those in the general population participating in sports and recreational activities.

❖ Collaborate with sports organizations at both international and local levels to implement a sports safety promotion program (e.g., regulations ensure pre-participation physical examination of potential athletic participants).

❖ Collaborate within public health teams and the Ontario Health Promotion Resource System (e.g., Physical Activity Resource Centre, Heart Health Resource Centre) to ensure
that injury prevention messages are incorporated into the general messages about physical activity. Promote integrated injury prevention message across public health programs and utilize the ontario health promotion resource system as a resource (e.g. Ontario Injury Prevention Resource Centre, Heart Health Resource Centre)

❖ Advocate for the use of Canadian Standards Association approved sports and recreation equipment.

Injury Prevention with Older Adults

Physical changes occur as individuals age, but this happens gradually and can go virtually unnoticed. The risk of injury often stems from a lack of compensation for these changes. The Centre for Activity and Aging has set up physical activity guidelines which address aging factors and are designed to reduce the risk of injury. In addition, many of the strategies used for adults can also be applied to older adults. Preventing injury with this age group should be incorporated into the same multi-factorial approach that is taken for fall prevention. Much of this detailed information can be found in the Evidence-Informed Practice Recommendations for Falls Across the Lifespan.

Engaging Diverse Ethnocultural Groups

In order to engage diverse groups within communities, it is important for sport and recreation clubs to:

❖ Develop protocols to connect with ethno-racial groups within different communities.
❖ Present information on sports and recreation activities in English as well as the other main language groups in the area.
❖ Ensure that the registration process is facilitated by friendly and engaging workers who have undergone anti-racism training and are preferably representative of the community.

In order to best create a sports and recreation environment that is discrimination free:

❖ Implement policies on equity and harassment.
❖ Make facilities wheelchair accessible.
❖ Make programs affordable or free.
❖ Design activities which engage the target population and are respectful to cultural ways.

❖ Ensure leaders and volunteers have appropriate training regarding the social, cultural, and technical aspects of program implementation.

❖ Provide support for isolated groups who wish to participate (inclusion).

Managing the Risk of Specific Popular Sports

Sports which have been found to be associated with the greatest number of injuries have been identified and are important to address. Many of the intervention points within the popular sports category overlap with the age category points, so a combination of both strategies could be used. Strategies include examples of education, use of equipment, training and policy initiatives.

Hockey

Hockey is a favourite pastime of many Ontarians. The following are practices that can be used to help reduce the risk for injury:

❖ Ensure that all of the necessary equipment is used and that it is worn correctly and fits properly (e.g., full-face protectors, mouth-fitted or laboratory made mouth guards).

❖ Use hockey equipment, such as helmets and face shields, that are CSA approved.

❖ Encourage wearing of protective gear and set a good example of safety on and off the ice (e.g., coaches wear helmets and face shields while on the ice during team practices).

❖ Warm up before all practices and games. Ensure adequate physical conditioning. Include strength, flexibility, and endurance training as part of the programming. Encourage participants to know their limits.

❖ Learn and reinforce proper hockey skills, concepts, techniques, rules, and regulations (e.g., make sure players are aware that body checking from behind is strictly prohibited).

❖ Ensure that coaches and officials have proper certification and qualifications.

Baseball

Baseball injuries are broadly broken down into four types: collisions, falls, sliding-related, and overuse injuries. The
following are tips to help reduce the risk for injury:

❖ Ensure there is a good base level of physical conditioning.

❖ Encourage participants to know their limits and to avoid playing through pain. Be aware of potential overuse injuries (e.g., limit the number of pitches thrown by an individual player and refrain from pitching when pain or fatigue is present).

❖ Wear the appropriate gear and ensure proper fit (e.g., wear a double eared batting helmet and face shield when waiting to bat, at the plate, and when running the bases).

❖ Learn the rules of the game and follow them. Encourage fair and appropriate play.

❖ Encourage the use of softer balls for children younger than 10 years of age as they are less skilled and coordinated.

❖ Modify the rules for children. Encourage children to play tee ball as a way of developing technique.

❖ Learn proper technique and practice it (e.g., players should be instructed to slide in the correct manner, which is feet first, rather than head first).

❖ Modify the playing environment (e.g., to prevent sliding injuries, use breakaway/quick bases instead of standard stationary bases).

❖ Ensure playing fields and facilities are well maintained. Inspect the area for holes, glass, and other debris.

**Cycling**

Cycling is a popular recreational activity. Ways for managing the risk while keeping active include:

❖ Bicycle Helmet Use:

In Ontario, all individuals under 18 years of age are required to wear a bicycle helmet when riding. Some communities require helmet use while on sidewalks or roadways, while others require use at all times, regardless of where the individual is riding. Enforcement includes the issuing of tickets to individuals (or parents, if the child is under 16 years) not abiding by the law.

A properly fitted and certified helmet is effective in reducing the risk of injury for cyclists of all ages and for all types of crashes. A helmet should not have any
cracks, missing padding, or missing hardware. There should be no modifications such as drilled holes, added stick- ers, or paint.

A helmet that has been through a crash should be replaced, even if it does not appear to be damaged, as it may not pro- vide adequate protection in another crash. If unsure as to whether a helmet is still usable, throw it away and get a new one.

A helmet should be replaced after five years of use. (Safe Kids Canada, 2008)

❖ Bicycle Helmet Legislation:

Cycling related head injuries among chil- dren decreased by 45% in provinces with legislation, compared to a 27% reduction in provinces without legislation.

It may be beneficial to introduce re- quirements regarding helmet use for adults over 18 years of age. This will en- sure adults are acting as positive role models with respect to this issue.

❖ Bicycle Helmet Promotion:

Community based campaigns with hel- met giveaways and education about helmet use have been shown to increase helmet use. School programs and subsi- dized helmet campaigns may also in- crease helmet use but to a lesser degree than community or free helmet pro- grams.

❖ Bicycle Skills Training:

The effectiveness of programs, such as those teaching handling skills and educat- ing the public to improve knowledge and compliance with rules and regula- tions (e.g., CAN-BIKE), is being evalu- ated by the Cochrane Collaboration. (SMARTRISK, 2005)

Soccer

Soccer is a common activity enjoyed by Ontarians of all ages. The following are some points that can be used to educate coaches and participants to reduce the risks for injury; with more examples available in ThinkFirst Foundation of Canada’s 2006 document Playing Smart Soccer.

❖ Encourage warming up before games and practices. Ensure there is a good base level of conditioning.

❖ Be aware of participant limits. Push- ing too hard can increase risks for in- jury.
❖ Consult a medical professional before returning to play post injury.

❖ Wear the proper gear and make sure it fits properly (e.g., shin guards, footwear, and padding). Use it during games and practices.

❖ Use the appropriate equipment and ensure proper use. Use nonabsorbent soccer balls and check the pressure before each game or practice. Ball size should be appropriate for the specific age group.

❖ Ensure goal posts are properly secured. Avoid crawling or climbing on the goal posts or hanging from the crossbar.

❖ Be aware that ankle braces are more effective at maintaining ankle stability and preventing injuries than taping.

❖ Check to see that the playing field is in good condition.

❖ Learn and follow the correct techniques (e.g., proper technique for heading the ball).

❖ Encourage responsible action from everyone involved. Players need to follow the rules and be aware that foul play is not acceptable. Coaches and referees should enforce all the rules of the game and encourage fair play.

### Skiing, Snowboarding, Ice Skating, In-line Skating

In Ontario, snowboarding and in-line skating have become popular with youth and young adults. Skating and skiing still remain popular with all age groups. The following are some practices that can be used to help reduce the risk of injury.

❖ Educate skiers that ski bindings should be adjusted by a professional at the beginning of each ski season to reduce the risk of sustaining an injury.

❖ Promote the use of helmets when skiing/snowboarding and engage key stakeholders on the topic of adopting legislation for helmet use in these sports.

❖ Educate that skiers and snowboarders should remain on slopes suited to skill level and build up gradually to more advanced runs. Stay within the boundaries and go with a partner.

❖ Educate in-line skaters that wrist guards, elbow, and knee pads, have
all been shown to significantly diminish injury risk.

❖ Increase awareness that even in sports where helmet use is not mandated, there is a significant reduction in injuries when one is worn (e.g., skating).

❖ Supervise young children when skating.

❖ Educate public skaters to follow the rules of the skating rink and skate in the same direction as the crowd. Avoid sudden stops in high traffic areas.

❖ Raise awareness about the requirements for skating on a frozen lake, pond, or river (e.g., test the thickness of ice before venturing out. Ice must be at least 10 cm for skating alone and 20 cm for group skating (Ontario Injury Prevention Resource Centre, “Compass Vol. 4, Issue 1”, January 2007).

❖ Take the time to learn the proper technique with each of these sports.

❖ Ensure that there is an adequate base level of physical conditioning.

❖ Wear several layers of light, loose, and water and wind-resistant clothing for warmth and protection.

❖ Be aware of surroundings. Watch for obstacles and other people. Stay in control.

**Boating & Waterskiing**

To reduce the risk of becoming injured in a boating related incident, there are several preventive measures that can be followed.

❖ Wear a PFD

❖ Do not consume alcohol prior/during boating excursions.

❖ Get trained on boating and water safety.

❖ If waterskiing, make sure you have been trained appropriately and have a ‘spotter’ in the boat to ensure your safety while skiing.

❖ Check weather forecast prior to any excursion on the water.

By following these suggestions as well as using common sense in all situations, one can reduce risk while participating in boating related activities. (SMARTRISK, 2008)
**Football/Rugby**

Football and rugby are sports enjoyed by many Ontarians. To reduce the risk for injury:

- Ensure that players have a good base level of physical conditioning.
- Know your limits. Pushing too hard can increase your risk for injury.
- Take time to warm up and cool down at each game and practice.
- Wear the appropriate gear for the activity, such as a mouth guard, helmet, shin pads. Ensure that the equipment is in good condition and fits properly. All players should put on all the proper and required protective equipment at practice, as well as at games.
- Learn the proper techniques and skills for the activity. Ensure players and coaches are aware of the rules and have proper certifications. Promote "fair play" and adherence to the rules.
- Encourage players to report any pain or injury to the coach. Emphasize the importance of not playing through pain.
- After an injury, advice from a physician or other health professional should be sought before returning to play. (SMARTRISK, 2006A)

**Tobogganing**

Tobogganing is a fun and popular winter activity enjoyed by children and adults alike. To reduce the risk of injury:

- Choose a hill with a gentle slope and make sure that there is enough room to stop. Check that the hill is free from potential hazards.
- Hazards can be difficult to see. Toboggan when you can clearly see and be seen by others.
- Ensure that you can control your speed and that you can steer or stop quickly.
- Check your toboggan to make sure that it is in good condition.
- Wear a helmet as this has been shown to prevent head injuries in both children and adults.
- Avoid frostbite by dressing in layers and keeping your head, ears, and hands covered.
❖ Wear bright coloured and reflective clothing. Scarves, drawstrings, and long hair can get snagged and should be tucked inside your coat.

❖ Always sit or kneel facing forward.

❖ Make sure that everyone is out of the way before starting down the hill. Toboggan down the middle of the hill, and use the sides to walk to the top.

❖ Take note of any age restrictions when buying a sled or toboggan. Carry only the recommended number of passengers on a toboggan.

❖ Adults should supervise and accompany children while tobogganing. (SMARTRISK, 2006B)

Managing the Environmental Risks

The social, physical and political environment are intertwined and closely connected to one another. Therefore, changes applied to one of them are often felt, in large part, by the others.

❖ Promote safe/clean parks and fields using the media, flyers, posters, and other visual advertisements.

❖ Collaborate with the neighbourhood community to clean up debris and garbage in park areas.

❖ Keep community centres open for extended hours to ensure youth and children in low income areas have a safe place to participate in sports and recreation activities.

❖ Find parents and other adults who are willing to help improve the physical environment of common play areas for children and youth.

❖ Approach local politicians and stress the importance of a safe and clean environment for children to be active in.

❖ For further information on managing the risk in playgrounds/play areas, please refer to Injuries Associated with Falls Across the Lifespan or in Safe Kids Canada’s 2007 Playground Safety Manual.

When planning any injury prevention approach, it is important to first analyze the injury issue in terms of who is getting injured (host), what is causing the injury (the agent), the environment in which the injury is occurring (the social and physical environment). This will capture the
specific needs in terms of injury prevention on a behavioural and environmental level. Policy changes can also be implemented accordingly.

Haddon’s Matrix can be applied to all areas of injury prevention. For example, it can be applied to child injury prevention (helmet use in snowboarding) (Table 3).

For more information on models of injury prevention, please refer to the OIPRC website: www.oninjuryresources.ca
Table 3- **Example of Haddon’s Matrix as applied to child injury prevention (snowboarding & helmet use)**

<table>
<thead>
<tr>
<th>Phase</th>
<th>HOST</th>
<th>AGENT (SNOWBOARD)</th>
<th>PHYSICAL ENVIRONMENT</th>
<th>SOCIAL ENVIRONMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-event</td>
<td>Snowboarding ability, training.</td>
<td>Maintenance of snowboard, adequate sharpening of edges, proper installation of bindings, adequate waxing of board.</td>
<td>Adequate snowboard trail markings, adequate grooming of hills, minimal ice, appropriate snowboard for individual’s skill level, correctly installed bindings for (goofy/regular) snowboarder.</td>
<td>Attitudes about staying on proper trails, wearing helmet for every snowboarding excursion.</td>
</tr>
<tr>
<td>Event</td>
<td>Human tolerances of crash forces, wearing of helmet, wearing of other protective gear.</td>
<td>Ability of bindings to come loose in crash, crash worthiness of helmet and other protective gear.</td>
<td>Presence of fixed object near snowboard trail, presence of other skiers/snowboarders.</td>
<td>Enforcement of mandatory helmet use.</td>
</tr>
<tr>
<td>Post-event</td>
<td>General health of injured snowboarder.</td>
<td>Ski hills designed to minimize blind turns to reduce the incidence of other skiers/snowboarders running into injured individuals on the hill.</td>
<td>Availability of effective and timely emergency response.</td>
<td>Public support for trauma care and rehabilitation.</td>
</tr>
</tbody>
</table>

www.health.qld.gov.au
Implementation and Evaluation

After determining the unique risk factors, numbers, and rates of injuries associated with the participation in sports and recreational activities, as well as the most common types of injuries among specific age groups across the lifespan, tailored and multifaceted injury prevention strategies can be implemented, each targeting these distinct populations.

Implementation and ongoing evaluation at each stage is essential in order to maximize the effectiveness of reducing the risk of injuries for individuals of all ages who engage in sports and recreational activities. In addition, because injuries from these activities are a product of various risk factors, from those related to physical fitness to those connected with equipment and infrastructure, multiple levels of the local community need to be involved in order to gain maximum benefit from injury prevention programs. (Public Health Agency of Canada, 2001) For example, sectors in the community which are responsible for equipment guidelines and standards, the implementation of organized sport and recreational activities, as well as officials at the government level, are key to the process and need to become involved in the injury prevention strategy.

Evaluation of Prevention Initiatives

Determining the effectiveness and efficiency of an injury prevention program is an important step prior to its implementation. To do this, an evaluation framework needs to be put in place which looks at not only the intended outcomes of the program and initiatives, but also evaluates each stage of the implementation process. Any evidence-based population health approach to injury prevention requires resources within the community. (Nova Scotia Injury Prevention, 2003) This type of approach to injury prevention incorporates the whole population and works on improving the health of the population over its life-course. It focuses not only on the physical health of the individual, but also the social, political, and economic conditions and how they affect health on a broader population base.

The effectiveness of a program is measured by the ability of the program to reduce or minimize the risk of injury in a given population. In addition to assessing
the effectiveness of a program, it is also important to determine the efficiency of a program, or in other words, the ability of the program to produce the greatest outcomes using the smallest amount of resources, as resources are often limited. (Raina P, Turcotte K & Soubhi H., 2006)

There are numerous factors to consider when evaluating a program. For example, questions to consider include:

❖ Does local data for a baseline exist? If not, how will it be collected?

❖ What was identified as the issue to be addressed? Which risk factors were targeted?

❖ Has anyone else addressed this issue successfully before? If so, what did they do, and how can it be translated to our local context?

❖ What goals do we hope to achieve, and how can they be translated into specific, measurable objectives? How can these be expressed as intended short-term and long term outcomes?

❖ Who do we need to align or partner with to achieve our intended outcomes?

❖ Who are we targeting with our messages or other interventions?

❖ Is each step of the process decided on complete?

❖ Are the appropriate age groups (target population) being reached?

❖ Are we having an impact on our intended short-term outcomes (e.g., Are the skills being taught? Are changes in attitude, knowledge, and behaviour around risk being realized?)

❖ Are we having an impact on our intended long-term outcomes (e.g., Is there a reduction in sports and recreation related injuries?)

When looking at the efficiency of the program, the cost effectiveness of the initiative is an important aspect to consider.

**Implementation of Evidence Informed Practice Recommendations**

Once the various factors associated with an injury prevention program have been considered, modified, and adapted to meet the needs of the at risk population and the program itself has been established as one considered optimally effective in reducing the burden of injury, the
planning and implementation process can effectively begin. A sample of such a process, using the five-step public health approach is summarized in Figure 5. Note that the process begins with defining the problem, moving on to identifying risk and protective factors, selecting an intervention, implementing and evaluating the intervention. While the process is shown proceeding in a single direction, it is important to note that it may be necessary to revisit an earlier stage of the process at any time, as new information and a richer understanding of the injury issue, and the social and political context comes to light.

When implementing a plan, a specific system must be in place to guide the prevention initiatives. This includes specific
goals, objectives, timelines, personnel responsible, costs, evaluation protocols, and room for potential modification.

Such a system involves asking questions at each stage of the process, which in turn link to evaluation issues. For example, defining the problem amounts to asking, “Who is getting hurt and how?”, often by analyzing surveillance data. In evaluation terms, answering this question corresponds to conducting a needs assessment. Defining the problem concludes when one has a clear goal, or statement of intended change in mind.

Once one has a goal or goals defined, one can translate these into objectives using the old anagram SMART, a mnemonic device to remind one that objects are to be; specific, measurable, attainable, relevant, and time-bound. In short, they are specific statements of what one wants to see change as a result of the intervention, for whom, by how much, and over what timeframe. The link back to evaluation is again clear, as in evaluation terms objectives are really just intended outcomes.

Once one has intended outcomes, one can continue the plan by identifying: which activities will produce these outcomes; who needs to be targeted by these activities, and how these activities naturally group into the components of your intervention. One can diagram the connections between components, activities, targets, short-term outcomes, and long-term outcomes to produce a program logic model that will help guide implementation, evaluation and communication with program stakeholders, management and staff. (Porteous, N.L., Sheldrick, B.J. & Steward, P.J., 1997)

Programs are most effective when an individual is assigned to manage the specific tasks in the plan. Without this, the goals of the program may not be reached. As an important first step of any plan which involves communications, it is essential to consider the target audience with respect to their attitudes, beliefs, and emotions around injury risk. By doing this, the program can be carried out in a way which will increase the likelihood of change in knowledge and skills of that population, in particular. (Raina P, Turcotte K & Soubhi H., 2006)

It is also important to tailor the intervention to the local social and political context, as only then can the injury prevention strategies become maximally effec-
tive in modifying the knowledge and skills, and subsequently reducing the risk and prevalence of injury in the specific population. Figure 5 centres the program planning and implementation process on the social and policy context for this very reason.

For example, the appropriate and necessary social and political support must be available in the local community in order to successfully implement the program. Without support at these levels, the implementation process can be slowed or hindered. Connect and collaborate with individuals in your community, including city council, sports and recreation coalitions, public service organizations, including those that address sports and recreational activities, health care professionals, and other key stakeholders. Seek out community and business groups which will support the program.

At this stage, potential limitations must also be considered. This includes issues related to infrastructure and the availability of resources in the community. This will differ in each community and must be adapted to accordingly.

And finally, as with any injury prevention plan, continuous refinement and modification will occur as the plan is further developed. As injury priority issues change, so will the programs put in place. This further emphasizes the importance of continuous evaluation at all stages of implementation by way of surveillance, research, and consultation.
References


