Child and Adolescent Ski and Snowboard Related Injuries

A review of the literature
Introduction

Adolescence is a developmental period marked by increased health risk-taking and novelty seeking behaviours (Kelley, Schochet & Landry, 2004). This marked increase in risk-taking usually does not occur at any other point in the lifespan (Kelley, et al., 2004). Adolescence is also marked by an increase in injury and mortality rates (SMARTRISK, 2009); in fact, mortality rates increase by 200% during this developmental period (Dahl, 2004). This rise in mortality has been related to adolescents’ increased involvement in maladaptive health risk-taking behaviours, such as risky driving practices and risk-taking in sporting and leisure activities (Steinberg, 2004). Maladaptive risk-taking, by definition, is pathogenic and dangerous, with little or no chance for secondary gain and refers to the risky behaviours that should be discouraged among most adolescents (Baumrind, 1987). The increase in maladaptive risk-taking among youth has been called one of the greatest behavioural changes that occurs within adolescence (Kelley, et al., 2004); it is a time marked by increased novelty seeking, risk-taking and in turn injury and mortality. In fact, statistics on motor vehicle crashes, risky sexual behaviours, risk-taking during sporting or leisure activities, binge drinking and crime demonstrate that adolescents engage in more risk behaviours than any other age group, including children (Dahl, 2004; Steinberg, 2004). Accordingly, researchers have devoted much attention to this period of heightened risk-taking during adolescence (Dahl, 2004) and efforts to understand how other variables may influence adolescent risk engagement have been extensively examined.

Various environments and activities have been studied in terms of how they relate to adolescent risk-taking trends, such as home environments, school atmospheres, and driving and sporting activities. One specific area of sporting activities where maladaptive risk-taking and injury may occur is in skiing and snowboarding. This is an area that should be of particular
interest to Canadian researchers and programmers as these types of sporting activities are increasingly popular among our adolescents. In fact, according to the Canadian Ski Council, skiing and snowboarding have been found to be among the most popular sport and recreation activities for Canadians (Canadian Ski Council, 2009). In 2007 alone, 4.3 million Canadians over the age of 12 participated in some form of skiing and snowboarding activity (Canadian Ski Council, 2009). The rate of participation for Canadians 12 and over in snow sports has been found to be roughly 15% (Canadian Ski Council, 2009). As such, these activities present an important area for Canadian researchers to focus their attention, as there may be unique risk-taking behaviours and resulting injury patterns occurring among our adolescent populations and focused programming efforts may be required.

This document will serve to review and outline the most common injuries among children and youth participating in skiing and snowboarding activities. Additionally, various aspects of adolescents’ lives will be considered as they relate to their risk-taking on the ski hill and injury patterns. Attention will be given to the various reasons why youth may be particularly at risk for injuries to themselves and others in these winter recreational sports, including etiology, gender differences, ski hill terrain, comparisons with other sports, and parental influence on injury perceptions and rates. Finally, this document will present a summary of various programming pieces focused on child and adolescent ski and snowboarding injuries and will offer some recommendations regarding future programming efforts.

Common Injury Patterns Among Youth

Skiing and snowboarding each present distinct injury patterns for youth. Researchers have found that in the United States alone, there are over 500,000 ski-related injuries per year, and 180,000 of these are to skiers under the age of 16 (Meyers, Laurent, Higgins, & Skelly, 2007),
with injury rates for youth being between 3.9 and 9.1 per 1,000 ski days (Meyers, et al., 2007). Using data from the Canada West Ski Areas Association regarding injuries during the 2008/09 season, the Canadian Ski Council (2009) reports that youth between the ages of 10 to 19 present the highest rates and number of injuries. The 10-19 age range typically accounts for 55% of all injuries sustained by skiers and snowboarders. Moreover, the Health Surveillance and Epidemiology Division of the Public Health Agency of Canada has reported that 10-19 year olds account for over 90% of the reported injuries for snowboarding and over 65% of the injuries for downhill skiing.

Researchers have found that head and neck fractures are the most common cause of fatal injuries in these sport activities (Meyers, et al., 2007) and that in the United States these account for roughly 11-20% of all injuries among children and adolescents (Meyers, et al., 2007). Moreover, some Canadian research has indicated that adolescents may be twice as likely to suffer head and neck trauma (B.C. Injury Research and Prevention Unit 2006 a and b). Additionally, skiing and snowboarding each present distinct injury patterns. Specifically, Canadian researchers have found that the most common injuries in skiing are to the leg (27%), the knee (25%) and the arm (15%) and that the most common snowboarding injuries are to the forearm and wrist (each with 30%) and the shoulder or elbow (12%) (B.C. Injury Research and Prevention Unit, 2006 a and b).

Overall, it is clear that injuries are a common occurrence in skiing and snowboarding activities and moreover it appears that youth significantly contribute to these injury statistics and have specific injury patterns and behaviours on the ski hill. As such, a specific understanding of child and adolescent injuries is needed, as well as programming tailored to their safety needs on
the hill. The following sections of this review will focus on explaining this problem further and will present programming options for how to best work with youth.

**Etiology of Youth Injuries**

As indicated, it is clear that many youth are being injured on ski hills, but the question remains as to why this is occurring. Researchers have found that “youth have a disproportionate amount of risk” (Hoshizaki, Vassilyadi, Post, & Oeur, 2012, p.133) for a variety of reasons, which will be outlined below.

*Body Size*

Approximately 15% of ski hill injuries among youth may be attributed to the fact they are still in a developmental period of growth (e.g., bone growth, etc.) (Maffulli & Baxter-Jones, 1995). The force that incidents on the ski hill (e.g., falls, collisions, etc.) may put on children’s bodies may be too much for them during this developmental period and thus put them at a greater risk for moderate to severe injuries as compared to skiers and snowboarders who have completed their growth (Meyers, et al., 2007). For example, a study done by Huber and colleagues (1982) likened the force that skiing places on a youth’s tibia to the force of a boxer’s hit to the head. Additionally, youth are put at a greater risk for injury on ski hills due to their body proportions. Specifically, adolescents and young adults tend to have smaller heads and be shorter in stature and therefore are closer to the ground when they fall, “which results in unique impact characteristics, contributing to brain injuries” (Hoshizaki, et al., 2012, p.133). As such, youth require specific and focused programming as their basic developmental trajectories put them at a greater risk for injuries on the ski hill than adults.
**Skill level**

There have also been some injury trends uncovered corresponding to experience level in these activities. Research conducted in Quebec has found that injury rates are highest among self-identified beginners and intermediates (Bridges, Johnston & Rouah, 2003). For skiers, 22% of beginners and 35% of intermediates sustained injuries and for snowboarders, 28% of beginners and 36% of intermediates sustained injuries (Bridges, et al., 2003). This has been described as a bimodal trend around ski hill injuries, with beginners experiencing high injury rates due to their inexperience and more experienced intermediate participants pushing themselves beyond their abilities (Meyers, et al., 2007). These trends also correspond to the time in the ski season, with the beginning of the season being the worst time for injuries, as adolescents may not have had opportunities to practise their abilities (Meyers, et al., 2007). As such, it appears that programs should not only educate the beginners (conceivably a group where the majority will be the very young skiers and snowboarders just starting out) but also re-educate the intermediates (conceivably a group where the majority will be adolescents and young adults who have spent time learning the sports). A program focusing on working with both the very young beginners and adolescent intermediates could prove successful in decreasing the injury statistics corresponding to these experience categories.

**Equipment**

The equipment that children and adolescents use while on the hill has also been related to their injury rates. For example, due to their constant growth, adolescents’ equipment may be ill-fitting and thus ill-adjusted. The problems around fit of equipment have been found to increase risk for injury, as well as risk for injurious behaviours such as the inability to stop (Meyers, et al.,
2007). For example, it has been found that among youth, up to 35% of lower body injury trauma cases have been attributed to ill-fitting equipment (Meyers, et al., 2007).

Helmet use has also been cited around injury rates. Currently in Canada, there is no nation-wide law requiring skiers or snowboarders to wear helmets. However, there is a national policy directed toward encouraging the wearing of helmets and becoming educated on the benefits and limitations of helmet use (see Appendix A of the Alpine Responsibility Code) and suggesting that everyone should ski and snowboard in a responsible and safe manner (Canadian Ski Council, 2009). In a survey of over 80 Canadian ski areas, it was found that 55% of riders wear helmets and that Quebec has the highest rate of use (65%) and western Canada has the lowest (50%) (Canadian Ski Council, 2009). A study from the Canadian Medical Association Journal found that helmet use among skiers and snowboarders reduced the likelihood of a head injury by 35%, as compared to users without helmets. Additionally, it has been found that the rate of head injury for adolescents was reduced by roughly 59% with helmet use.

Although helmets can be an important aspect of keeping skiers and snowboarders safe, their use is also controversial, as research has also indicated that helmet use may increase injuries (Meyers, et al., 2007). Specifically, the work of Dr. Shealy should be noted. Dr. Shealy, who has been referenced by the Lids on Kids program, has found that the severity of injuries may be higher with helmet use. Specifically, Dr. Shealy reports that with helmet use, 66% of injuries tend to be more serious than a mild concussion, whereas with non-helmet use he found only 23% of injuries were more serious than a mild concussion (Canadian Ski Council, 2009). Dr. Shealy attributes these statistics to the fact that helmet users may feel safer and therefore be more inclined to take risks and ride faster (Lids on Kids, 2011). Programs focusing on skiing and snowboarding safety should emphasize that riders are not invincible just because they are
wearing the gear. The Lids on Kids program has taken note of this by teaching adolescents that if they are wearing a helmet they should “ski or snowboard as if you’re not wearing one” because helmets do not equate to absolute safety (Lids on Kids, 2011).

*Heightened Period of Risk-Taking*

Another contributor to adolescents’ increased injury rates on the ski hill is their natural inclination toward risky behaviours. The ability to judge and understand risky situations is an important skill for people to develop and it commonly increases during adolescence and emerging adulthood (Byrnes, 1998; Garon & Moore, 2004; Halpern-Felsher & Cauffman, 2001; Mann, Harmoni, & Power, 1989; Steinberg & Scott, 2003). During adolescence and early childhood, roughly between the ages of 14 years to the mid-to-late 20s, there is a shift towards reward sensitivity that may create an increase in risk-taking (Cauffman, Steinberg & Woolard, 2002). It is during this time that youth become more aware of immediate rewards for their behaviour (Steinberg, 2004). There appears to be a temporal gap from roughly the age of puberty to the early 20s, which may “impel adolescents toward thrill seeking [due to] the slow maturation of the cognitive-control system, which regulates these impulses” (Steinberg, 2007, p. 55). This vulnerability toward engaging in risk is a persistent influence on behaviour (Slovic, 1966). As such, adolescents on the ski hill are more likely to engage in risky injurious behaviours simply because their development naturally inclines them to do so. When deciding whether or not to speed or attempt a risky move on the hill, adolescents’ judgement is clouded by their inability to accurately judge risks and their developmental focus towards rewards instead of potential consequences (e.g., injuring themselves or others). Programmers should take this developmental tendency toward risk-taking into consideration when developing activities on the ski hill for adolescents. Programmers need to remain cognizant that the adolescents who are being injured
and injuring others due to risky behaviours may be acting in risky ways due to their age and may not fully comprehend the possible consequences of their actions. As such, programming that reminds them regularly about safety and the responsibility code of the hill may help to keep the consequences that they might otherwise naturally forget, in the forefront of their minds while enjoying a day on the ski hill.

The sections below will outline two ski and snowboard related risky behaviours that may increase due to adolescents’ natural risk-taking tendencies, namely collisions and excessive speed.

**Collisions**

Collisions with objects and people due to behaviours on the hill are one of the leading causes of hospitalizations and fatalities among children and youth on the ski hill (Meyers, et al., 2007). In fact, researchers have found that up to 76% of ski hill related hospitalizations and fatalities are related to a high-speed collision of some sort (Skokan, Junkins & Kadish, 2003; Xiang & Stallones, 2003; Xiang, Stallones & Smith, 2004). This demonstrates that programmers should consider focusing on collisions and do so through efforts targeting the root causes of these injuries, namely excessive speed and risk-taking. Program efforts might focus on education and awareness around collisions, including the causes of collisions and awareness of the objects and people (e.g., young inexperienced skiers) that are most likely to be collided into by an adolescent skier out of control on the hill.

**Excessive Speed**

As previously outlined, excessive speed is a causal factor in many of the collisions that occur on the ski hill (Meyers, et al., 2007). Speed and distance are difficult for youth to judge even when behaving safely (Meyers, et al., 2007), so these become even more difficult for them
to manage when they start taking risks on the hill. Research has reported numerous recent instances where young skiers and snowboarders lost control due to travelling at speeds beyond their capabilities (Meyers, et al., 2007). Youth may need to be continually reminded to watch their speed to avoid injury, especially from colliding with objects and people.

**Gender and Injuries**

Researchers have found specific gender differences around ski hill injuries. It has been consistently observed that male skiers and snowboarders sustain more injuries than females. Additionally, it has been found that males have differing patterns of injuries; females sustain the majority of their injuries through falls to their knees and collisions with others, whereas males are more likely to injure their heads or shoulders (MacNab & Cadman, 1996). A recent analysis conducted by SMARTRISK (Ontario Injury Prevention Resource Centre, 2010) demonstrated that males may account for over 60% of emergency room visits from ski or snowboard injuries.

These differences may be due to the fact that adolescent males tend to engage in maladaptive physical health risk-taking behaviours more than females and thus sustain more injuries (Coppens & Gentry, 1991; Ginsburg & Miller, 1982; Rosen & Peterson, 1990). This finding has been attributed to gender differences in socialization patterns (Block, 1983; Morrongiello & Dawber, 1999), varying beliefs about injury vulnerability (Morrongiello & Dawber, 1999), and differences in risk appraisals (Hillier & Morrongiello, 1998).

Programmers should remain cognizant of the gender differences in the rates and types of injuries occurring among skiers and snowboarders. A single prevention campaign/intervention for all adolescents would be unlikely to produce reduced injury rates across genders. General programming efforts should be developed to be inclusive of both genders, but there should also be efforts tailored to males and females specifically, as gender presents unique injury patterns on
the ski hill.

**Ski Hill Terrain and Injuries**

Some researchers have focused their attention on how the terrain of ski hills may relate to injuries among youth. One study from the United States found that on ski hill runs inside the park, 24% of children and adolescents were injured as compared to 7% of adults (Henrie, Aoki, Biggs, & Willick, 2009). The Canadian Ski Council (2009) has reported that 75% of injuries among skiers and snowboarders occur on marked runs, with only 11% occurring within terrain parks, 10% within out of bounds or closed runs, and 4% getting off lifts. Research has indicated that these injuries on marked runs tend to be attributed to falls or collisions with other objects (Ontario Injury Prevention Resource Centre, 2010). However, recent research has indicated that terrain park injuries may account for more than 22% of injuries (Henrie et al., 2009) and that young adults and adolescents account for the near majority of these injuries (48%). Around terrain parks, it has been found that the majority of injuries here tend to occur on jumps (Henrie, et al., 2009). Additionally, it has been found that the percentage of spinal and head injuries more than double within terrain parks. Overall, campaigns must be tailored for the various activities that adolescents engage in while on the ski hill. In order to reduce injuries, adolescents must be educated and reminded about the safety procedures that should be practised in the various locations that they might be skiing or snowboarding in. For example, a campaign could be designed to address safety on marked runs, where the majority of injuries occur, but a separate campaign could target adolescents who enter terrain parks, as they may cause or experience more severe injuries if they are unaware of how to stay safe in these parks.
Comparisons with Other Sports

When compared to other winter sports, snowboarding and skiing account for the second and third (respectively) highest numbers of injuries, with ice hockey being the only sport with more (Canadian Ski Council, 2009). Additionally, skiing and snowboarding account for the highest percentages of both fractures and hospital admissions among all winter sport activities. When compared to all sports, skiing and snowboarding injuries combined account for the fourth highest number of injuries, surpassed only by ice hockey, soccer and basketball (Canadian Ski Council, 2009). Overall, these statistics demonstrate that skiing and snowboarding are two sports that present a substantial risk for our population when it comes to injuries.

Parental Influence

From the aforementioned research, it is clear that youth on ski hills may be inclined to take more risks and thus sustain and cause more injuries to those around them, particularly other youth and children who are just learning the sport and may not have the control of a more advanced skier or snowboarder. As such, it is important to be aware of influences on adolescents’ risk-taking behaviours. Specifically, parents are one of the most important influences on youths’ behaviour (Morrish, Kennedy & Groff, 2011) and therefore play a role in the decisions that youths make while on the hill.

One area in which parents influence their teens’ behaviours is through their own behaviours. Researchers have found that adolescents will mimic the safety behaviours that their parents demonstrate and that parental safety behaviours (or lack thereof) translate into the behaviours that children will demonstrate (Bianchi & Summala, 2004; Morrongiello, Corbett & Bellissimo, 2008; Morrongiello & Lasenby-Lessard, 2007). For example, if a parent teaches his child to ski safely and watch out for others, but then behaves recklessly on the hill himself, his
previous safety messaging may be negated in his child’s mind. This is true for children’s current behaviours as well as for how they feel adults are supposed to behave. Parents need to be vigilant about “practising what they preach” to their children and ensuring that they are modelling safe behaviours to their children around ski hill safety.

Researchers have looked at parental influence on their children’s ski hill behaviours and have found that one important area for parents to exert their influence in is ensuring that their children have been taught the appropriate skills for the ski hill activities they plan to engage in (Meyers, et al., 2007). Additionally, parents should make sure that youth have been educated on their responsibilities around the safety of everyone else on the hill (Meyers, et al., 2007). To ensure their children have an appropriate ability level in order to ski and snowboard safely, parents can talk with their children about ski hill safety before the activities, enrol their children in classes and spend time with their children on the hill before allowing them to ski or snowboard alone.

Moreover, some researchers have demonstrated that certain parental behaviours around ski hill activities may lead to increased risk-taking and injuries among youth. Specifically, Ackery and Detsky (2011) report that some parents may push their adolescents to be riskier in winter sports due to hopes that their children may be discovered and become pro athletes or simply because they are living vicariously though their children’s actions. In cases such as these, prevention of injury may not be as simple as education directed toward parents, as the parents may be overestimating their children’s abilities and see education and prevention tools as not pertaining to them. As such, multifaceted programming and awareness campaigns that involve parents, children, and ski hill workers, coupled with rules around behaviours on the hill and constant reminders of the alpine responsibility code, may bet the most effective strategy for
reducing adolescent risks that result in injury to themselves and others.

Another area parents can play a key role in ski hill safety is around how seriously ski hill injuries are taken by their children. Keays and Pless (2010) have found that when there is media coverage of high profile ski injuries (e.g., the death of Natasha Richardson) that parents may begin to take ski hill safety and injuries more seriously and become more anxious about their children getting hurt, as demonstrated by a significant spike in emergency room visits during said media blitzes. However, this vigilance and increased anxiety is sometimes overdone by parents and can overwhelm a hospital system. Additionally, it appears that this effect is not long lasting with parents and that soon after the media coverage ends, parents’ vigilance around injury and safety on the ski hill returns to baseline levels. This research demonstrates that programming needs to educate parents to maintain reasonable and consistent levels of vigilance around their children’s behaviours on the hill, as to not become overprotective, nor to become lackadaisical when it comes to safety.

Lessons Learned for Programming and Prevention Efforts

A great deal of programming efforts have focused on adolescent ski hill safety. The following sections will review various programs that have been implemented, aspects of programming that should be incorporated into any new multifaceted approach and present some overall learnings and suggestions for future programs.

Programming efforts in the United States

The National Ski Areas Association (NSAA) operates out of the United States and has developed several programs focused on ski hill safety. One program example from NSAA is the “Heads Up” campaign, which was developed in partnership with the NSAA, the National Ski Patrol, the Professional Ski Instructors of America, the Association for Snowboard Instructors,
and AIG insurance. This program focuses on generating a behaviour change on the hill through using social marketing techniques (e.g., signage generating awareness of the issue and encouraging safe practices, etc.) to remind skiers and snowboarders that they are responsible for those around them and that not everyone on the hill is as experienced or capable as they may feel they are. The goal of the program is to reduce injuries through behaviour change on the hill by implementing a unified approach across the industry committed to proactive and strong safety messaging (NSAA, 1999). The NSAA and partners designed this program so that it would reach all levels of the ski and snowboard populations (i.e., rookies, veterans and employees) and ideally be embraced industry wide (NSAA, 1999). The main focus of “Heads Up” is to convey simple and memorable messages on the ski hill regarding the responsibility code that everyone should obey. “Heads Up” speaks to all types of people on a ski hill – young and old, experienced and inexperienced – and includes programming materials and activities that can be adapted for the specific needs of various areas (NSAA, 1999). The program intends to remind skiers and snowboarders that they need to stay aware of others around them and ski and snowboard in a responsible manner. Some communications used in this campaign to convey these messages were “Heads Up. You’re Responsible”, “Heads Up. Know Your Limits” or “Heads Up. Set The Example”. “Heads Up” represents a comprehensive social marketing awareness campaign, which raises awareness around the responsibility of everyone on the ski hill. However, one aspect of awareness that has not been addressed is increasing the visibility of younger skiers, who have a higher chance of being collided with and injured by adolescents who tend to take more risks and thus cause more of these injuries.

Beyond “Heads Up”, the NSAA and partners have also created numerous other safety campaigns dedicated to reducing injuries on the ski hill through behaviour change. For example,
in 2004 the NSAA partnered with Burton Snowboards to create the “Smart Style Terrain Park Safety” initiative, which is focused on promoting a code of conduct for terrain parks where participants are encouraged to plan their runs safely, respect others using the park and only participate to what their personal ability level allows for (NSAA, 2012). The communication plan for this program included four main messages – “Make a Plan”, “Look Before You Leap”, “Easy Style It”, and “Respect Gets Respect” – and these were meant to encourage awareness and safety of riders in the terrain parks. In 2008, two more programs were created by the NSAA. The first was the “Get Smart Freestyle Terrain Resource Guide”, which included safety recommendations for terrain park participants and reminders regarding the responsibility code (NSAA, 2012). The second 2008 program was a component to the aforementioned “Heads Up” campaign and was entitled “Objects are Closer Than They Appear” and focused on the first portion of the responsibility code which reminds skiers and snowboarders to always stay in control and be able to stop or avoid others and objects (NSAA, 2012).

Overall, the programming that has been developed by the NSAA has been multi-faceted and directed at some of the real safety issues that ski hills experience. As such, they represent good quality examples for Canadian programmers looking to develop new campaigns while attempting to target youth, (the ski hill participants getting injured and injuring others the most). However, one aspect that is missing from this programming is direct efforts to raise the visibility of the skiers and snowboarders who are most vulnerable to being collided into by risky adolescents, namely children new to the ski hill. A Canadian program that has focused on raising this type of visibility for vulnerable populations on the hill will be outlined below.
Programming Developed in Canada

The PACE Penguin Children’s Ski Safety Program (2011) was developed by Kerina Williamson and the Canadian Ski Patrol System to educate ski hill participants about safety. The premise of this program is that the parents of small children receive kits with a child version of the alpine responsibility code, a checklist, lost ID card, and a PACE bib which is brightly coloured and has the phrase “Give PACE Extra Space” on it. These bibs are worn by the children on the hill and make them more visible to the people around them who may be skiing or boarding faster and in a riskier manner than the child. It is thought that these bibs will help to draw attention to the children on the hill and thus make them less likely to be run into and injured by others. The PACE program raises the visibility of young, vulnerable ski hill participants and also educates them and their parents around safe skiing. This program could be incorporated into any initiative attempting to target adolescents on the hill, as it not only raises awareness around the fact that speed and collisions are a problem on ski hills, but also helps to make small children more visible to others.

Other Important Programming Components to Consider

There are several other important aspects of ski hill programming that can be included in any multi-faceted and comprehensive approach that is being developed. One area to consider is ensuring that the marketing materials are inclusive to all ski hill participants. Specifically, teens with disabilities are increasingly participating in snow sports (Ferrara & Peterson, 2000) and thus would also benefit from injury prevention ski hill programming. These teens take similar risks to non-disabled teens (e.g., natural tendency to take risks, increased speed and collisions) and therefore may also need reminders about safety. There have been programs focused on targeting disabled riders, such as “Disability Snowsport, UK” (2012), which focuses on promoting equality
and opportunity for disabled people who wish to take part in snow sports. However, there is a lack of programming focused on both non-disabled and disabled teen riders equally, which presents something for new programming initiatives to focus on. Additionally, research has shown that participation in snow sports provides numerous benefits to people with disabilities, such as physical strengthening and increased self-esteem (Nasuti & Temple, 2010). As such, inclusion of disabled teens in both marketing materials and activities would not only increase the reach of the programming, but it may also serve to encourage teens with disabilities to participate in snow sports and obtain the associated benefits.

**Conclusions and Recommendations**

Several key learnings for campaign development can be observed from the aforementioned research and programming findings. First, it is obvious that adolescent skiers and snowboarders do contribute a great deal to the injuries that are seen on ski hills. Specifically, these teen skiers and snowboarders may be inclined to take excessive risks for a variety of reasons (e.g., increased risk-taking behaviours, tendency to speed, lack of control/experience) and therefore may ride faster and less in control than other participants. As such, these adolescents pose a significant threat to others on the hill through the potential of colliding with them and causing injury. It appears that the most vulnerable age group on the hill would be the younger and less experienced children who may be collided with.

Several programs have been developed around these key learnings, such as the “Heads Up” program, which aims to use social marketing techniques to remind skiers and snowboarders of their responsibility to ride safely and in control. However, this program has not incorporated any materials to increase the visibility of the younger and more vulnerable skiers and snowboarders, as to help adolescents become more aware of when and where increased vigilance
around safety is necessary. The PACE Penguin Children’s Ski Safety Program has implemented a campaign in which children are made move visible to others through wearing colourful bibs; however, this initiative would also benefit with additional awareness materials targeted at the adolescents on the ski hill who are more prone to colliding with and injuring the younger riders.

From this research it would appear that the most comprehensive recommendation for ski hill safety programming would be to build upon current initiatives and attempt to incorporate the work being done into one multi-faceted campaign targeting all ski hill participants. Such programming should focus on reducing injuries from collisions among children and adolescents due to risky behaviours on the hills, such as excessive speed and riding out of control. This programming should include education and awareness components directed at the adolescents who are taking the most risks and therefore presumably causing a great deal of the collision related injuries. In these components, the visibility of children on the hill should be increased through the messaging and bibs used by the PACE Penguin Children’s Ski Safety Program.

In addition to the material and awareness components, it appears to be very important to work closely with the ski hills where the programming will be implemented, as ski patrollers and ski hill staff are key in circulating materials and generating interest in the program messages. Almost every successful ski hill program has worked closely with ski hill operators and patrollers and this appears to be a key component for success. Also, social marketing approaches to messaging may be the most appropriate delivery style as the goal of these program efforts should be toward raising awareness of the issue and inciting behaviour change on the ski hills around responsibility and alertness. It appears that simple repetitive messages that are easy to remember and understand may be the best tool. One very important aspect to incorporate into campaign materials is that they are transferable across various groups. For example, materials and
messages should be marketable to all ages, from small children to parents, as each group needs to become more aware of their responsibility on the hill and what the materials are calling for them to do (e.g., that a bib denotes a small child that you need to take extra precautions around). Additionally, messages should be targeted at all levels of experience. For example, if skiers or snowboarders who consider themselves to be intermediate level riders see a program message that is clearly directed toward less experienced people, they may disregard the message and continue riding without taking it into consideration. As such, materials should remind participants that it is everyone’s job to keep the hills safe and that they each have a responsibility for their behaviours and how these may affect the people around them. One final aspect to consider when developing materials is that they are inclusive to all ski hill participants, particularly disabled skiers and snowboarders as they are also taking the same risks on the hill and need to be targeted in prevention and awareness raising efforts as well.

Programming efforts that attempt to incorporate the aforementioned key directions would be able to target a widespread audience on the ski hill and be inclusive of the various groups that exist. As such, they may be able to create further successes around reducing injuries on the ski hill due to collisions by adolescents with younger skiers and snowboarders. As outlined in this literature review, adolescents appear to be taking the greatest risks on the hill and therefore creating the most danger for those around them. Efforts must be made to draw their attention and the attention of those who can influence them toward the responsibility they have to stay in control and avoid injuring others. In addition to highlighting this responsibility, efforts must also be made to remind youth where the most vulnerable skiers and snowboarders are through increasing their visibility on the hill (e.g., colourful bibs). Such a multi-pronged approach may be successful in creating long lasting behaviour changes in young skiers and snowboarders.
Overall, there is no shortage of areas for exploration in the creation of campaigns around ski hill safety. The research, statistics and previous programs outlined throughout this report speak for themselves regarding the necessity and possibilities for future campaigns to be developed. It is clear that well thought-out programming could have an important and positive impact on adolescent safety behaviours in these common winter activities.
References


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