Nova Scotia Non-Legislated Sport and Recreation

Helmet Policy Paper

Prepared for Nova Scotia Health Promotion and Protection

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Disclaimer

The information in this paper is current up to June of 2007. The results of the studies reported in this paper are those of the researchers and/or authors noted in the reference list. This paper does not critique or accept any responsibility for any inherent limitations of the studies. It must be noted that research in sport and recreation activities is somewhat limited to date however it is continuingly expanding in research quality and scope. This paper will require future updating as new information and research becomes available.

Abbreviations

Commonly used acronyms and abbreviations

ASTM	American Society for Testing and Materials
BCIRPU	British Columbia Injury Research and Prevention Unit
BSI	British Standards Institution
CHIRPP	Canadian Hospital Injury Reporting and Prevention Program
CPSC	United States Consumer Product Safety Commission
CSA	Canadian Standards Association
DAI	Diffuse Axonal Injury
HI	Head Injury
ICP	Intracranial Pressure
LOC	Loss of consciousness
MVC	Motor vehicle collision
NSEF	Nova Scotia Equestrian Federation
NSHPP	Nova Scotia Health Promotion and Protection
SEI	Safety Equipment Institute
SIS	Second impact syndrome
TBI	Traumatic Brain Injury

Introduction

Purpose

The purpose of this paper is to identify and review a variety of sport and recreation activities where current helmet regulations or legislation does not apply. A review of the existing research will assist in determining if additional efforts should be considered for these activities. Recommendations for Nova Scotia will be based on existing evidence, and will provide a baseline for those in decision-making positions to gauge present and future helmet initiatives. Legislating helmet use is not necessarily a stand-alone option but a piece of a comprehensive strategy. Other recommendations may include facility rules, facility changes, equipment changes, educational programs and continued surveillance.

A key objective while researching this paper was to determine whether helmets would be effective in a particular activity while still providing the participant with an enjoyable physical experience. Enjoyable physical activity is the primary goal while also ensuring that participants are engaging in the activity in a safe manner to prevent injuries. Physical activity provides each individual with numerous benefits including enhanced general health, such as strong bones, muscles, and heart, increased self esteem, decreased risk of obesity, and provides opportunity to build healthy friendships[1]. Physical activity is strongly encouraged by those producing and endorsing this paper. We hope that participation rates do not decrease as a result of the recommendations made within this paper. The intention is to increase helmet use, when applicable, within these particular activities and to ensure that those in Nova Scotia remain active, in a safe manner so that they are able to continue participating in their sport of choice for many years to come.

Two lists of activities are found in this paper. The first list considers activities where the use of helmets has received attention or has been the subject of debate in Nova Scotia. The activities in this list include; skiing and snowboarding, equestrian, recreational ice-skating/figure skating and sledding. Within each of these activities, the paper reviews the mechanisms of injury, statistics, position statements, existing programs and recommendations for Nova Scotia.

The second list consists of activities where the risk of head injury may be lower than those in the first list. The use of helmets within these activities may be controversial or have not been considered to be necessary for the activity. These activities include soccer, rugby, rock climbing (more specifically bouldering), whitewater kayaking, parkour and ultimate Frisbee. Within each of these sports, a brief description will be given outlining mechanisms of injury, injury statistics and recommendations. Appendix A outlines the recommendations for each activity from both lists.

Background

Injuries are a leading cause of disability and death in Canada. Approximately 90-95% of injuries are predictable and preventable[2], including injuries to the head.

Unintentional injuries cost Atlantic Canada more than one billion dollars in 1999, with Nova Scotia accounting for approximately $372 million of that amount[3]. This financial cost is pale in comparison to the human costs to the individuals and their families. These injuries can be prevented by education, legislation and programming to enhance the understanding of the risks that one takes on a daily basis.

This paper has been written to ascertain the risk of head injury while engaging in a variety of sport and recreation activities. It reviews the potential effectiveness of helmets for a variety of popular activities in Nova Scotia. Each activity discussed in this paper has been selected and approved by a steering committee of provincial stakeholders with a high level of interest in sport and recreation and the prevention of head injuries in Nova Scotia.

Nova Scotia Health Promotion and Protection (NSHPP) in partnership with the QEII Health Sciences Centre Division of Neurosurgery have prepared this paper as a guiding document. The underlying goal is to continue to promote active and healthy life styles for all Nova Scotians as well as to enhance the safety of all individuals participating in sports and recreation activities. The recently amended helmet legislation promotes helmet safety while on a bicycle, in-line skates, skateboards, roller skates, and scooters[4]. The goals of this research paper are to review the potential effectiveness of wearing a helmet in a variety of other sports and recreational activities that are not included with that legislation.

The availability of best or promising practices is limited for helmet use, especially for those activities that are not legislated. There is a need to progress the research to develop best and/or promising practices of helmet use within the activities presented in this paper. These practices may assist with the future development of comprehensive strategies to increase helmet use and potentially decrease the risk of severe head injuries.

Before beginning the review of each activity, the paper will review the purpose of this document, background information for Nova Scotia, and the significance of injury prevention in Nova Scotia, basic anatomy and physiology of the brain, head injuries in sports and recreation activities and the current helmet legislation in Nova Scotia.

Significance of Injury Prevention in Nova Scotia

Injury prevention is one of the priorities of the Nova Scotia government, and a major focus of NSHPP[5]. The Nova Scotia Injury Prevention Strategy was released in 2003, and

is organized into a number of strategic directions (to view the strategy, see http://www.gov.ns.ca/hpp/repPub/NSIPreport04.pdf).

Every injury impacts the individual and family in a number of different ways; physically, emotionally and financially. The injured individual and their family and friends may have to make many adjustments to accommodate for the injury, resulting in high levels of family stress. Even a minor injury can result in major life changes for years after the injury. A head or brain injury can provide minor disruption in one's life or have long lasting and devastating effects.

The community, the province and the country carry the financial burden of these devastating injuries. Aside from the physical and emotional costs of injury, there is the enormous financial cost. Unintentional injuries cost Atlantic Canada more than one billion dollars in 1999, Nova Scotia accounted for approximately $372 million[6]. It is estimated that to treat one severe brain injury, it costs $6-8 million dollars throughout a lifetime. There is a need to find ways to prevent brain injuries in order to reduce the costs but, more importantly to reduce the human suffering of brain injury.

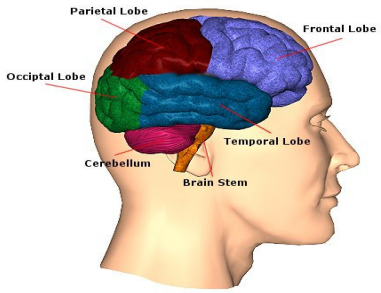
Anatomy and Physiology of the Brain

According to Fleminger & Ponsford (2005), head injury (HI) is a leading cause of disability and survivors often suffer cognitive, mood, and behavioral disorders[7]. A traumatic brain injury (TBI) typically results from either a direct or an indirect impact to the head and neck when the body is stopped or accelerated rapidly[8].

The Head Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Medicine (2006) defines mild traumatic head injury as ''a traumatically induced physiologic disruption of brain function, as manifested by one of the following:

-Loss of consciousness (LOC);
-Memory loss (before or after the incident)
-Change in mental state
-Neurologic deficits that may have short or long term consequences"[9].

To understand how a brain injury can lead to such disabilities, it is useful to understand the basic anatomy of the brain. The brain has three primary components: the cerebrum, the cerebellum, and the brainstem. Each is responsible for different functions[10].



Picture: ThinkFirst Canada

The cerebrum controls a number of higher functions including taste, touch, smell, hearing, and sight, as well as voluntary skeletal muscle movements. The cerebellum controls reflexes, balance and certain aspects of movement and coordination[11]. The brainstem is responsible for a variety of automatic functions that are critical to life, such as breathing, digestion and heart beat, as well as alertness and arousal[12].

The brain can receive several different types of injuries depending on the location of the damage, and the type and amount of force that impacts the head. There are five types of traumatic brain injuries:

1. Concussion (any neurological dysfunction with or without loss of consciousness)
2. Diffuse axonal injury (DAI) (shaking or rotation of the head causing tearing of axons)
3. Contusion or blood clots (brain bruise or bleeding)
4. Coup-contrecoup injury (injury at site of impact as well as on opposite side of head) and
5. Secondary impact syndrome or recurrent TBI (two consecutive head injuries with insufficient healing time between the first and second injury)[13].

The skull is very thin, and the brain very soft. It does not take a large force to result in a head injury. The vital functions of the brain coupled with the inability of brain tissue to repair, often results in patients' suffering permanent injury and disability. Helmets can be effective in preventing or reducing the severity of head injuries[14] and are mandatory in some activities such as organized hockey and football, and recommended in a number of other sports.

Head Injury in Sports and Recreation

The competitiveness and sometimes aggressiveness of sports may increase the risk of injury while participating in an activity. Injuries from sport and recreation activities account for approximately 20% of visits to emergency departments in Canada[15], with concussions reported as the most common type of head injury. While helmets have not been shown in the scientific literature to protect a person from concussion, they have been shown to be beneficial in preventing other types of head injuries such as penetrating injuries[16].

Yang et al. (2007) conducted a study in the United States reviewing the average length of stay and costs of sport related injury hospitalizations. In their study of 7979 injuries, 1923 or 24.2% were head injuries that required hospitalization. The overall length of stay for all injuries was 2.4 days with a median of 1.1 days. As the authors point out, these are simply the days that were spent in hospital and likely required additional time away from school and work was required for the individual and their caregivers[17].

A number of options are available when promoting helmet use in activities. These options are valuable as there are often arguments for and against the use of helmets while participating in a sport. The option that is chosen must be based on the existing evidence and what is best for the safety of the athletes. Some sports do not require mandatory

helmet use because the number of head injuries is not considered significant enough to warrant helmet use or would alter the way the activity is played. This document discusses these issues and bases the recommendations on the existing evidence.

When concussions and other head injuries do occur, it is important that athletes, coaches, parents and trainers understand how to treat and manage the injuries to ensure that individuals do not suffer from permanent brain injury and/or the long-term impacts of the injuries are minimized.

Concussion Education

Concussion education may be beneficial for each of the activities presented in this document and could extend to all sports. Whether a helmet is used or not, a concussion may occur and learning how to properly manage these injuries may reduce potential long-term consequences. Some key features to remember about concussions is that losing consciousness is not necessary, and that a concussion can result from a strong hit anywhere on the body that causes the brain to move within the skull[18], [19].

In 2001 and again in 2004, a group of experts met to discuss concussions in sports and worked together to form a consensus on concussion classification and management. Prior to these meetings, there were over 35 ways to classify or grade a concussion. Upon completion of these meetings, the group was able to narrow this down to two classifications: simple and complex. The key difference between these two classifications is that a simple concussion will resolve itself within 7-10 days, typically without any complications. A complex concussion takes longer, often more than 10 days[20].

McCrory et al. (2005) state that it is important that a physician see any person who has a suspected concussion. If they are injured in a game or practice, they should be removed from play immediately and be evaluated by a physician. Once diagnosed, the athlete should rest until they are symptom free. From there a graduated return to play can commence using the following steps:

- Rest from all activity (physical and cognitive (e.g. reading, watching television, video games etc…))
- Begin light aerobic exercise
- Begin sport-specific training
- Begin non-contact training (may begin resistance training)
- Begin full contact training once cleared by a physician
- Return to play

It is very important during this time to allow 24 hours between each step to ensure symptoms do not return. If symptoms return at any time during the process, the athlete should return to the first step until the symptoms are gone. Using this guideline, the athlete may safely return to playing the sport[21].

While the activities included in this paper do not necessarily require helmets at this time, they have been included because of the risks of head injury while engaging in the sport. Not all activities that have a risk of head injury are included in this paper, such as

gymnastics, cheerleading or the use of Heelys. Other organized sports such as hockey, lacrosse and baseball all have helmet regulations within their respective leagues and are therefore not reviewed within this document.

Gymnastics and Cheerleading

Gymnastics and cheerleading are ranked within the top 20 causes of sport related head injury requiring treatment at an emergency department in United States hospitals[22]. Although most of the injuries in gymnastics are strains, sprains, and fractures of the lower extremities, head injuries do occur due to the types of skills they complete[23]. In addition, Hutchinson (1997) found that head injuries represented approximately 7% of all injuries sustained by cheerleaders[24].

Heelys

The use of Heelys, small wheels inside the heel of a shoe, has increased significantly since 2000. Studies are starting to be published on the incidence of injuries from this activity[25] and organizations such as the Canada Safety Council are beginning to request bans on these shoes within public areas such as retail facilities, schools and at sporting events[26].

A study on the injuries sustained while 'Heeling' determined that females were more likely than males to be injured and the average age of injury for both sexes was 9.6 years of age. The participants were most likely to injure themselves when shifting their weight onto the wheels and commonly fell to the front or to the back. The injuries in this study were primarily orthopedic in nature and no head injuries were documented. The authors strongly suggest the use of full protective gear to prevent against potential injury[27].

Helmet Legislation in Nova Scotia and Canada

In 1997, Nova Scotia implemented helmet legislation for individuals of all ages to wear a helmet when riding a bicycle. In 2002, this legislation was expanded to include other non-motorized wheeled activities such as scootering, in-line skating and skateboarding[28].

In January 2007, this legislation was amended. Current helmet legislation in Nova Scotia states that an individual, regardless of age, must wear a helmet when operating a bicycle, scooter, skateboard, and in - line skates *at all times*[29].

Safe Kids Canada (2005) reviews all of the current legislation surrounding helmet use in Canada and posted a chart on their website. The legislation in Nova Scotia is potentially one of the strongest in Canada. British Columbia, New Brunswick, and Prince Edward Island have legislation in effect for individuals of all ages when riding a bicycle. Alberta and Ontario have legislative laws that incorporate age restrictions. However, many provinces have no legislation and allow jurisdictions or municipalities within their province to mandate their own by-laws. The fine for not wearing a helmet in Canada

varies depending on the province[30]. In Nova Scotia, the fine totals $135.75 once all court fees are paid.

Helmets have been found to be effective in reducing the risk of head injuries in up to 88% of cases[31].

Section A: Sports/Activities with Evidence of Helmet Effectiveness

Introduction

Rationale for Selection

Many head injuries occur in sports every year in Nova Scotia. The use of helmets may reduce the severity of head injuries. Unless helmets have already been mandated by either the governing body for the sport or by the government, helmets are a personal decision or choice. An adult or a parent for a child participating in a sport often makes this decision. Many professionals in sports such as skiing, snowboarding and equestrian activities will wear helmets to protect their heads voluntarily, or it may be mandatory for their particular level of competition.

Each of the following sport and recreation activities has been identified as having high to moderate risk for head injury. These activities have been researched internationally to determine if using a helmet will reduce the amount of devastating or fatal head injuries to their participants.

Activities to be reviewed:

1. Skiing and Snowboarding
2. Equestrian Activities
3. Recreational Ice Skating and Figure Skating
4. Sledding

These activities have been identified by a steering committee of Nova Scotia provincial stakeholders (government injury prevention specialists, physicians, nurses, police (HRM and RCMP), and recreation personnel) as activities where the participants may be at an increased risk of sustaining a head injury. Recommendations have been made by injury prevention experts in the field regarding helmet use within each of these activities.

For each activity, the paper will review the following:

- Potential mechanisms of injury
- Statistics
- Position statements
- Existing Programs and/or legislation
- Recommendations

Skiing and Snowboarding

NOTE:
The ski hills in Nova Scotia have helmet regulations for students participating in skiing and snowboarding trips with their school. Helmets are required for all students or groups of students who participate in downhill skiing or snowboarding (cross country skiing is excluded) while on the slopes of Martock[32]. Wentworth requires children in a variety of ski hill programs and while on school ski trips to wear a helmet while participating in snow tubing and snow school programs[33]. Ben Eoin requires children and youth participating in school programs on their hill (as well as on the terrain park and half pipe) to wear a helmet[34]. A helmet that is designed for the sport is best to minimize the risk of severe head injury[35].

The Nova Scotia Department of Education has Physical Education Safety Guidelines for grades primary to grade twelve. Within these guidelines, helmets are mandatory for alpine skiing and snowboarding and must be worn at all times. The guidelines for cross-country activities do not mention the use of a helmet as a piece of equipment[36].

Mechanisms of injury

Skiing and snowboarding offer people a great form of physical activity, and unfortunately many opportunities for a variety of injuries. It has been estimated that head injuries are the cause of approximately 60% of deaths occurring on ski hills[37].

A common mechanism of head injury in skiing and snowboarding is collision with trees[38], and/or other objects or surfaces such as lift poles, ski equipment, or the ground. Skiing over jumps and colliding with other people may also result in injury[39].

Statistics

The voluntary use of helmets while skiing and snowboarding is increasing around the world. Ski hills in the United States have seen the use of helmets increase from 12.1% in 2001 to 19.8% in 2002. Snowboarders in this study were more likely to wear helmets than skiers. Many professional skiers and snowboarders wear helmets while participating in their activity; however, amateurs are least likely to wear a helmet[40].

A set of statistics reported by the National Ski Areas Association reported that helmets were worn by 38% of their study cohort in 2005/6, which was increased from 25% in 2002/3. This study also showed that the more advanced a participant was, the more likely they were to wear a helmet, and that those between the ages of 18 and 24 were the least likely to wear a helmet of all age groups[41]. Statistics are showing increases in the use of helmets while skiing and snowboarding, but are helmets making a difference in the number of head injuries during these sports?

The statistics vary depending on the type of study conducted when attempting to determine the effectiveness of a helmet protecting an individual who is skiing or

snowboarding. One study by Sulheim, Holme, Ekeland and Bahr (2006) determined that the use of helmets while skiing and snowboarding might reduce the chance of a severe head injury by approximately 60%[42]. According to a separate study of ski areas in Quebec, Canada, helmets might protect against head injuries in 29-56% of head injury cases while skiing and snowboarding[43].

In a study conducted by the US Consumer Product Safety Commission (US CPSC), the researchers saw a decrease in the total number of general skiing injuries requiring emergency care from 114,400 in 1993 to 84,200 in 1997; however head injuries did not follow the same trend. Head injuries increased to 15% in 1997 from 12% in 1993 within the total number of injuries. Throughout the study time period, the number of all snowboarding injuries increased from 12,600 to 37,600, with head injuries increasing from approximately 1,000 to 5,200 in the four years. This study determined that a helmet would have protected the individual in 44% of head injuries during their study time and determined that approximately 11 head injury deaths may have been prevented with the use of a helmet[44].

A study reviewing death certificates in Colorado, US, revealed that between 1980 and 2001 there were 149 deaths on their ski hills. Twenty-one were children under the age of 17 and 128 were adults. Traumatic brain injuries (TBIs) were the primary cause of death with children (66.7%) and were also the cause in a large number (42.2%) of the adult fatalities. Those who had fatal injuries were most likely to be in a collision with another object, likely a tree[45]. These are some of the worst-case scenarios involved with head injuries while skiing and snowboarding. Not all injuries result in death.

Compilation of Canadian Hospital Injury Reporting and Prevention Program (CHIRPP) data at the IWK Health Centre in Halifax revealed that between 1999 and 2003 there were 14 head injuries related to snowboarding. The majority of these injuries were classified as minor head injuries and the majority of the participants injured were male. Losing control and colliding with another object or person were the primary causes of injuries. There were not enough injuries related to skiing in CHIRPP to report on[46]. A search of the NS Trauma Registry revealed 11 injuries between 2001 and 2006. The average age was 28 years old; all were male and all received a blunt trauma; and 63.6% of these people reported wearing a helmet at the time of injury[47]. Within Nova Scotia, the statistics for injury are far lower than other areas in the world.

A study of 8 Norwegian ski hills in 2002 reported that 578 of their 3277 total injuries were to the head. The researchers broke it down to 17.9% for alpine skiers and 17.8% for snowboarders. Twenty-five per cent of the total numbers of head injuries seen by ski patrol were referred to a doctor for further treatment. The authors concluded, “helmet use is associated with reduced risk of head injury among snowboarders and alpine skiers” (p. 923)[48].

A study in Eastern Canada at the Mont Tremblant ski area reviewed 1332 injury reports by the ski patrol between 1999 and 2000. Two hundred and forty six (representing 18.5% of the total injuries) were injuries to the head and or face. This study included injuries to

skiers, snowboarders and snowbladers (shorter skies with normal ski boots) with helmet use being present in 17.4%, 16.7% and 11.4% in each activity respectively. A concussion diagnosis represented 11% of the total injuries sustained by the participants but was the primary suspected diagnosis of 83% of the head injuries. The ski patrollers in this study had just completed a course on concussions at the beginning of the season and the authors feel that it may have increased awareness and therefore may have led to higher reported numbers of concussion within their study [49].

Nineteen ski hills participated in a study on head injuries in Quebec, Canada. Of the participants, 693 had suffered a head injury to some extent with almost 70% being a concussion. Of those participants with head injuries, 32% were transported to a hospital by ambulance. This study analyzed the effect of wearing a helmet with increases in neck injuries and found nothing statistically significant; however they found a suggested increase in risk of neck injuries with the use of a helmet once the sensitivity analysis was conducted[50]. Concern surrounding the potential of increased risk of neck injuries with the use of a helmet has been discussed in the literature. The following studies attempted to answer the question of whether helmets do or do not increase this risk.

Hagel et al. (2005) found limited evidence for the concern of helmets increasing the risk of neck injury. They state, "Although we found no statistically significant estimates for neck injury and no evidence of effect modification by age, our sensitivity analysis suggests an increased risk of neck injuries with helmet use" (p. 284)[51]. Macnab, Smith, Gagnon and Macnab (2002) looked specifically at whether helmets increased the risk of cervical spine injuries in children. They found that the use of a helmet did not increase the risk of neck injury within this age group[52]. Sulheim et al. (2006) found "a trend toward a lower risk for neck injuries with helmet wear" (p. 923)[53]. Bridges, Rouah, and Johnston (2003) were unable to make the connection between increased risks of neck injury with the use of a helmet in their study[54]. More research in this area is needed to determine whether the use of a helmet is in fact increasing the risk of neck injuries.

Position statements/ recommendations

A variety of experts in the fields of injury prevention and medical treatment have voiced their opinion on the use of helmets while skiing and snowboarding. The following sources recommend wearing a helmet while skiing and snowboarding:

- ThinkFirst Canada[55]
- Child Safety Link[56]
- The Canada Safety Council[57]

The following sources provide slightly more specific recommendations regarding helmet use while skiing and snowboarding:

- Safe Kids Canada recommends helmets for children, racers and any other activity that may contain high-risk situations when engaged in downhill skiing[58]. Helmets are also recommended for snowboarding[59].
- The American Medical Association recommends the voluntary use of a helmet for youth while skiing and snowboarding[60].

Effectiveness of programs, initiatives and legislation

Research surrounding the effectiveness of helmet programs for skiing and snowboarding is limited. Currently, most mandatory helmet regulations are for children participating in specific activities while on the hill. There are no studies that measure the effects of these programs to our knowledge at this time.

Recommendations for Nova Scotia

1. Continue to educate people of all ages regarding the benefits of wearing a helmet while participating in skiing and snowboarding.

   Potential Actions: Public Service Announcements (PSAs), education sessions, brochures and posters. Ski hills and sport stores should support and post information promoting helmets for skiing and snowboarding in Nova Scotia. For students participating in school ski trips, sufficient time should be set aside to show the students ski safety videos, such as the ThinkFirst "Smart Skiing and Snowboarding: A Skiing and Snowboarding Injury Prevention Program" that covers many safety features on the hill, including helmets.

2. Work with the owners/operators of ski hills to expand mandatory helmet regulations for all ages on their hills. Many hills already have some regulations in place for the use of helmets on the ski hills. Working with the owners/operators of the hills to have provincial consistency with regards to helmet regulations may help to highlight the importance of helmet use on the hills.

   Potential Actions: Begin to phase in this recommendation over a few years.

Equestrian Activities

NOTE: In 2003, Equine Canada passed a regulation that all juniors (under the age of 18) must wear an approved Safety Equipment Institute (SEI), American Society of Testing and Materials (ASTM) or British Standards Institution (BSI), properly fitted helmet every time they are mounted on competition or event grounds[61]. This does not include recreational riding, trail riding, or while grooming or maintaining their horse.

Within the Nova Scotia Equestrian Federation (NSEF), helmets are mandatory for all ages if they are participating in a NSEF event of any kind. This includes all activities including trail rides, coaching seminars or courses, and riding demonstrations (H. Myrer, personal communication, May 10, 2007).

The Nova Scotia Department of Education has made helmets mandatory for equestrian activities within the Physical Education Safety Guidelines[62].

Mechanisms of head injury

Given the power and size of horses, it is not surprising that there are a variety of ways to be injured when working around or riding these animals. According to ThinkFirst Canada, mechanisms of injury include the rider falling off of the horse, the horse trampling the rider, or being dragged by the horse. Others include being kicked or bitten by the horse, a rider trapped under a horse, the rider being jammed between the horse and another object, or the rider hitting an obstacle while still being on the horse (e.g. tree branch)[63].

Statistics

There are an estimated five to eight thousand equestrian participants in Nova Scotia. In 2006, the NSEF had approximately 2,300 members within their organization (H. Myrer, personal communication, May 10, 2007). Several studies have reviewed the injury rates for those participating in equestrian activities. With approximately 32 riding schools in Nova Scotia[64], ensuring the safety of all equestrian participants is imperative.

Equine Canada took steps to decrease TBIs in 2003 by executing their regulations for the use of helmets on competition grounds. The research performed at that time indicated that wearing approved helmets could reduce head injuries in equestrian activities by 70-80%[65].

The British Columbia Medical Association produced a fact sheet on equestrian helmets and pointed out some startling facts. Horses lift the participant to at least 8 feet (3 meters) above the ground; a fall from 2 feet can cause a TBI. A skull can be broken with an impact of 7-10 kph while most horses travel at 65 kph[66]. These facts, among many others such as the obvious size and power of a horse illustrate the risk involved with horseback riding. In fact, the injury rates in this sport have been compared to those of motor vehicles.

A number of cited sources in research have stated that serious equestrian injuries are more prevalent than motorcycle injuries. A severe injury typically occurs to a motorcyclist every 7000 hours of participation in comparison to equestrian injuries at every 350 hours[67]. An alternative method of viewing this is to compare the hospital admission rate of equestrian activities of 0.49 per 1000 hours to the injury rate 0.14 per 1000 hours for motorcyclists[68]. The use of a helmet may decrease the severity of equestrian head injury.

CHIRPP data from the IWK Health Centre recorded 13 head injuries related to horseback riding between 1999 and 2003. The majority of these individuals were between the ages of 10 and 14 and all of the patients were female. The majority of the patients reported using a helmet or a hard hat. The athlete was most likely to fall to the ground and hit their head. The result was typically a concussion[69]. Injuries can be more severe without the use of a helmet. A five-year study in British Columbia, Canada, found that 15 people had died while engaging in a horse-related event (riding, working, competing etc…). Of these 15 people, nine died as a result of a head injury, and none of them were wearing helmets at the time[70].

The British Columbia study estimated that approximately 33,000 individuals participate in equestrian activities[71], which is significantly higher than in Nova Scotia, where participant numbers five to eight thousand (H. Myrer, personal communication, May 10, 2007). Within these five years, there were 1950 hospital admissions due to injuries associated with horses. This study determined females were the most likely to be injured (62%) and that the head was most likely body part to be injured (20%)[72]. A data sampler of head injuries in all sports and recreation disciplines in Canada with the CHIRPP database (1997 to 1999) found that informal horseback riding resulted in 31.7% of female head injuries related to sports[73].

The United States Pony Club stated in their annual report of injuries that the number of head injuries in equestrian activities has declined since instituting the ASTM/SEI helmet regulations, even though they have seen a slight increase in the number of concussions among their participants[74]. It is important to realize that while wearing a helmet may reduce the risk of severe head injury in equestrian sports, there is no scientific evidence that a helmet will protect an individual from sustaining a concussion in the event of a collision of the head with another object[75]. However, experts state that helmets may reduce the severity of the concussion in the event of a collision of the head with another object (B. Hunt, personal communication, August 29, 2007)

Position statements/ recommendations

Various injury prevention stakeholders have provided recommendations regarding the use of helmets during equestrian activities. Fortunately, rules are now beginning to be implemented requiring helmets during competitions[76]; however few rules include all disciplines in equestrian activities. The following injury prevention sources have recommended helmets to be used while engaged in equestrian activities:

- The Nova Scotia Equestrian Federation[77].
- The Canadian Equestrian Federation and the American Medical Equestrian Association in combination with Safe Riders Foundation[78],[79].
- ThinkFirst-SportSmart Canada has developed a program titled "Smart Equestrian" and they recommend an ASTM/SEI approved helmet for all ages when walking, working with or riding any horse[80].

Effectiveness of programs, initiatives or legislation

As stated above, the United States Pony Club states in their annual report of injuries that the number of head injuries in equestrian activities has declined since instituting the ASTM/SEI helmet regulations even though they have seen a slight increase in the number of concussions within their participants[81].

In Ontario, The Horse Riding Safety Act, Bill 12 was passed in 2001. The new Bill requires that all equestrians under the age of 18 must wear a helmet when they are engaging in riding lessons, riding a horse on trails or public roads as well as during any training session. However, this Bill does not include competitions. Since this Bill has been passed, they have seen significant increases in the amount of helmets being worn by equestrian participants[82].

A concern in the equestrian sport world is that in Western competition. Within competition, it is customary for the rider to wear a cowboy hat as part of the attire that is judged. The concern among equestrian riders is that if they wear a helmet during Western competitions the judges may score them lower for not wearing a cowboy hat. However, when the Ontario Equestrian Federation investigated this concern, the response received from the Western competition organizers was in support of helmets[83]. According to the Equine Canada rules, the participant will not be penalized when scored if they choose to wear a helmet instead of a cowboy hat or other attire[84]. The change in rules allows the safety of the participants to be a priority, rather than their clothing.

Recommendation for Nova Scotia

1. Work with recreational and competitive equestrian organizations and enhance regulations to ensure that all equestrian participants are wearing approved, properly fitted helmets while training and riding horses in order to prevent severe head injuries.

   Potential Actions: Encourage and work with all recreational and competitive equestrian facilities to adopt mandatory helmet regulations for all ages while trail riding, training and competing.

Ice/Figure Skating

NOTE: The Nova Scotia Department of Education has made helmets mandatory for ice-skating within their Physical Education Safety Guidelines[85].

Mechanisms of head injury

The most common mechanism of injury in ice-skating is falling. McGeehan et al. (2004) found that falls accounted for 91.4% of all of the skating injuries that were investigated[86]. Other potential causes are collisions with another person or object as reported by the IWK CHIRPP data report[87].

Statistics

According to CHIRPP data there were approximately 20 head injuries related to ice skating between 1998 and 2002, accounting for 9% of the total injuries for this activity reported to the IWK Health Centre[88]. Between 1999 and 2003, this number increased to 25 reported and treated head injuries. The majority of the injuries (56%) occurred to those 10-19 years of age and had an almost equal distribution between males (52%) and females (48%). Sixty-eight per cent of the injuries occurred in a stadium or arena with 76% reporting that the activity was recreational in nature[89]. In Nova Scotia, we are currently legislated for helmet use with in-line skating[90], but no provincial legislation or rules exist for ice-skating.

McGeehan, Shields, and Smith (2004) compared the statistics of different skating activities such as ice-skating, skateboarding, roller-skating, and in-line skating. Seventy-six per cent of patients were reported to have no helmets (or other protective equipment) at the time of injury. Of the 419 skating injuries during the 31-month period, ice skaters had more head injuries than the other styles of skating. The authors of this paper concluded that children should wear a helmet while participating in ice-skating[91].

Knox, Comstock, McGeehan and Smith (2006) looked at injuries between 1993 and 2003 from the activities of ice-skating, roller-skating and in-line skating. This study found that those involved in ice-skating sustained more head injuries (13%) than roller skaters (4%) and in-line skaters (5%)[92]. These studies demonstrate the need for further research into whether helmets should be legislated, as the risk of injury may be higher in ice skaters than in in-line skaters.

The above studies reviewed the recreational side of ice-skating. To complete the picture, this paper will discuss the potential of head injury in figure skating where the risks may be higher considering the jumps, spins and speed involved in practice and competition. It should be noted however, that figure skating has been included with the first list of activities because the injuries sustained are often classified with all ice-skating injuries. Figure skating may be more effectively suited with the second list of activities that require increased education.

Ron Ludington, the director of the Ice Skating Science Development Center in the US in 2000 took steps towards implementing helmets during practices for figure skaters after witnessing a skater he was working with fall, hit his head and almost die as a result of his injuries. No helmet exists that is specific for figure skating[93]. This indicates the need for further research to determine the best way to protect a figure skater's head.

While statistics on injuries sustained by those who train in figure skating are minimal, many websites discuss serious head injuries that professionals have sustained during competitions and training. These injuries happen and may potentially be prevented or reduced in severity with the use of a helmet.

Position statements/recommendations

Few injury prevention sources have made statements on the use of helmets when ice-skating. The following sources have made helmet recommendations for ice-skating:

- Public Health Agency of Canada[94].
- Child Safety Link[95].
- ThinkFirst Canada[96].

The Nova Scotia Department of Education has made helmets mandatory for ice-skating within their Physical Education Safety Guidelines[97].

Effectiveness of programs, initiatives or legislation

At this time, no programs or initiatives have been implemented or evaluated to determine the effectiveness of helmets in ice or figure skating.

Recommendations for Nova Scotia

1. Work with the ice rinks, the Department of Education and outdoor skating/pond hockey event coordinators in Nova Scotia to implement mandatory helmet regulations within their facilities and during their events.

   Potential Actions: Increase education initiatives, and support these facilities in implementing mandatory helmet regulations.

2. Suggest the use of helmets and educate the public on the benefits of wearing a helmet while skating on outdoor ponds.

   Potential Actions: Public Service Announcements (PSAs), education sessions, brochures and posters.

Sledding/Tobogganing/Tubing

Mechanisms of head injury

Lee et al. (1999) reviewed sledding injuries in Ottawa. Ninety-five children were injured. The most common mechanisms of injuries while sledding were collisions with another object (33%), losing control of the sled while on ice (29%), and sledding off of a jump (16%)[98]. Another potential mechanism of injury to consider is the participant slipping and falling while on the hill[99].

Statistics

Numerous media articles[100], [101], [102] highlighted the potential dangers associated with sledding after the deaths of an eight year old in Quebec and a twelve-year-old in Manitoba in January, 2007. Both deaths involved head injuries. A National Post story lists seven deaths from injuries sustained while sledding since 2003[103]. Deaths can occur, and helmets may help to prevent these deaths. Other preventive measures may help to reduce these risks as well.

A study conducted in Ottawa, Ontario reviewed and interviewed individuals injured while sledding who reported to the emergency department and conducted on-site evaluations of 20 different sledding sites around the Ottawa-Carlton region. Icy conditions were thought to be the cause of the majority of the injuries. The injured participants ranged in age from eight months old to 17 years of age, and averaged 9.9 years. Males were injured in 63% of the cases. Parental supervision was reported to be present at the time of injury in 51% of cases, and as high as 86% during the on-site visits. A GT style sled was used by 27% of those injured while sledding, and was the common sled used when participants received injuries. This study found that 12% of the head injuries were classified as minor head injuries and one participant sustained a basal skull fracture. The most serious head injury in this study, which involved a motor vehicle, was a depressed skull fracture with intracerebral hemorrhage. Helmets were not used in any of the injured cases[104].

CHIRPP data revealed 333 sledding injuries that required treatment at the IWK Health Centre between 1998 and 2002. Of these injuries, 48 (14%) were to the head[105]. Between 1999 and 2003 the IWK Health Centre saw a small increase in the number of head injuries (up to 55) associated with sledding. Seventy six per cent of these injuries occurred as the result of some form of contact between the participant and another object, person or animal. The majority of these injuries were classified as minor head injuries (58.2%) and concussions (12.7%)[106]. Fortunately, the injuries have been minor in Nova Scotia, however even minor injuries can be prevented. Many organizations committed to injury prevention recommend the use of helmets while sledding.

Ontario has designated sledding hills, which the authors define as, “those hills that the community has officially set aside specifically for sledding. They are usually posted as such, are free of obstacles along the slope, have an adequate run-off area at the bottom of

the hill, and protected uphill walkways" (p. 198). The majority of the injuries sustained in this study (70%) occurred on the non-designated hills[107]. Implementing a similar design in Nova Scotia may be beneficial to potentially reducing our sledding injury numbers.

Position statements/recommendations

Many sledding injuries can be prevented by identifying and eliminating potential risks including rocks, trees, or the end of the hill flowing into a street[108]. Helmets may help to reduce the risk to a participant's head as well. The following organizations have made statements supporting helmets while sledding:

- Child Safety Link[109]
- ThinkFirst Canada[110]
- The American Academy of Orthopedic Surgeons[111]

Effectiveness of programs, initiatives or legislation

At this time, no programs or initiatives have been implemented to determine the effectiveness of helmets while sledding.

Recommendations for Nova Scotia

1. Enhance public education prior to and during the sledding season to ensure parents and children know what dangers to look for while sledding.

   Potential Actions: Public Service Announcements (PSAs), education sessions, brochures and posters.

2. Identify those hills that are safe and those that may pose dangers to those using the hills for sledding.

   Potential Actions: Post signs indicating whether a hill is considered safe. Post signs on hills indicating the dangers present on hills. Educate the public on these signs so that they know whether the hills they are on are safe and where dangers may be present.

3. Enhance public education prior to and during the season about safe positions for these activities. This would include never sledding headfirst and never going down the hill on your stomach.

   Potential Actions: Public Service Announcements (PSAs), education sessions, brochures and posters.

4. Consider using a helmet to protect your head while sledding.

Potential Actions: Continue research to determine if evidence mounts for a recommendation. In the meantime, provide Nova Scotians with education regarding helmet use and allow them to make their own personal decision.

Section B: Sports/Activities with Limited or No Evidence of Helmet Effectiveness

Introduction

Rationale for this section

Many head injuries occur during sport and recreation activities where the use of a helmet may not be an option; helmet legislation, rules or recommendations have not been developed or has not been considered yet. It is not our attempt with this paper to change the way a sport is played, but to enhance safety with the use of helmets that is realistic, and to identify sports where increases in education may enhance safety, and therefore reduce rates of head injuries among the participants.

The purpose of this section is to identify activities that may have risks of head injury and to provide recommendations to prevent the potential of long-term consequences. Education is imperative for these activities, especially for the athletes, parents, coaches and trainers.

Activities to be reviewed

The activities to be reviewed in this section include:

1. Soccer
2. Rugby
3. Rock Climbing (more specifically Bouldering)
4. Whitewater Paddling/Kayaking
5. Parkour
6. Ultimate Frisbee

These activities have been identified by a steering committee of Nova Scotia provincial stakeholders (government injury prevention specialists, physicians, nurses, police (HRM and RCMP), and recreation personnel) as activities where the participants may be at an increased risk of sustaining a head injury which may not require helmets or in which do not think of using helmets at this point in time. While this list is not completely inclusive of all activities that may be categorized into this section, we hope that the education recommendations may be transferred to other activities.

As mentioned in the beginning of the paper, managing concussions and other head injuries properly is key. It is sometimes difficult and frustrating for athletes to take the time needed to completely recover from concussions and head injuries, however having the risk of re-injury to the brain may produce life long consequences if a head injury is not properly managed.

Soccer

Soccer is one of the most popular sports played throughout the world. According to Soccer Nova Scotia, there are approximately 26,000 participants enrolled in their provincially organized program (Soccer Nova Scotia, personal communication, June 14, 2007). One of the most important skills to learn and master in soccer is heading the ball, a skill that is used by all players on the team as a defensive or offensive maneuver. Placing a full helmet on soccer players will significantly change the sport. Some players choose to wear headgear however this piece of equipment does not have the capability to protect a player against most head injuries[112].

Mechanism of head injury

The most common mechanisms of head injury in soccer are a collision between two players or a collision between the player and the ball. There are also collisions with other structures such as goal posts, the ground and other objects on the field[113],[114]. The US CPSC reported that 40% of head injuries were caused by contact with another person, 10.3% with contact to other items (e.g. goal post, ground), 12.6% with the ball and 37% that were not specified[115].

There are two areas on the field that have a higher risk of head injury than others. They include the penalty box area (box surrounding the goalie), and the midfield areas. The penalty box area offers an increase in risk due to the corner kicks into this area in an attempt to score on the opposite team. Balls are often kicked with power and height over a short distance, therefore increasing the risk of injury. Another potential for risk in this area is for the goalkeeper, defender or opponent when the opposite team rushes the goal/goalie in an attempt to score a point and colliding with each other. Finally, each player close to the goal is at risk of colliding with the goal post during the competition.

The second high-risk area on the field is in the midfield area, where many of the balls are directed away from their goal into the opponents' half of the field. These balls are typically kicked from the goal/penalty box area into the middle of the field using considerable force and ball height[116].

Statistics

The CHIRPP database revealed 65 soccer related head injuries between 1999 and 2003 at the IWK Health Centre in Halifax. Sixty per cent of the injuries occurred during organized play or practice. A collision was the primary cause (66.2%) for the head injury and the majority of the injuries were minor or diagnosed as a concussion[117].

Pickett, Streight, Simpson and Brison (2005) used CHIRPP data in Kingston Ontario to identify injuries that occurred while playing soccer between 1996 and 2001 that required medical attention in an emergency department. Of the 1714 total injuries sustained by players, 13.7% were injuries to the head. The majority of the head injuries occurred during organized play or practice[118].

Concern has been voiced about the role of heading the ball causing head injuries in acute and long term circumstances. Within the Kingston ON study, a number of head injuries were identified that were due specifically to heading the ball. Of the 235 injuries to the head, 153 were due to some form of contact with another person, and 62 injuries with the ball. Within these 62 cases, only 4 injuries were due to contact with the ball when heading[119].

Recommendations for Nova Scotia

The number of participants in soccer is so great and the benefits of getting children out playing the game far exceeds any great concern for serious life-threatening head injuries.

1. Encourage and work with Soccer Nova Scotia in implementing courses focused on the identification and management of head injuries. Ensuring proper management of head injuries may allow each player the ability to play the sport they enjoy longer.

   Potential Actions: Pre-season education sessions with the athletes, coaches and parents on the proper management of head injuries and safe return to play.

2. Work with Soccer Nova Scotia to implement courses for their coaches on the importance of proper heading the ball at all ages and how to progress the player through the stages of safe heading in order to prevent head injuries.

   Potential Actions: Pre-season education sessions with the athletes, coaches and parents on the proper management of head injuries. ThinkFirst has a program (SMART SOCCER) that is designed to assist coaches, parents and players through many aspects of playing soccer in a safe manner, including heading the ball.

Rugby

Rugby has been played in Canada since the 1860's. While its popularity varies across Canada, it is played in every province[120].

Mechanism of head injury

Potential mechanisms of injury while participating in rugby include tackles (includes tackles to or from another person), hits (includes hits to or from another person), slips, trips or falls, collisions, player being stepped on or kicked, being hit by the ball, or running into an object such as a goal post[121].

Statistics

In a 1995 search of the entire CHIRPP database, 839 rugby-related injuries were identified. Within these injuries, 3.9% were concussions and 2.7% were minor head injuries[122]. A search of the CHIRPP database of rugby related injuries treated at the IWK Health Centre between the years of 1999 and 2003 revealed that there were not enough injuries to report on (M. Merrick, personal communication, April 21, 2007). Studies from the United States and other areas of Canada involved larger populations and were better able to generate statistics.

A large study from the United States identified injuries from playing rugby between the years of 1978 and 2004. They found that, "the face, shoulder, head, ankle and knee were the most frequently injured sites, and strain/sprain, laceration, fracture, and contusion/abrasion were the most common diagnoses"(p. 326). Injuries to the head accounted for 11.5% of the total injuries reviewed in the study and found that participants under the age of 18 sustained more concussions than the older group[123]. Similarly, a fact sheet produced by the B.C. Injury Research and Prevention Unit (BCIRPU) reports that 5-25% of all rugby injuries are to the head. The information sheet mentions the use of headgear as a method to protect only the ears and scalp from lacerations[124].

Petterson (2002) conducted a study to determine the attitudes of Canadian coaches and players. It revealed that of those participating in the survey, 27% wore headgear. The majority of players in the study felt that the use of headgear could protect them from concussions but chose not to wear headgear and felt that mandatory rules should not be implemented. The number one reason that players do not wear headgear is that it is currently not mandatory, followed by the headgear being uncomfortable and financial issues[125]. The majority (56%) of the coaches on the other hand, did not feel that the use of headgear would reduce the risk of concussion and some even felt that the use of headgear might increase the number of concussions because players may play more aggressively believing that the headgear will protect them[126]. The use of padded, not particularly protective, headgear in rugby is not known to protect the player against a concussion[127], [128].

Recommendations for Nova Scotia

1. Continue to monitor the activity to determine if head injuries are increasing.

Potential Actions: Conduct a search of the databases in Nova Scotia to determine if the number of head injuries sustained within rugby is increasing.

2. Work with the athletes and coaches on implementing courses for them on the risks associated with head injuries.

Potential Actions: Pre-season education sessions with the athletes, coaches and parents on the proper management of head injuries.

Rock Climbing (Bouldering)

There are two primary forms of rock climbing: aid climbing (use of devices in the rock to support the climber) and free climbing (only uses the natural structure of the rock)[129]. Free climbing can be divided into traditional lead climbing, sport lead climbing, bouldering, and free solo climbing[130]. The equipment and procedure for each of these activities are slightly different and may require different training in order to progress through the activity safely[131]. Rock climbing in all of its forms can occur outdoors and indoors in natural or artificial environments.

There are a variety of protective measures used when bouldering. A crash pad is a piece of protective equipment. This is a thick foam pad resembling a mattress that cushions the climber from colliding directly with the ground[132]. Spotters may also be used with or without the crash pad to assist the climber in falling safely (e.g. protecting the climbers head) if they do in fact lose grip and fall[133]. Those who participate in bouldering do not use ropes or harnesses that may be used in other forms of rock climbing[134].

Mechanisms of head injury

Head injuries may occur in rock climbing if loose objects fall from above and strike the climbers head or if the climber falls and hits their head on the rock or ground. Either way, a helmet may protect the climber from life-long injury, disability or death[135]. It would seem from the description of bouldering that a participant is more likely to fall and hit their head sustaining an injury than to have something fall on their head, although both may be possible.

Statistics

It appears that the majority of injuries sustained in rock climbing or bouldering are finger and shoulder injuries[136] or soft tissue injuries[137]. No statistical studies that included head injuries were found during this research. The debate about the use of helmets within bouldering is prominent within the industry. Many websites have forums where helmet use is discussed among their participants. Helmets make intuitive sense for rock climbing and bouldering. While crash pads and spotters may provide the climber with some protection, a helmet may provide additional protection.

Recommendation for Nova Scotia

1. Continue to build on the research currently available in this field.

   Potential Actions: Work with those who boulder to determine what the risks may be for head injuries. Educate the athletes participating in this activity of the risks associated with falling from even a short distance.

Whitewater Paddling or Kayaking

Whitewater paddling or kayaking can be a dangerous sport. Participant experience and the level of difficulty of the water path may determine the extent of the risk factors.

Mechanisms of head injury

The most commonly reported mechanism of head injury within this sport is having the kayak tip over and the participant hitting their head on a rock[138]. Others include hitting their head on the kayak once they are out of it, collisions with the paddle or any other object. Unfortunately, a head injury in this sport can be more devastating because if the participant losses consciousness, they could drown[139].

Statistics

Few statistics are available on head injuries in whitewater kayaking. Fiore and Houston (2001) reported the majority of the injuries that were sustained in their study were abrasions (25%), tendonitis (25%), contusions (22%) and dislocations (17%). Those participants in the higher level of difficulty stream were injured more than those in the lower level intensity streams[140].

Many people feel that a helmet is an essential piece of whitewater kayaking gear. Unfortunately, few standards exist for kayaking helmets. Flaws in kayaking helmet manufacturing include the use of poor quality material, little material actually holding the helmet in place, allowing the water to move the helmet exposing the head to potential injury, little energy absorption potential and improper fitting (K. Ankney, personal communication, May 21, 2007).

Wittmann (2000) found that the fatality rate for whitewater activities was 2.9 per 100,000 participants or 1.1 per 100,000 user days, significantly lower than other daily activities such as rock climbing, scuba diving and driving a car[141].

Recommendation for Nova Scotia

1. Continue to monitor the activity to determine if head injuries are increasing.

   Potential Actions: Conduct an annual scan of head injuries sustained while engaging in this activity to determine if head injuries are increasing.

Parkour

The term Parkour means "the art of movement"[142]. This discipline has a French origin and combines skills of pure athleticism (e.g. gymnastics and climbing) and martial arts. "The ultimate goal in parkour is to 'flow' along one's path, from point A to B non-stop, like water" (¶ 4)[143].

Parkour is often viewed as an extreme sport; however, those who engage in this activity describe it as an art or discipline. The movements are designed so an individual can navigate around obstacles (physical or mental) using quick thinking and flexibility while using the least amount of energy possible. It provides the individual with a direct route in the most efficient manner. Part of learning how to be efficient is learning how to prevent injury[144]. Those who have been practicing parkour for some time recommend taking the time to train, learn and master the basics before moving on to the more difficult maneuvers as a method of preventing injuries[145].

Mechanisms of head injury

The discipline of Parkour may be dangerous simply because of its nature of jumping, climbing and vaulting. Head injuries may be possible if the participant makes an error in movement.

Statistics

No injury statistics on Parkour were found. Most injuries that are discussed include orthopedic injuries.

Recommendation for Nova Scotia

1. Continue to learn about parkour and monitor the activity to determine if head injuries are becoming prevalent.

   Potential Actions: Conduct an annual scan of our databases to determine if head injuries are increasing.

Resources

The following is a list of websites that provide additional information on the discipline of Parkour:

www.halifaxparkour.com
http://en.wikipedia.org/wiki/Parkour
www.parkour.net
http://www.parkour.asn.au

Ultimate Frisbee

Ultimate Frisbee (also known as Ultimate) is an activity that combines the skills of soccer and football together using a Frisbee. The Ultimate Player's Association Board has described this activity as, "Player defined and controlled non-contact team sport played with a flying disc on a playing surface with end zones in which all actions are governed by the 'Spirit of the Game™'"[146].

Mechanisms of head injury

As Ultimate Frisbee is a non-contact sport, the number of injuries should be relatively low. A risk assessment conducted with the University of Oxford Sport Federation (2006) found that the risk of head injury is low; however the following potential mechanisms of injury still exist:

- Head to head collisions
- Head to shoulder collisions
- Disc hitting head
- Collision with the disc[147]
- Head colliding with the ground.

Statistics

A study published in the Wisconsin Medical Journal found that head injuries accounted for 30% of the injuries sustained by their respondents. Of these head injuries, 35% were concussions, 38% were due to a collision, and 33% were from 'laying out' (a horizontal dive). The majority of the injuries sustained in the sport were to the muscles of the extremities of the body[148]. The sport of Ultimate Frisbee is increasing in numbers and participation all over Canada, including Nova Scotia. No statistics appear to be available on the number of injuries at this time for Nova Scotia.

Recommendations for Nova Scotia

1. Continue to monitor this sport to determine if there are increases in head injuries.

   Potential Actions: Conduct an annual scan of our injury databases to determine if head injuries are increasing.

2. Work with the athletes, coaches and parents to implement courses regarding head injuries to ensure they are prepared to recognize and deal with these injuries when they occur in an effective manner.

   Potential Actions: Pre-season concussion education sessions to assist with educating them about the importance of head injury management. Work with the organizers of Ultimate Frisbee in Nova Scotia to place concussion management tips on their website to assist in educating the athletes.

Conclusion

The purpose of this paper was to identify those activities where helmets may be effective in preventing or reducing the severity of head injuries. The research is clear on the benefits of helmet use in skiing, snowboarding, equestrian activities and ice-skating, and recommendations have been made on how to increase helmet use in these activities. It was felt that the current research does not provide enough evidence to advocate for mandatory helmet use with the other activities discussed throughout the paper at this time.

Some potential positive outcomes of our recommendations for the use of helmets in skiing, snowboarding, equestrian and ice-skating activities may be a decrease in the number of head injuries that are sustained and decreased severity and number of fatalities due to head injuries. Education is a strong component of many of our recommendations within all the activities. Since helmets may not protect the participant against concussions, it is imperative that athletes, trainers, coaches and parents become more aware of concussions, so they can be recognized and managed more effectively, and athletes can safely return to play the sports they enjoy.

Potential negative outcomes may include reduced participation in some activities simply because the athlete may not want to wear a helmet to participate in their sport of choice. This negative aspect is of great concern, as the authors of the paper want everyone to remain active throughout their life participating in the sport or activity that they enjoy. The recommendations in this paper are intended to enhance the health and safety of each individual in Nova Scotia when participating in physical activity. It is not our intention to see a decrease in physical activity due to increased helmet regulations but simply to see a decrease in the number of head injuries that may occur with or without the use of a helmet.

The safety of all people in Nova Scotia is of utmost importance. The recommendations made in this paper are one more step towards making Nova Scotia as safe as possible. Continuing education initiatives to promote the use of helmets in a variety of activities throughout life as well as educating around effective recognition and management of concussions will assist athletes through this process.

Appendix A

Recommendations for Sports/Activities Presented in this Paper

Activity	Recommendation	Age
Skiing/Snowboarding	Education, consider facility rules/legislation	All ages
Equestrian	Expand rules to include helmets for all participants in equestrian activities (e.g. trail riding)	All ages
Ice/Figure Skating	Education, consider ice rink facility rules/legislation, mandatory helmets for organized outdoor skating events	All ages
Sledding	Education (benefits of helmet use, safe riding positions, etc…), designate and promote safe hills in Nova Scotia, continue research	All ages
Soccer	Concussion education, continue proper heading education for coaches	All ages
Rugby	Monitor, concussion education	All ages
Rock Climbing (Bouldering)	Monitor	All ages
Whitewater Paddling/Kayaking	Monitor	All ages
Parkour	Monitor	All Ages
Ultimate Frisbee	Monitor, educate	All ages

Appendix B – Concussion Management Stepwise Process

The following has been retrieved from: Brain Injury Association of Nova Scotia (BIANS). (2003). Concussion management guidelines.

Medical attention is always advised before any return to play. Physician-supervised concussion managements should adhere to the following steps:

Proceed to the next step if symptom free. If symptoms occur, drop back a step to where there are no symptoms, and try to progress again.
Step 1: No activity, complete rest
Step 2: Light exercise such as walking or stationary cycling.
Step 3: Sport-specific activity (e.g. skating in hockey, running in soccer)
Step 4: Sport practice without body contact.
Step 5: Sport practice with body contact, once cleared to do so by a medical doctor. The time required to progress from full non-contact exercise to contact will vary with the severity of the concussion.
Step 6: Sport play or full activity.

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