

**Heads Up:  
Improving Youth Athlete Concussion Knowledge  
and Protocol in British Columbia**

by

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## **Abstract**

Concussions in youth sports have gained increasing attention over the past decade, as connections between head impacts and long-term damage have become more apparent, and as high profile cases of concussions have garnered more consideration in the public discourse. Despite this growing awareness, there is little in the way of basic legislation or policy to protect at-risk youth athletes in British Columbia. The highest incidence of concussion in the general population is among eleven to fourteen year olds in the province. This study investigates policies that other jurisdictions have implemented in efforts to increase awareness among athletes, parents and coaches, and reduce the number of youth concussions.

The project evaluates the effectiveness of such measures using multiple criteria. I recommend introducing legislation for return-to-play policy and the integration of education into province-wide school curriculum as the best options to accomplish these goals and improve health outcomes for youth athletes.

**Keywords:** concussion; return-to-play, health, British Columbia, sports, Canada

## **Dedication**

To the numerous individuals in the medical, not-for-profit, and political realms who seek to balance newfound and burgeoning knowledge of traumatic brain injury risks with the life-changing, community affirming, and character-building benefits that organized sport offers us.

## **Acknowledgements**

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## List of Acronyms

BC	British Columbia
CDC	Center for Disease Control
CTE	Chronic Traumatic Encephalopathy
PPM	Policy/Program Memorandum
PSO	Provincial Sporting Organization
RTP	Return-to-Play
SIS	Second Impact Syndrome
SLICE	Sports Legacy Institute Concussion Educators
USSA	United States Soccer Association

## Glossary

Chronic Traumatic Encephalopathy	A progressive degenerative disease of the brain, discovered by Dr. Bennett Omalu, often found in athletes and other individuals with a history of repetitive brain trauma.
Concussion	A traumatic brain injury that alters the way your brain functions. Effects are usually temporary but can include headaches and problems with concentration, memory, balance and coordination.
Provincial Sporting Organization	PSOs are autonomous, not-for-profit societies responsible for regulating all areas and levels of their sport's participation within the province. An example is Football BC.
Second Impact Syndrome	Condition that can occur when the brain swells rapidly after a person suffers a second concussion before symptoms from an earlier one have subsided. Catastrophic and fatal injury can be the result.

## **Executive Summary**

Concussions in youth sports have gained increasing attention over the past decade, as connections between head impacts and long-term damage have become more apparent, and as high profile cases of concussions have garnered more consideration in the public discourse.

A concussion results from a direct blow usually to the head, but often from another part of the body as well. This blow creates head trauma that can lead to short or long-term neurological effects. Symptoms can include, but are not limited to dizziness, nausea, vomiting, difficulty focusing, sleeplessness and headaches. Most concussions symptoms clear up within one to two weeks, but recovery can be longer in children and adolescents (McCrory et al, 2012). The largest potential concern with head injuries is Second Impact Syndrome. This can result when an athlete receives a concussion before a previous concussion has resolved. The effects of this can be deadly.

Despite the growing awareness of the risks of concussion, and the rapid growth of concussion related legislation in the United States – all fifty states have adopted legislation since 2009 – Canada has yet to put forth a comprehensive legislative or educational strategy to increase awareness among youth athletes, coaches or parents.

### **Policy Problem and Methodology**

The policy problem researched in this study is that too many children in British Columbia are at risk of both concussion and repeated head impacts and there is a lack of coherent regulation in place to monitor head injuries during youth sports participation.

This study employed several methodologies. A literature review assessed the incidence and the risks that concussion and repeated concussions pose to youth athletes and found that age differences are of utmost importance when looking at this issue. I performed a cross-jurisdictional scan of the policy environment and examined medical journals and sports-science publications to assess the regulations put in place across Canada and the United States. I designed survey questions that the Angus Reid Institute distributed.

Responses helped to inform policy proposals. I interviewed two stakeholders close to this policy field to gain an understanding of their experiences.

### **Policy Options and Recommendations**

Three policy options emerged from the literature review, cross-jurisdictional analysis, survey data, and expert interviews:

- Education campaigns due to their positive effect on the reporting of concussions from youth athletes;
- Return-to-play legislation because it helps to build a safer environment for youth athletes;
- A ban on contact sports until the age of 14 because younger athletes are at a higher risk of injury and long-term negative effects than older athletes.

I used four criteria to assess the ability of each option to reduce the number of youth concussions in British Columbia:

- Effectiveness
- Cost
- Anticipated stakeholder acceptance
- Implementation complexity

### **Recommendations**

The analysis identifies two effective options that I recommend be implemented: school district education and return-to-play legislation. School district education is a low-cost option that comes with high likelihood of acceptance and a broad reach at the youth athlete level. Return-to-play legislation provides the legal backing to help protect children from the risks of repeated head injuries and reinforces educational awareness.

## Introduction

Concussion in youth sports is a problem with increasing awareness over the past ten years among the public. Canadians have become accustomed to seeing their favourite hockey stars deal with career-altering head injuries, but these impacts were never taken as seriously as they have been in recent years. Perhaps this increase in public perception is best signified by the movie “Concussion”, starring Will Smith as Dr. Bennet Omalu, who first discovered the link between repeated sub-concussive impacts and the degenerative brain disease, Chronic Traumatic Encephalopathy (CTE). In feature stories that ran for the week of November 23 - 27 (2015), the *Vancouver Sun* covered the risk of serious long-term disability and death from concussions youth received playing organized sports. Despite the growing awareness of youth concussions and the increase in perceived long-term risk of repeated impacts to the head, there is little in the way of basic legislation or policy to protect at-risk student athletes in British Columbia.

A concussion is defined as a traumatic head injury that alters the functioning of the brain (Mayo Clinic, 2016). This injury results from a direct blow usually to the head, but can arise from a blow to another part of the body as well. The impact produces biomechanical forces that are transmitted to the brain and result in trauma that generally has short-term impact, but also can have long term effects. Eighty per cent of concussion symptoms usually clear up within the first seven to ten days, but recovery can be longer in children and adolescents (McCrory et al, 2012). If not properly managed, a rare condition call Second Impact Syndrome (SIS), where a second concussion is experienced before the first has healed, can lead to rapid swelling of the brain and catastrophic injury or death. It is important to note that neither impact has to be severe in nature for SIS to ensue. The secondary impact causing SIS can occur anywhere from minutes after the first impact, if an athlete continues to play in the game or practice, to several weeks after if the athlete’s activity is not monitored.

Symptoms of concussion fall into four categories: physical, cognitive, emotional, and sleep-related. Within each of these categories there are a number of signs and symptoms that can indicate a concussion.

**Table 1. Potential Signs and Symptoms of a Concussion**

Potential signs and symptoms of a concussion Source: McCrory et al. 2012			
Physical	Cognitive	Emotional	Sleep-related
Headache, nausea, vomiting	Difficulty concentrating or remembering information	Irritability	Drowsiness
Sensitivity to noise or light	Feeling foggy or slow	Sadness, increased level of emotions	Change in sleep pattern, sleeping more or less than usual
Balance problems, visual problems	Confusion	Nervousness	Difficulty falling asleep

In British Columbia, the vast majority of concussions experienced by children age 10 to 19 occur from sports participation (Rajabali et al. 2013). In fact, 57.2 per cent of concussions in 10 to 14 year olds arise from playing sports. For the group age 15 to 19 this number is 57.8 per cent. Sports concussions for children age 5 to 19 in BC are split between injuries that occur at school (40.4%) and injuries that occur in sports and recreation outside of these institutions (59.6%). For this reason, this report looks closely at options at both the school district level and the provincial government level to address the problem.

Injuries of all kinds are considered an accepted element of sports participation, regardless of the age of an athlete. There is simply no way to remove the pace and chaotic nature of many sports and as such, some level of risk is inherent. However, this does not imply policy makers should avoid regulations to minimize these dangerous aspects. Public discourse increasingly recognizes the risks of concussion and accumulated head

injuries in sport and concussion related legislation now exists in all 50 states in the US. Despite this, Canada lags behind and its children are at a heightened risk of injury as a result.

The policy problem identified in this report is that too many children in British Columbia are at risk of both concussion and repeated head impacts, due to the lack of a coherent regulation in place to reduce the likelihood of multiple head injuries during youth sports participation.

This study examines the issue of concussions in youth athletes in British Columbia for two reasons. First, no coherent policy exists as either a school district mandate, or an overarching piece of legislation. BC has a piecemeal policy environment where individual sporting associations have introduced their own policies, with little to no compliance mechanism in place to assure that measures are followed. Children in this province are at risk, and the policy regime lags behind the standard being set elsewhere. Second, the BC provincial government has a chance to lead (Stilwell Interview, 2015). In putting forward an effective policy framework that leads to a verifiable reduction in harm, the province can provide a pathway to participation Canada-wide, and improve the health outcomes for its children.

The following research is organized into eight distinct parts. Following the introduction, Section 1 provides a literature review of relevant information regarding concussions in youth sports. Section 2 describes the methodology used for the report. Section 3 is a report on cross-jurisdictional findings related to policy and practice in this area. Sections 4 outlines the criteria and measures derived to evaluate potential policy options in BC, while section 5 describes these options. Section 6 lays out the final policy recommendation and Section 7 provides a conclusion for the report.



# Chapter 1. Literature Review

## 1.1. Youth at Risk

Research on concussions in youth sports has intensified in recent years and suggests that children are more at risk than adults for both short and long-term impacts (Rajabali et al., 2013). Dr. Robert Cantu, a leading voice in the medical community on concussion issues, describes some of the reasons for increased risk of damage as:

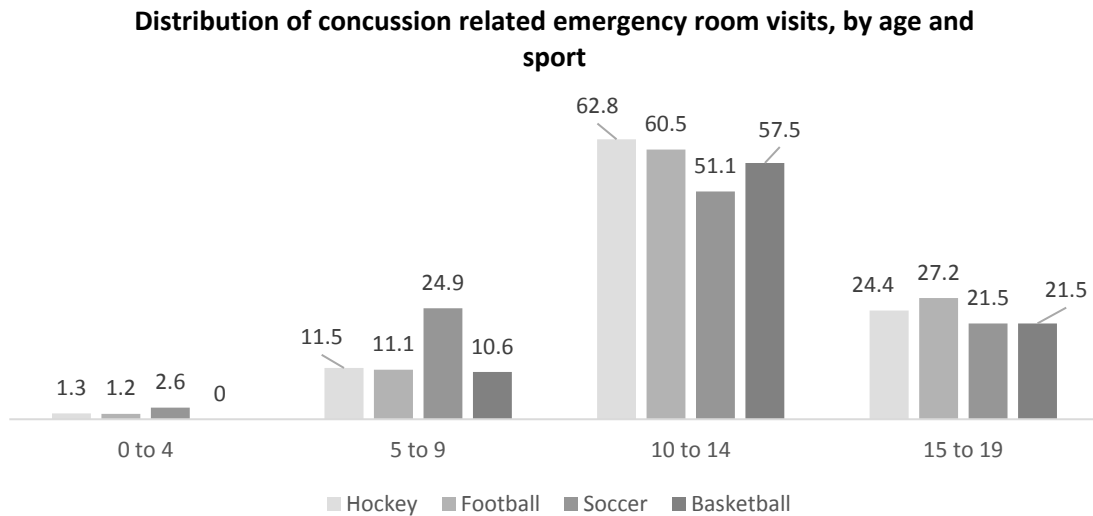
- A lack of myelination of nerve fibers. Myelin is the coating that helps transmission and provides structural strength in the brain. These fibers are more at risk of tearing in youth brains from an impact.
- Children's brains are housed in disproportionately large skulls. Their skulls are nearly adult sized but their necks are smaller and weaker and can lead to a "bobble head effect"
- Children often have inexperienced or ill-equipped coaches in charge of them while playing sports. This can lead to further risk if a child's injury is not treated or managed properly (Cantu, 2015).

The 2013 BC Adolescent Health Survey, conducted by the McCreary Centre, asked 30,000 children across the province about their experiences with concussion. 19 per cent of boys and 14 per cent of girls, for a total of 16 per cent overall, reported having experienced a concussion that year. Among these, 18 per cent said they did not access medical care when they thought they needed it (McCreary Centre, 2013). When asked why they did not seek medical help, 19 per cent of these children said it was because their parents would not take them, and 15 per cent said they had previous negative experience with doctors that dissuaded them from asking for help. This information suggests that there is a role for public policy to help educate youth athletes and their parents in the short and long-term risks of concussions and ensure the athlete receives appropriate medical attention and monitoring.

The rates of sports-related concussion appear to be higher for children than they are for adults (Parachute Canada, 2013). Studies find that the rate of concussion in high school athletes is significantly higher than those who play at the adult level (Karlin, 2011). When looking at specifically British Columbia, as shown in Figure 1, the rate of sports-related concussion is highest among the 10 to 14-year-old age group, a group often

ignored in school concussion policy. The percentages may be an underestimate of the total number of concussions because they represent only the youth who seek medical care at an emergency room.

**Figure 1. Concussion-related ER visits in British Columbia**



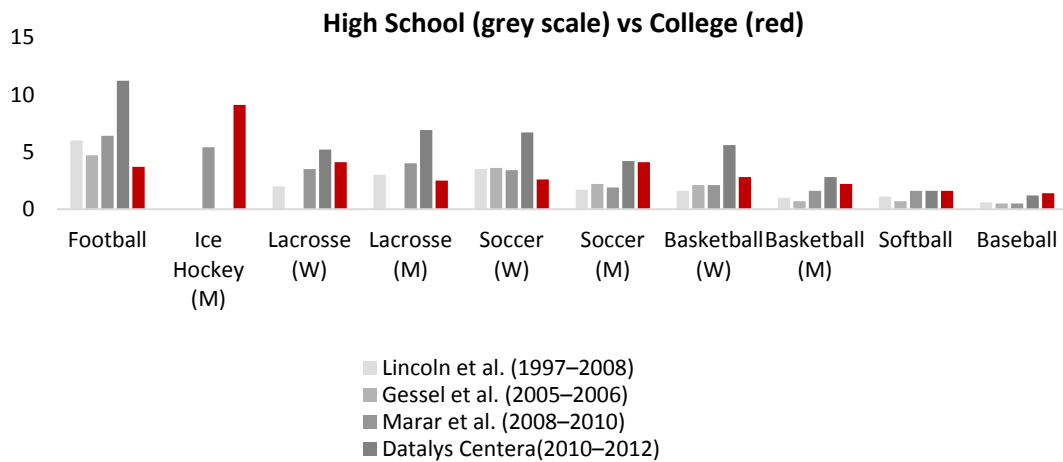
Source: data obtained from Rajabali et al. (2013)

Little attention has been paid to the age at which children are permitted to engage in contact sports. Given that children are at a higher risk of brain injury and require longer to recover from an injury after it has happened, an inquiry into age requirements would shed light on the injury risk for BC children.

When assessing recovery times for young athletes, difference in duration between injury and return to play is key to understanding this issue. Concussion protocols in professional sports operate with the understanding that recovery to baseline levels can take three - five days. However, among collegiate athletes this average jumps to five - seven days, and among high school athletes recovery takes roughly ten - fourteen days. Research is lacking in recovery times for age populations below high school, but there is enough evidence to assume that duration would at least meet or, more likely, exceed that of the high school cohort.

Additionally, while boys make up the larger aggregate number of concussions in sports, the rates of concussion for female athletes competing in the same sports as their male counterparts are actually significantly higher. Figure 2 shows concussion by athlete exposure. An athlete exposure is defined as a unit of susceptibility to injury, which is defined as one athlete participating in one game or practice, in which he/she is exposed to the possibility of athletic injury (Segen’s Medical Dictionary, 2011). The data suggest that high school athletes are at least as likely, and in many cases more likely, to sustain a concussion playing these major sports than college athletes (Graham et al. 2014). The gray scale indicates concussion incidence in high school athletes as found in different studies. The red highlighted bar represents the Hootman et al. (2007) study including sixteen years of data on concussion incidence in college athletes. The most recent data from Datalys Centera show a concussion rate higher in high school athletes than college athletes in every sport other than baseball. It is important to view this data along with the BC specific information above to see that the group most at risk of concussion is 10 – 14 year olds. The absence of policy leaves this group at a heightened risk of injury.

**Figure 2. Concussion rate per 10,000 athlete exposures**



## 1.2. A lack of concussion reporting

A common theme in the literature surrounding concussions is underreporting. Dr. Scott Delaney looked at 469 athletes at McGill University over a 12-month period to

understand the prevalence of concussion reporting. Of the 469 athletes, 20 per cent said they either had or believed that they had suffered a concussion. Among these respondents, 80 per cent said they did not report their concussion (Delaney). A similar study of 1,532 Wisconsin high school football players found that less than half (47%) who believed they had a concussion had reported it (McCrea). In this case, the primary reasons for not reporting were thinking that it was not serious enough, not wanting to be pulled from competition, or a lack of awareness of a possible concussion (McCrea, 2004). The literature consistently notes these same reasons (Weinberger and Brisken 2013, McCrea et al. 2004, Delaney et al. 2014). Regardless of jurisdiction or sport, there are either competitive motivations or barriers in understanding the risk that lead to under-reporting by athletes. These findings suggest that without a regulatory regime in place, the risk to athletes will continue to exist. An Angus Reid Institute survey of 1,522 Canadians found that among those who played sports in their youth, 30 per cent had experienced or thought they had experienced a concussion. Among this group, fully half did not report this to an adult or a medical professional.

Much of this lack of reporting can be attributed to a lack of awareness and education on behalf of both athletes and coaches in youth sports. With this in mind, there appears to be a significant gap in policy in BC. Confounding the problem further, there are issues in creating a unified definition and thus quantification of total concussions in British Columbia. The 2013 BC Injury and Prevention report that attempted to do this noted that there are “under reported and inconsistently coded” data (Rajabali et al. 2013, p. 4) with regard to terminology and severity surrounding head injuries, concussion and brain trauma, across medical institutions.

### **1.3. Conclusion**

With a high level of concussions going unreported, there are increased risks of re-injury and further long-term effects to children who continue to participate in sports. Children playing sports are at a high risk of concussion compared to the adult population, and specifically the 10 to 14-year-old age group likely faces a higher risk than any age cohort. These age-specific risk factors mean that policy needs to address youth sports in order to prevent undue risk of head injury for youth athletes. An increase in reporting is a

necessary step so that head injuries do not slip through the cracks. The risks of secondary head trauma and Second Impact Syndrome are such that failing to recognize an injury can lead to devastating and sometimes fatal results. Evaluation of policy options in other jurisdictions helps assess the appropriate path forward for British Columbia.

## **Chapter 2. Methodology**

This study uses a combination of primary and secondary sources to assess youth concussions from sport in British Columbia and evaluate potential policy options to address the lack of information and regulation protecting young athletes.

### **2.1. Secondary data sources**

A preliminary scan of jurisdictions and sporting associations covered Canada and the United States. I chose these regions because of the comparative similarities in the sports played in school and minor leagues by the majority of young athletes, and the varying levels of perceived progress in preventing concussions and regulating the sporting activities that produce them. The literature scan identified several jurisdictions of interest, including the province of Ontario in Canada, Washington State, California and Texas. I then undertook deeper research for these jurisdictions, using media reports, journals, proposed and approved legislation, and concussion prevention and awareness advocacy websites. Analysis of each of these cases forms the basis for the argument that BC has too little in the way of concrete policy toward youth concussion from sports. Secondary data, drawn from a wide array of medical journals, as well as international conferences on the issue, are utilized to establish the incidence of concussion, success in implementing policy, and necessity of policy in British Columbia.

### **2.2. Primary data sources**

I designed a survey that the Angus Reid Institute distributed. The survey provides publicly available data, with no barriers to access, regarding opinions of 1,522 respondents on concussions and concussion policy for children in sport. Additionally, it provides information to help identify the prevalence and underreporting that appear consistently in medical journals. The survey provides four policy options as follows:

- Requiring a trained medical professional to be present at all games and practices

- Requiring education on concussions and concussion prevention as a mandatory requirement of participation for all coaches
- Banning children under the age of 14 from participating in contact sports
- Implementing return-to-play policies where steps are followed by an athlete suspected of suffering a concussion before they are able to return to normal activity

I undertook two interviews to provide context for the policy environment and the need for oversight. The first is a member of the legislative assembly of British Columbia, Moira Stilwell, who introduced return-to-play legislation in 2011. Dr. Stilwell has done much of the foundational work in speaking to stakeholders about this issue in preparation for the creation of her bill. Second, I spoke with a representative of BC high school football in an effort to gauge the state of concussion protocol within school districts.

## **Chapter 3. Cross-Jurisdictional Findings**

### **3.1. Washington State**

The trailblazing jurisdiction in policy making for youth concussion is Washington State. The impetus for action is unfortunately tragic. In October 2006 during the second quarter of a middle school football game, Zachary Lystedt took a hit to the head while making a tackle. He was visibly shaken, holding his head and writhing on the ground, which can be seen from video taken of the game. He did not go through any concussion protocol and returned to the game, playing both offense and defense for the third and fourth quarters. After the game, he collapsed while speaking to his father, and lapsed into a coma for over a month, an apparent victim of Second Impact Syndrome. To this day, he is still physically impaired from the injury, though his recovery has been profound, and he continues to advocate for concussion safety while attending college. With advocacy from the Lystedt parents and the efforts of Washington State House Republican Jay Rodne, the Zachary Lystedt Law, Bill 1824, the first comprehensive concussion protocol policy in the country, was signed into law in May 2009. The law applies only to high school sports, and does not cover younger age groups who are also engaged in contact sports. The key tenets of the law are as follows:

- Any athlete suspected of suffering a head injury or concussion must be immediately removed from play
- School districts are mandated to work with the Washington Interscholastic Activities Association to develop an education policy to educate both athletes and coaches on the risks of head injury, and steps toward prevention and safety
- Athletes and their parents are required to sign an information sheet about concussion and head injury before they are able to participate in their first practice of the season
- An athlete who has been removed from play must be cleared to return by a certified medical professional, who has been trained in concussion management
- Private sports leagues that want to use publicly owned fields are required to comply with the law



Though limited to high school sports, the law has had an impact. A 2014 study found that after the Lystedt Law went into effect the number of concussions reported in high school sports more than doubled, including a 3.5 times increase among female athletes. (Bompadre et al., 2014) An additional qualitative study surveyed 270 high school coaches of football and soccer in Washington State three years after the implementation of the law. They found that “nearly all coaches answered concussion knowledge questions correctly” and that nearly all coaches had received training in a minimum of two modalities (video, in person, written etc.) (Chrisman et al. 2013). Impact of the law on athletes and parents surveyed was less promising. Only 34.7 per cent had been exposed to a minimum of two modalities of concussion information among athletes, and just 16.7 per cent among parents. The report suggests that while the legislation has helped to increase awareness for coaches through mandatory training, more was necessary to make young athletes and parents aware of these same principles. Despite this, the law does set a precedent for concussion protocol that can be emulated in other jurisdictions.

### **3.2. Ontario**

Until very recently, Canada had no concussion legislation in any province or territory. This is rapidly changing thanks to the progress made in Ontario, which passed a law in June of 2016.

The first step in developing a policy was a Policy/Program Memorandum (PPM 158) released in March of 2014 by the Ministry of Education. The Memorandum called for all publicly funded elementary and secondary schools in the province to develop a policy on awareness, prevention, identification and management of concussions in scholastic sports (PPM 158, 2014). Ontario was the first province to develop a full protocol for its schools, and went a step further in November 2015.

As was the case with Zachary Lystedt in Washington, it took a tragic event to lead to legislation in Ontario. Rowan Stringer, a 17-year-old female rugby player, died in May 2013 after suffering her third concussion in less than one week. Stringer was found to have suffered Second Impact Syndrome. After her death, a coroner’s inquest jury came up with 49 recommendations on what could be done going forward to protect athletes.

Their first recommendation, put forth with multi-party support in the Ontario legislature in November 2015, is the creation of a law governing youth sports in the province, both inside and outside schools, to be called Rowan's Law (CBC, 2015). Similar to Washington State, this would entail education and training programs, as well as Return-to-Play policy to be implemented in the case of a suspected concussion. The coroner's inquest also recommended that the Ontario Ministry of Education provide funding to its school districts to implement the 2014 recommendations of the PPM.

### **3.3. United States Soccer Association**

In August of 2014, a class-action lawsuit was filed against FIFA, the United States Soccer Association (USSA), and the American Youth Soccer Organization, by a group of parents and players. The claim was negligence in treating and monitoring head injuries, and called for rule changes to increase safety (Strauss, 2015). There were approximately 50,000 reported concussions high school soccer in 2010, more than baseball, basketball, softball and wrestling combined (de Menezes, 2015). In response to the lawsuit and mounting criticism, USSA released a number of rule changes in November of 2015. The rules included a ban on heading the ball for children 10 and under, and a limit on the number of headers, allowed in practice only, for children ages 11 to 13. Rules were also modified to allow for temporary player substitutions if a head injury is suspected, a change from the standard rule for nearly all soccer associations that allowed only three substitutions per game.

### **3.4. California**

In July of 2014, the California State Legislature passed Bill 2127. This is "An act to amend Section 49475 of, and to add Section 35179.5 to, the Education Code, relating to interscholastic sports" (Bill 2127, 2014). The bill introduced changes to middle school and high school football to limit potential head trauma. The amendment stated that football teams for ages 12 to 18 years old would no longer be allowed to conduct more than two full-contact practices per week, and that those practices would be limited to a 90-minute maximum. Further, off-season full contact practices have been banned. These simple

changes were made to reduce the number of head impacts among young athletes, and focus on skill-based training and form, rather than impact related drilling.

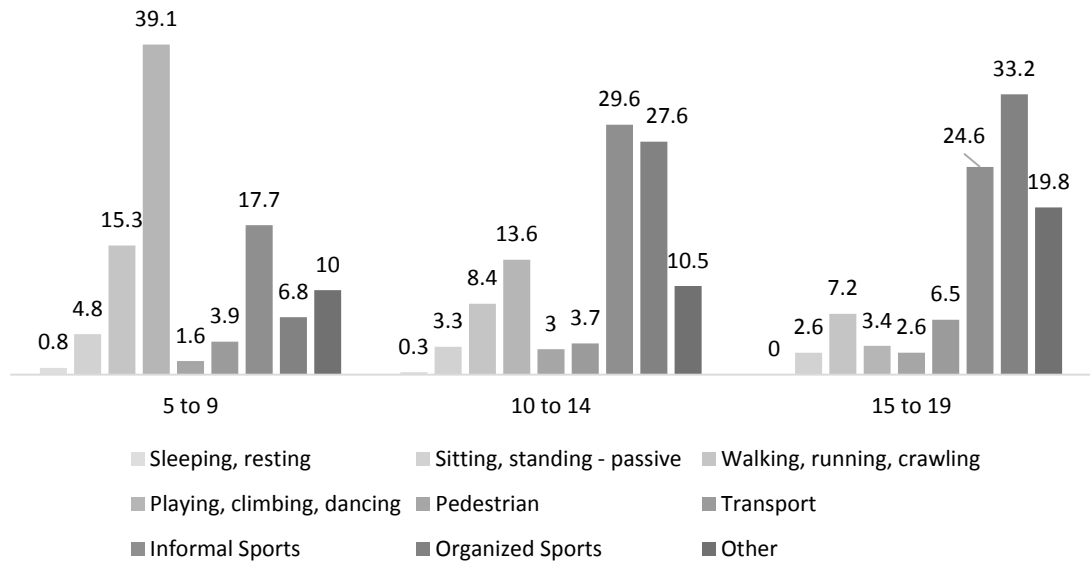
### **3.5. Texas**

Perhaps the most comprehensive policy to handle youth concussions in sport is in Texas. The state has taken the principles of the Lystedt Law, Return-to-Play, removal from play, and education, and expanded upon them. House Bill number 203 entails the creation of a concussion oversight team for each school district in the state. This team is comprised of a physician and one of the following: an athletic trainer, an advanced practice nurse, a neuropsychologist, or a physician assistant. The extra member must be trained in the evaluation and treatment of concussions before they are eligible to be chosen for the position. Texas was the first state to require such a team to be present for football games.

### **3.6. British Columbia**

The vast majority of youth concussions, especially among those between the ages of 10 – 19 occur during sports participation. For those in the 15 to 19-year-old cohort, one-third of all concussions occur in organized sports, while the 10 to 14 group are split almost evenly between informal sports (29.6%) and organized sports (27.6%). Figure 3 shows this breakdown.

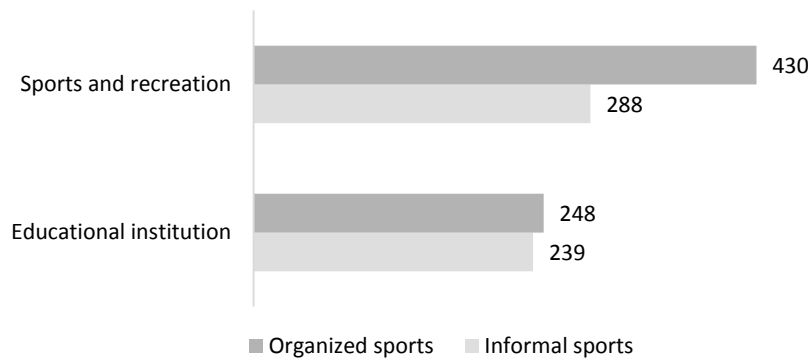
**Figure 3. Distributions of Concussions, Ages 5-9, 10-14, and 15-19, by Activities**



Source: BC Injury and Prevention Unit Report 2013

Data suggest that a comprehensive youth concussion policy in BC should include a focus on school districts, in addition to amateur sport associations. Injuries are almost as likely to occur to children at school when playing sports, both informal and organized, as they are outside of these institutions. Figure 4 shows that a substantial number, 40.4 per cent, of sports-related concussive injuries happen at educational institutions.

**Figure 4. Number of concussion or minor head injury-related emergency department visits, ages 0-19 years, by activity and location 2001-2009**



Source: BC Injury and Prevention Unit Report 2013

Amateur organizations in BC that are key stakeholders include professional sporting organizations (PSOs), particularly the BC Minor Football Association and the BC Soccer Association. PSOs are autonomous, not-for-profit organizations responsible for regulating their sport's participation within the province. Often PSOs oversee a large number of regional leagues, who in turn organize at the local level.

The findings from a scan of concussion policy in BC indicate a fractured environment, with policies in place in some areas but lacking in others. Enforcement and monitoring mechanisms are also lacking in reach and uniformity. This finding was echoed in a survey of 44 national sporting organizations (NSO) and PSOs, done by the Canadian Concussion Collaborative in 2014. This group found that just 14 of the 44 organizations they investigated had a protocol in place, and only "a few" had made it mandatory (CCC, 2014, p. 2). Though these are not BC specific numbers, they help to indicate the culture around this issue in Canada, as the NSO/PSO dynamic is similar across the country. Recall that all 50 states in the US have legislation to monitor and prevent head injuries for youth athletes. In Canada, there are no laws in place. Fortunately, in BC several

organizations have undertaken comprehensive concussion protocols. However, weak enforcement regimes and little oversight of long-term and age related risks are evident.

### **3.6.1. BC School Districts**

Policies at the school district level in BC are piecemeal. As noted previously, no formal province-wide school concussion policies exist in Canada outside of the progress made in Ontario with PPM 158. The only policy statement I could find in BC was Greater Victoria School District's policy 5141.22, 'Concussion Awareness'. This document simply notes that concussions are an issue and states that the district "will develop and implement concussion management strategies" which "may include, but are not limited to: communication strategies, prevention strategies, awareness initiatives, identification of concussion process, diagnosed concussion management resources and strategies" (Victoria Policy 5141.22, 2015).

### **3.6.2. BC Amateur Football Association**

The BC Amateur Football Association oversees high school football in the province, as well as the university and community level. This organization adopted a protocol effective June 2010 to address the concussion issue for its young athletes. It includes the following initiatives. First, all coaches who wish to participate in the association must first pass an online course called "Making Headway in Football". Through this program, coaches receive education about concussion risks, signs and symptoms. The coach must assess an athlete's injury and initiate removal and assessment of that player.

Second, informed consent forms are mandatory for both athlete and parent upon registration. The concern with this portion of the program lies with the minimum age requirement in BC Football. An 8-year-old is eligible to play tackle football in BC. This includes full impact practices and games. The child is asked to sign over their assent recognizing the injury risk associated with their participation in order to register. Children almost certainly are unable to understand the long-term risks associated with repeated sub-concussive impacts, so this is inherently problematic. From an organizational

perspective, this step makes sense to avoid litigation in any potential injury. However it is unlikely that the athlete and parents fully comprehend the associated risk. Even with education in place to inform about the risks of concussion in a general sense, the effect of repeated impacts, as described in the medical research surrounding the pre-adolescent brain, is challenging to communicate, as the research is new, complex and developing. It is for this reason that the Concussion Legacy Foundation, led by Dr. Robert Cantu and Chris Nowinski, has called for a policy of either banning contact sports for children under the age of 14 completely (Fink, 2011), or the institution of a “hit count” for young football players that removes players from the game after a designated number of tackles (Concussion Legacy Foundation, 2014).

There are two final portions of the BC Minor Football Associations policy. Any athlete suspected of suffering a head injury must be removed from play. Once removed from play, the athlete must get clearance from a licensed medical professional before being allowed to return to practice or game activity. All minor football associations in the province are obligated to participate in this protocol.

The issue with football in BC is enforcement and discipline. An interview with a representative of BC high school football, who wishes to remain anonymous, provided some insight into some of these problems. Asked about concussion in youth football, this person approved the direction the sport is going, but raised concerns about shortcomings of current policy.

**Table 2. Observations from BC High School Football Representative**

Positive Observations	Negative Observations
Drills have changed. They are doing less unnecessary tackling and changing the way they practice.	No professional provided for concussion assessment or protocol of action for an injured player.
Improved awareness of the concussion issue.	Relying on assistant coach with limited medical experience as a paramedic for treatment of injured player.
Using the Sports Concussion Assessment Tool (SCAT) to assess athletes after injury.	The online protocol that is promoted by BC high school football is not mandatory
	Return-to-play is voluntary, though encouraged.

### **3.6.3. BC Soccer Association**

The BC Soccer Association oversees 40 youth district leagues and over 100,000 players. A concussion policy similar to the BCAFA has been created and is being implemented, with the Association stating the expectation is that all district leagues will have a formal protocol in place by September of 2016 (BC Soccer, 2015). There are concerns over the ability of the organization to fully monitor its mandated program. Head of communications Peter Loneran described this in November 2015 in saying: “With the province being so big, that is our challenge. We’d be lying if we said we could be at every game, every weekend.” (Hall, 2015). The doubt expressed by the organization is a key



indicator that some form of cooperation with government is necessary to ensure the safety of all players. When the Provincial Sport Organizations pass their mandate down to the local level, compliance is problematic when there are funding or staffing shortfalls.

There is also concern over the lack of movement by BC Soccer on reducing heading among younger players. As discussed earlier, the USSA has removed or reduced heading for players under 14.

#### **3.6.4. BC Minor Hockey Association**

Hockey Canada has been at the forefront of putting forward progressive policies in Canada to reduce concussion risk and increase education and awareness. Hockey Canada has removed hitting for players under 14 to minimize the risks of concussion and other physical damages to young players. They have also implemented a Return-to-Play program, where athletes need a medical professional to sign off on their health before returning to action. Additionally, a free concussion awareness ‘app’ exists for players and parents that can be downloaded on smart phones and tablets to help educate players and athletes on the issue. Hockey programs in Canada are central to our culture and thus it is not surprising that Canadians think of it when asked about participants suffering a concussion while playing. The Angus Reid Institute survey noted above found that 81 per cent of respondents listed hockey when asked about concussions, just above football at 80 per cent, and well ahead of rugby at 46 per cent (Angus Reid Institute, 2015).

#### **3.6.5. BC Summary**

A recent series of articles in the *Vancouver Sun* summarizes the situation in British Columbia. Dr. Shelina Babul, a clinical assistant professor at the University of British Columbia in the department of pediatrics stated that “right now we’re looking on an individual association and school district basis” (Shaw, 2015). This draws attention to my research findings. While a number of different processes and policies exist that are available to schools and PSOs, a fractured and incoherent environment, with multiple organizational responsibilities, has made consistent delivery of policy difficult. This puts young athletes in British Columbia at greater risk than is necessary. Dr. Babul says that

legislation “would ensure everyone has the knowledge and understanding” that is required to form a cohesive and safe policy environment. The medical research is consistent in stating that athletes need protection through policy and its application to mitigate the risks of head injuries. The issue is garnering sufficient awareness and support among the responsible parties to take initiative and develop appropriate protocols.

## **Chapter 4. Criteria and Measures**

This section outlines the criteria and measures that I use to assess each of the policy options proposed to reduce concussion likelihood and increase reporting of these injuries among youth athletes. These criteria stem from the societal objective of maintaining health and safety for young athletes in the province.

I use four criteria to evaluate policies: Ease of implementation, based on both the cost and complexity of said implementation, anticipated stakeholder acceptance, and two measures of effectiveness. Each policy option receives a measurement rating of low, medium or high for each criterion. Table 3 summarizes the criteria and their measures.

**Table 3. Criteria and Measures Outline**

<b>Criterion</b>	<b>Description</b>	<b>Measure</b>	<b>Methodology</b>
Effectiveness 1	Does the policy increase reporting of suspected concussions?	<i>High:</i> 25-40% increase in reported awareness through qualitative survey <i>Medium:</i> 10 – 24% increase <i>Low:</i> less than 10% increase	Obtained from literature review. Inference based on data regarding reporting of suspected concussions.
Effectiveness 2	Does the policy reduce the number of head impacts in youth sports	<i>High</i> <i>Medium</i> <i>Low</i>	Obtained from literature review. Inference based on data regarding reduction in concussions. Due to data limitations, these are made with a qualitative assessment by the author of this study
Buy-in from prospective stakeholders	What is the level of acceptance based on each stakeholder's interests and associated burden or gain from the policy option	<i>High:</i> Likely to approve <i>Medium:</i> Largely indifferent <i>Low:</i> Likely in opposition	Positions of: General public Provincial government PSOs
Ease of Implementation	The cost of each policy to the government	<i>High:</i> There are low capital costs, and few extra staff needed to implement. <i>Moderate:</i> Low capital costs, five or more extra staff needed to implement. <i>Low:</i> Moderate capital costs, five or more staff needed to implement.	General estimate through expert interviews and literature review.

	How easily and effectively can the policy option be implemented?	<p>High: most of the resources necessary are already in place, or require little training.</p> <p>Medium: some training and coordination necessary.</p> <p>Low: requires departmental co-operation and/or extra training of relevant individuals to put policy in place.</p>	Inferences made from literature review, expert interviews, and considerations of the administrative coordination necessary
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There are two distinct goals used to derive the measures for effectiveness.

#### 4.1.1. Effectiveness Criterion 1: Reporting Increase

The first goal is to seek an *increase* in the number of reported concussions among student athletes. The research is conclusive that underreporting is pervasive. Increased awareness of the signs and symptoms of concussion may help to increase the number of reported concussions. An increase in reporting is a fundamental starting point for gathering better data on the incidence of this injury and indicator of greater awareness among parents and youth. The measure of a policy’s effectiveness for this criterion is the anticipated percentage increase in concussion reporting among student athletes. Data exist for British Columbia in the 2013 BC Injury and Prevention Report with respect to the number of concussions in each sport and among each age group, based on a comprehensive overview of medical records and incident reports across the province. The report itself draws attention to the difficulty in estimating this number, due to the large number of unreported concussions. This number likely will rise considerably if a policy is effective. Estimates from the research suggest that approximately half of all concussions go unreported. The Angus Reid Institute survey found that among those Canadians who played youth sports 31 per cent reported having a concussion. Of this group, only 58 per cent said that a responsible adult was aware of their injury, and just 32 per cent saw a doctor. With this in mind, I estimate that an effective policy would capture a maximum of

a 40 per cent increase in concussion reporting. Anything beyond this level, I consider an unanticipated bonus. These numbers represent reasonable metrics based on author expectation, as data is not available on such programs.

#### Measures for Effectiveness Criteria 1:

- Highly effective: 25 to 40 per cent increase in reported concussions from youth sports in British Columbia
- Moderately effective: 10 to 24 per cent increase in reported concussions
- Limited effectiveness: Less than 10 per cent increase in reported concussions

#### **4.1.2. Effectiveness Criterion 2: Concussion Decrease**

The second option for assessing the effectiveness of policy is the *decrease* in the total number of concussions. Because of the data limitations, this is difficult to estimate, and the purpose of Effectiveness Criterion 1 is to build this data set to obtain a more accurate scale of concussion incidence. Data limitations do not however preclude an estimated impact of each policy from being drawn.

#### Measures for Effectiveness Criterion 2

- Highly effective: A significant reduction in concussion in youth sports would be engendered by this policy
- Moderately effective: This policy would have a positive effect in reducing concussion
- Limited effectiveness: This policy would not have a noticeable effect on the number of concussions Buy in from prospective stakeholders

For this study, the stakeholders are British Columbian citizens, the province of British Columbia, and community sports organizations.

*British Columbian citizens* include adults, but not the youth athletes because they are not considered old enough to responsibly consent to participating in some of these high-risk sports.

*The Province of British Columbia* is represented by the Ministry of Education because of its integral role in education and governance of school-based sports.

*Community Sport Organizations* are the provincial sports organizations, including but not limited to BC Minor Football Association, BC Soccer Association, and BC Minor Hockey.

### **4.1.3. Stakeholder Buy-In**

Measure for Buy in from Prospective Stakeholders

Stakeholders' responses are ranked as:

- *High*: Most stakeholders will likely approve of the policy option.
- *Medium*: Most stakeholders are indifferent to the policy option.
- *Low*: Most stakeholders are likely in opposition to the policy option.

### **4.1.4. Ease of Implementation**

#### **Cost**

The options, discussed in detail in the next chapter, are assumed to be province wide and are quite different in scope. Thus, an absolute budget estimate is difficult to propose. Option 1 is a curriculum addition to school districts, whereas option 2 is legislation introduction and option 3 is a ban on particular contact activities. Thus, comparing the absolute budgets of these options was problematic, and I use a scale instead to compare the relative degree of expense each option carries. None of the options carry a significant capital cost, or an administrative cost that would be prohibitive.

Measure for Implementation Cost

- A five-point scale is used to estimate the relative change in budget for government, and the corresponding acceptance level.
- One on this scale means a substantial burden would fall on the government due to the policy option presented, thus, their acceptance of cost would be low

- Three means the financial burden on the government from a policy option is moderately increased
- Five means the financial burden is minimal

### ***Complexity***

The complexity of implementation criterion refers to the amount of effort necessary to ensure that the policy is in place and monitored, as well as the level of compliance cost for other relevant stakeholders. This involves looking at the current state of the policy environment and assessing how difficult it will be to get to a condition where the new policy is in place.

#### Measure for Complexity of Implementation

- High score: Similar to the status quo. Most of the resources are already in place to implement the policy option, low cost to stakeholders
- Medium score: Moderate change from the status quo. Some co-operation is required between groups to have the policy succeed, some training is needed.
- Low Score: Substantial change from the status quo. The option requires co-operation of multiple groups of stakeholders, the implementation of new legislation, or high cost to stakeholders



## **Chapter 5. Policy Options and Evaluation**

Examples of the policy options available are summarized in the cross-jurisdictional findings chapter. Some of these can be applied in individual sports and are already being done or are easy to implement without government policy. An example is the changes to training and practicing procedures in Hockey Canada's policies. Removing hitting from practices and developing technique and form over impact, can be very effective in reducing injuries and repetitive head trauma. However, these are 'private' actions taken on behalf of the sporting associations. My focus is on concrete steps that a provincial government can take to ensure reliability and compliance. As such, based on the assessed deficiencies found in the research, I develop three policies as options going forward, all of which require provincial government leadership.

### **5.1. Option A: School District Physical Education**

Option A takes into account some of the important deficiencies identified in the research, namely, that concussion awareness is insufficient, though improving, and that the number of concussions reported by students does not represent the total number of concussions incurred. Both the McGill and Wisconsin University studies identified a large degree of underreporting. In one case 47 per cent, in another 80 per cent of athletes who thought they were concussed did not report this to a coach or adult for various reasons related to competitiveness and cultural expressions of toughness.

The policy under consideration is a province wide mandate given to school districts to include in their physical education curriculum a section covering the health impacts and prevention methods surrounding head injuries. I propose a minimum of two hours each year initially to increase the level of awareness of these risks, however the time given to this course addition would be subject to revision as outcomes becomes more salient. The curriculum would include graduated intensity in terms of academic rigour, with younger students taught the dangers of hitting their heads in more age-appropriate, general terms; older students would be introduced to the biological factors associated with head trauma. One of the biggest benefits of this option is that it increases personal awareness and

responsibility, and creates a culture where all students are informed about concussion incidence and risk. Within this culture, reporting of injuries to an individual by other students will also ensue. Only by first introducing measures that can increase the reporting of this injury can a solid basis for policy be established going forward. Policy A would accomplish this.

Effectiveness:

*Measure 1, Reporting Increase: High*

I expect this option will have a very high likelihood of improving the awareness and reporting of young athletes. Analyses of similar programs, less comprehensive than the one I propose, show high effectiveness. One such study, performed by the Sports Legacy Institute Concussion Educators (SLICE) gave a workshop to 636 students between ages 9 and 18. The program involved demonstrations, discussions and case studies, and was delivered by members in health related fields. The mean score of students taking a concussion knowledge quiz pre-presentation was 34 per cent. After the presentation, which ran 40 to 60 minutes, the mean scores jumped to 80 per cent (Bagley et al., 2012). All age groups that participated achieve significant gains. Similarly, but among an older cohort, an educational lecture was shown to have a significant impact on university students when the intervention was undertaken before their specific sport season began (Miyashita et al., 2013). These increases in knowledge are the result of very simple and publically available communication tools on the risks and impacts of concussions. Furthermore, Bramley et al. (2012) discovered in their research with high school soccer players, that those who have received concussion education were twice as likely to report symptoms to their coach or trainer.

These studies indicate that basic education intervention strategies are effective in inducing a significant improvement in students' likelihood to report their suspicion of head injury to a responsible adult. I assume that the minimum reporting increase of 25 per cent, for a high effectiveness score, can easily be met by a policy of this scale. The education program would be given during mandatory physical education classes. A curriculum for

this program is easily attainable through many of the concussion education organizations that already exist.

*Measure 2, Decrease in the Number of Concussions: Moderate*

This policy is not in itself an active mitigation strategy to reduce the number of concussions in youth sports. It is designed to increase the ability of the youth athlete to recognize the risks of participation and the symptoms of a concussion, and know to report their symptoms to a responsible adult. The anticipated spinoff benefit is that students will more actively engage in a type of cost-benefit analysis when deciding which sports to participate in and what to do should they receive a hit that may be a concussion. Increased knowledge of symptoms means increased likelihood of self-reporting of injury. Because this program would be provincial, hundreds of thousands of students would be affected. Thus, this policy receives a moderate score when anticipating the overall reduction in concussions. It is necessary to note that because concussion reporting is so poor to date, incidence will be difficult to quantify over the first few years of implementation.

*Measure 3, Anticipated Stakeholder buy-in: High*

BC Citizens: There is no reason to anticipate large-scale opposition within this group. When asked in a survey whether provincial governments needed to step-up and do more in terms of concussion safety regulation, 65 per cent of Canadians said they agree that this is the case (Angus Reid Institute, 2015). The public safety elements of this change are easy to communicate to this group, and the cost to the public is negligible.

Provincial Government: The government would be largely in support of this policy due to the avoidance of formal legislation. Ontario has set out the line of implementation with PPM 158. A formal declaration that an education program must be in place through physical education class by a given deadline can be put forth with relative ease. Opposition from the school boards is likely to be negligible, as the safety of athletes is of utmost concern and the requirement does not involve any significant curriculum modifications.

Provincial Sporting Organizations: These organizations avoid cost in this policy, and incur benefit in the form of more educated athletes and increased safety. No opposition is anticipated.

#### *Measure 4, Implementation Ease (high)*

##### *Cost for Implementation*

Cost acceptance for Option A is considered to be high. The province will be responsible for program costs. These would be in the form of procuring the materials needed for the education package, formulating a Policy/Program Memorandum (PPM), and training staff. It is unlikely that these costs will be substantial. No *new* staff are needed, education materials already exist, and these materials simply need to be researched, compiled and refined for distribution.

Costs for procurement of education materials are extremely low, as Parachute Canada, funded in part by the Public Health Agency of Canada, and the Center for Disease Control in the United States, both have free online tools that can be used for learning and presenting (Parachute, 2016; CDC, 2016). These tools can be combined with other relevant materials to formulate an education package. An introductory, intermediate, and advanced package can be created based on the best estimates and analysis of available materials by the procurement staff. Advanced education packages would include more information about the neurological basis for concern about head trauma, and greater depth into some of the research compiled by experts in the field. The introductory package, for younger students, would be simpler, more age appropriate information.

A committee will need to be created within the Ministry of Education to formulate a PPM; however, this is not an overly labour intensive undertaking. Ontario has set a precedent (PPM 158, 2014) that BC may follow. The final portion of the province's costs is the training of staff. Familiarity with materials can be done through email communication with physical education teachers across the province. Once compiled, the education package can be sent to this staff with the notification that it will be worked into the curriculum for the following year.

### *Implementation Complexity*

The infrastructure for Option A is already in place. Implementation will be handled in two facets. The first requires the creation and distribution of a PPM, described in the preceding section. The second is the requisition of education materials and distribution to teachers.

Provincial sporting organizations are removed from the cost equation completely, as they bear no burden or benefit financially from the policy. The citizens of BC also have a low cost. Implementation costs are low for the same reasons that cost is relatively low.

The SLICE program was extremely effective in increasing concussion knowledge among students. Volunteers presented the program after they “received a standard training that included a review of peer-reviewed journal articles, CDC concussion guidelines, relevant concussion case studies, a previous SLICE presentation film, and delivering a mock presentation to SLICE officers.” (Bagley et. al, 2012). A similar program would be undertaken after materials are procured and sent to teachers.

## **5.2. Option B: mandatory Return-to-play legislation**

Option B works in the realm of sports participation. Return-to-play (RTP) is legislated participation by all school districts and provincial sports leagues in a program to enhance the safety of young athletes. This option carries the threat of legal repercussion. The burden of education in this option falls more upon the coaching and training staff than on the athlete. The tenets of RTP are:

- Any athlete suspected of suffering a head injury or concussion must be immediately removed from play
- Athletes and their parents are required to sign an information sheet about concussion and head injury before they are able to participate in their first practice of the season
- An athlete who has been removed from play must be cleared to return by an athletic trainer or medical professional, who has been trained in concussion management
- Private sports leagues that want to use publicly owned fields are required to comply with the law

- Any team official, parent/guardian or player who knowingly disregards their responsibility to acquire a medical doctor's written permission permitting a player to return to play will be subject to disciplinary action and/or sanction (Nepean Girls Hockey Association Policy Manual, 2015)

These tenets make up the laws implemented in all 50 US states, and recently passed in Ontario, as Rowan's Law. It goes further in mitigating the risk of concussion, as it requires those responsible for the children participating in the sport – the coaches, parents, or training staff, to become familiar with the legislation and be vigilant in monitoring their players, and removing them when necessary. The additional step I introduce is the requirement of the parent to engage with a video tutorial regarding the issue before signing consent. While an information sheet, which is the standard for this option, is a strong initial step, a video would act as an additional step to inform parents about the risks of concussion and how to prevent serious injury to their child.

#### *Measure 1, Reporting Increase: Moderate*

The increase in concussion reporting with RTP in place should be moderate and rising over time (as was the case with the first policy option). Bompadre et al. noted in their 2014 study that after the introduction of the Lystedt Law, reporting of concussions in young athletes had doubled, with particular success among female athletes, where the number reported had more than tripled. However, an additional study showed that just 34.7 per cent of students had been educated on concussion risk (Chrisman et al, 2014), so RTP had not affected athlete knowledge as widely as was hoped. This is likely due to the policy's focus on coaches and guardians, rather than athletes, in terms of educational reach.

#### *Measure 2, Decrease in the Number of Concussions: Moderate to High*

As students and adults take concussion risks more seriously and make a concerted effort to assess more accurately when an athlete has suffered a head impact, the incidence of concussions and particularly SIS should decrease over time. The decrease is not likely to occur immediately as it takes time to change the culture about concussions and return to play. As the legislation makes extra vigilance the norm, repeat concussions should decline

noticeably. Because reducing SIS is the key impetus of concussion prevention programs, this option receives a moderate to high score.

*Measure 3, Anticipated Stakeholder buy-in: Moderate to High*

There should be more resistance to RTP legislation than to education due to its legislative requirements. However, many PSOs have already undertaken this policy voluntarily. BC Minor Football, Hockey Canada and the Saskatchewan Soccer Association are examples. Given this voluntary trend, I expect relatively low levels of resistance from PSO stakeholders.

BC Citizens: There is little to no anticipated opposition from this group. Among the 1,522 Canadians surveyed, 92 per cent said they support implementation of RTP in their province. The caveat here is that in a follow up question, 45 percent of respondents said most strongly that PSOs should cover the funding cost for such a program, while 20 per cent said government should fund the program, 16 per cent said parents should pay extra fees, and 18 per cent were unsure (Angus Reid Institute, 2015). If PSOs are to pay for the cost of training coaches and staff, this will likely lead to slightly higher fees for parents enrolling their children in sports. This could increase opposition somewhat but these costs would not seem to be too onerous.

Provincial Government: There appears to be opposition within the government, though the reasons for this are still unknown. In 2011, MLA Moira Stilwell introduced a bill to implement RTP. It was a private members bill and failed to garner any government support. As of November 2015, Health Minister Terry Lake says there are no plans to go forward with concussion legislation (Shaw, 2015). In terms of objective reasons to oppose this option, cost and complexity of implementation may be driving concerns, factors I take into account below.

Provincial sporting organizations: PSOs would be required to educate their coaching and training staffs to be able to access public fields, and thus, will incur extra costs under this option. The fact that so many organizations have already undertaken this measure voluntarily suggests that opposition would be scattered. It may be the case that extra costs will be added to the operating budgets of these organizations and then passed on to the

consumer (parents and athletes), in the form of fees. If this is the case, as I anticipate it will be, then PSO opposition should remain moderate.

#### *Measure 4, Implementation Ease (Moderate)*

##### *Implementation Cost*

The implementation cost associated with option B for the government is moderate. The primary costs are in two areas, legislation creation and enforcement/compliance monitoring. In terms of creating legislation, Dr. Stilwell has already done much of the legwork. (Stilwell Interview, 2015). Compliance monitoring is the second portion where government funding will be necessary. The compliance monitoring program will be discussed in the following section as well, but the major costs necessary to note here are for administrative staff and start-up costs for data tracking. The province will need to employ staff to conduct a yearly review. These audits should create a culture of expectation within youth athletics that monitoring is ongoing. Additionally, they will provide data on compliance from year to year. The expectation is that organizations and school districts would be required to submit injury reports and meet specific deadlines. The government would randomly audit teams, cross referencing the team roster with medical records to ensure that injury reports had been properly filed. An audit group of five people made up of policy analysts, researchers, and data programmers would be the minimum number of staff able to manage this program over the course of one month. Additional costs exist for communication with stakeholders and when levying enforcement penalties. As no large capital costs are associated with implementation, I assign moderate to staffing and monitoring costs.

##### *Implementation Complexity*

I rank implementation complexity at moderate. One of the reasons for increased complexity is the financial burden to stakeholders. There will be a cost distributed to



citizens of the province. The cost of RTP comes in the form of training and implementation for PSOs and school district leagues and costs to the government in terms of drawing up, implementing, and enforcing legislation to put parameters in place. The taxpayer will likely see marginal taxation increases, but that is not where their cost consideration comes in. With new regulation in place, it will be incumbent upon both school districts and PSOs to increase the quality and quantity of medical personnel available for sporting events. Specifically, with respect to RTP condition A, no athlete shall be allowed to return to a game without consultation from a qualified athletic trainer or medical professional who has completed the relevant training. Sporting organizations will have to cover the costs of either hiring or training athletic trainers in order to ensure proper assessment of athletes when an injury is suspected. Note that this program does not specify that an athletic trainer *must* be present at sporting events, though the high school football representative interviewed for this project expressed a desire for this (High School Football Interview, 2016). The reasoning is that if an athlete has received a minor bump on the head, it would be safer to have a professional on site who could make the assessment as to the danger of re-entry into the game. If there is no perceived injury, or the professional administers a simple concussion protocol test, this will lower the likelihood of disruption for athletes. Many organizations may choose to do this for safety and convenience. The athlete's parents or guardians like likely be charged for these costs as part of the fees for the sport.

There will likely be additional costs associated with participation, in addition to fees that already exist for PSOs. Though not formally proposed, it may be productive for the government to consider a subsidy program for the first three years of implementation, to help PSOs cover some of these costs and phase in extra fees for athletes. Dr. Stilwell brought up this concern in our discussion of the difficulties in implementing RTP. The cost must not be prohibitive (Stilwell Interview, 2015) for young athletes who want to participate.

Much of the infrastructure, similar to option A, is already in place. However, the option requires adoption of legislation. As the bill was already written, and stakeholders were consulted by Dr. Stilwell in anticipation of this, much of the foundation for legislation exists. Communication with the BC Teachers Federation and the Ministry of Education

are necessary as a precursor to introducing the bill. Importantly, this issue is bipartisan and as in Ontario, expected to garner support from all parties (Antonella, 2015). If presented, as Dr. Stilwell mentioned, under the umbrella of preventative health, acceptance should be politically acceptable.

One of the difficulties associated with this policy is enforcement. As a province wide mandate, all sporting organizations are required, under penalty of law, to comply. Compliance however, ranges from easy to difficult, based on the location and the size of the organization. School districts should be relatively easy to monitor, as there are plenty of staff to perform random compliance checks as a part of a reporting protocol. Compliance tracking is more difficult however when considering a small lacrosse league on Northern Vancouver Island however, or a youth softball league in Houston BC. Thus, a communication strategy to inform all players, athletes, coaches, and trainers of these new regulations is imperative to achieve compliance. The primary method for enforcement however would be in a database of injury reports. Formal injury reports would be required in instances of concussion, and would henceforth create a database subject to audit against medical records by government. This would create an additional mechanism for enforcement and importantly, increased perception of potential risks to non-compliance, much the same as a person properly files their taxes to avoid risks associated with an audit.

### **5.3. Option C: Ban on Specific Contact Related Actions in Sport for Children Under 14**

Option C is among the more radical proposed solutions addressing concussions in youth athletes. Movements in this direction, as discussed in previous sections, are becoming more common. It is however, significantly more controversial than measures to improve reporting or adjust how concussions are managed. Body-checking in youth hockey has already been removed for children under the age of 14. This acts as a precedent for action going forward as organizations set their own policies. Given the actions undertaken elsewhere, and comments noted by medical professionals in the background research provided previously, the specific activities proposed for a ban are as follows:

1. Removal of heading from soccer for children under the age of 15.
2. Ban on tackle football for children under the age of 15.

*Measure 1, Reporting Increase: Low*

I do not expect this policy option to increase reporting, as it is an activity mitigation measure, and not an education tool.

*Measure 2, Decrease in the Number of Concussions: High*

The option should yield a large decrease in the number of concussions. As noted in section 1.1, the rates of sports-related concussion are higher for children than they are for adults (Parachute Canada, 2013) and a study by Karlin et al, in 2011 found that in British Columbia, the rate of sports-related concussion is significantly higher among the 10 to 14-year-old age group than the pentad above and below.

Removing heading from soccer, as has been done in the United States Soccer Association for specific age groups, should result in approximately a 30 per cent decrease in concussions from this sport. A study released in 2015 analyzed data collected from 2005 to 2014 from US high school soccer players, both male and female, found that 30.6 per cent of boy's concussions and 25.3 per cent of girl's concussions in soccer were a direct result of heading. There are additional concerns about the long-term effects of repeated head impacts and the potential for chronic traumatic encephalopathy to develop in soccer players (McKee et al. 2009). Many experts believe that reducing repeated impacts is integral to protecting developing brains, and with 42 per cent of children in Canada between the ages of 5 and 14 playing soccer (Canadian Heritage, 2013), this change would be extremely effective.

Unlike soccer, football is fundamentally built on contact for every player on every play. In this case then, children under the age of 15 could not play. A 2015 study of 4,092 youth football athletes, under the age of 15, found that 1 in 29 players experienced a concussion (Dompier et al., 2015). Rates of participation in BC are not available to extrapolate this number into a local context. However, the reduction in concussions would be substantial, as Howling et al reports that football is second only to hockey in its concussion rate per

athlete exposure. Since that 2007 report, Hockey Canada has announced a ban on hitting until the age of 13 (Hockey Canada, 2013). Children in BC will still be able to participate in flag football, as an alternative to the tackle game until the age of 15 under this policy option.

*Measure 3, Anticipated Stakeholder buy-in: Low*

BC Citizens: In our survey, just 42 per cent of Canadians support banning contact sports for children under the age of 14. With 58 per cent in opposition, a majority of this stakeholder group are against this policy option. However, given that hockey has already made rule changes to accommodate safety, and the US Soccer Association precedent has been set, there will likely be growing acceptance of this regulation. Those closely associated with tackle football are likely the most opposed.

While this option is less palatable in the current sports climate, the introduction of alternative options is likely to increase awareness of concussion related injuries in specific sports, and serve as a foundation for the introduction of option C further down the road. All of the options suggested in this report work in concert with each other. Awareness is the primary goal, with infrastructure to ensure safety as the secondary goal. One tertiary goal is the movement within society away from these activities for younger, more at risk athletes. For example, with football, a minimization of contact may be the initial approach. Putting a cap on practices, and total accumulated hits, as has been done elsewhere and is noted in the cross-jurisdictional comparison, is the first step in ultimately improving the safety of athletes by delaying their participation in these sports.

Provincial Government: The government would find it challenging to pursue this policy option, as the will of the public appears to be against it more so than other available measures. The counter-argument against option C is that it infringes on freedoms of citizens to engage in potentially dangerous activities if they acknowledge the risk. Because many young athletes under the age of 15 likely do not understand the long-term health risks associated with their participation, this is a complicated message to convey for the government and they would likely pass responsibility for this type of regulation off to the sporting bodies, rather than take direct action. Moreover, in a public health care system, society bears the costs of treatment and long-term care if necessary.

What this creates is a situation of moral hazard. If the costs of participation in riskier sports, strictly financially speaking, are the same for all sports and not increased for higher risk activities, the natural disincentive to participate is eliminated. A proposed solution to this in the long-term, though not explicitly advocated for by this report, may be the imposition of a fee on either specific sports programs that generate a higher likelihood of concussions in their athletes. Additionally, based on the information available, a school-by-school fee may be considered for those that generate more injuries overall. These types of initiatives would reduce the taxpayer funding of voluntarily incurred sports injuries.

Provincial Sporting Organizations: The overwhelming objection to this measure will come from the BC Soccer Association and BC Minor Football Association. As will be discussed in the implementation section, this policy proposal stands to cost these organizations financially, as they have no direct avenue to continue playing, in the case of football, or will have to implement rule changes for soccer. Soccer leagues should not anticipate a drop in enrolment, however BC Minor Football will lose revenue from its tackle leagues between the ages of 8 and 14, though some of this would be mitigated by increased enrolment in non-contact, flag football.

#### *Measure 4, Implementation Ease (Low to moderate)*

##### *Implementation Cost*

The responsibility for ascertaining which leagues and sports would be in need of regulation would fall on the province. Data collection and ultimately a memorandum of guidelines would be required. For this reason, I consider the cost to the government moderate.

##### *Implementation Complexity*

Option C receives a low score. The cost to citizens of BC for this option is negligible in terms of finances, however the losses for this group are in terms of participating in the sport they enjoy, or perceived losses in competitiveness due to rule changes that may not be adopted by other provinces.

The primary cost to relevant stakeholders is to BC Minor Football. These would be losses in fees for athletes in now defunct leagues. Some of this loss would be recouped by flag football leagues, which are run under the same organizations. The BC Soccer Association should not expect to see their participation levels drop as players adjust to rule changes.

A memorandum would need to come from the Ministry of Community, Sport and Cultural Development. This would likely be the Ministry responsible for research and review of which sports fall under a contact ban or rule change for athletes under 15. Communication and consultation between this taskforce and the sporting organizations. Finally, implementation on behalf of the sporting organizations is expected to be moderate, as they must communicate the message to their athletes. Government and school district assistance with this process would be valuable in reinforcing the safety philosophy behind changes to sporting activities, and promotion of safe practices.

**Table 4. Summary of Criteria and Measures**

	Option 1 Education	Option 2 RTP Legislation	Option 3 U-15 Contact Changes
Effectiveness: Reporting Increase	High	Moderate	Low
Effectiveness: Reduction in Concussion	Moderate	Moderate to High	High
Stakeholder Buy-in	High	Moderate to High	Low
Ease of Implementation	High	Moderate	Moderate-Low

## **Chapter 6. Recommendation**

After a review of the criteria and measures associated with each policy option the recommended course of action is a two-tiered approach. A multi-tier strategy allows for immediate implementation of the most accessible option, option A, followed by option B once there is demonstrable support from parents, teachers, and sporting organizations that opens the political window for legislation. The two will provide a strong foundation for safety and concussion risk mitigation going forward. While option C is very strong in terms of mitigating risk and meeting the assessed needs of many medical experts, public opinion has not moved in favour of this in a strong enough way to proceed with action at this current time. However, as discussions increase and high profile examples of this movement arise, it should become more palatable.

### **6.1. School District Education**

Implementing option A, an education campaign situated within the physical education curriculum, is an effective policy option at beginning to address the problem of too many youth concussions. It scores the highest when combining the criteria. First, the policy covers children across the entire province. It does so because the infrastructure is already in place and the province is able to mandate curriculum to all schools, both public and private (BCED Curriculum). One of the most effective steps that the province can take in looking to assure better health outcomes is to increase the knowledge of the populous, such that citizens become aware and hence, self-regulating. The literature found increases in general concussion knowledge and significant increases in reporting of concussions after education (Bramley et al, date, Bagley et al, date, and Miyashita date).

There is very little in terms of anticipated opposition to this policy proposal. Procurement of materials requires minimal resources, and could be undertaken immediately. I recommend that the government go forward with adjustments to the education curriculum while other measures, which require more time and resources, are pursued.

## 6.2. Return to Play Legislation

Return to play legislation has become an accepted part of the American youth sports culture, with acceptance in various forms in all 50 states (CDC, 2015). British Columbia should look to this and move to incorporate concussion law as soon as possible. While education through option A increases awareness and helps children to self-report symptoms, the onus must be on a responsible adult to assure that precautions are taken and appropriate medical attention received. Many studies corroborate findings that children will underreport concussion symptoms for competitive or ego driven purposes (Weinberger and Brisken 2013, McCrea et al. 2004, Delaney et al. 2014). Bompadre et al (date) observed the data since the Lystedt Law was implemented in 2009 and found a doubling of concussion reporting since that time period. Importantly, the CDC report on lessons learned from implementation of RTP suggests creating a reliable system to monitor data, and an outreach program to discuss implementation and monitoring with stakeholders in preparation for commencement of regulations (CDC, 2015).

One of the reasons that cost for this option is low is that Dr. Stilwell did much of the foundational work. Her bill in 2011 was not passed, but the survey results indicate a high level of public acceptance of RTP legislation (92 percent support) (Angus Reid, 2015). Such a bill, with strong public support, relatively low cost, and important health benefits for BC children, should be undertaken as quickly as possible. This option scores at least moderate to high for all criteria used to evaluate it, and will benefit from the introduction of option A. A combination of option A and option B can make a difference in the health outcomes of many youth and reduce the risk that another young athlete such as Rowan Stringer dies.



## **Chapter 7. Conclusion**

This paper provides an analysis of policy alternatives to increase reporting of concussions in youth sports, and ultimately reduce the total number of concussions from sport in British Columbia. It presents a review of the associated literature describing the health risks associated with impacts to youth's brains, and analyzes policies implemented across a number of different jurisdictions that attempt to reduce these risks. The paper provides a set of criteria and measures to analyse the ways British Columbia can act to accomplish these goals. I recommend a multi-tiered approach, including a curriculum adjustment to incorporate concussion knowledge into the physical education program, and the creation of return-to-play legislation, such that compliance with concussion reducing initiatives can be enforced.

Limitations to this study are associated with stakeholder interviews. In order to ascertain which policies will be the most palatable to sports organizations across the province, interviews with representatives should be undertaken. There is also a need to collate data once an education program is in place, in terms of reporting numbers and testing students' knowledge. These will serve as markers for future policy evolution going forward.

British Columbia's government has likely been watching the process unfold in Ontario. Rowan's Law has been passed, marking the first provincial concussion legislation in the country. This may serve as an example for other provinces to follow in ensuring athlete safety.

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## Appendix A.

### Summary of data from Concussion Questionnaire

#### Angus Reid Institute Survey

Different proposals have been made to address the issue of concussions in organized youth sports. Would you support or oppose each of the following policies? (Support Shown)										
	Total	Region							Gender	
		BC	AB	SK	MB	ON	QC	ATL	M	F
Requiring a certified trainer or health professional be present for every organized youth game	72%	62%	60%	63%	75%	71%	87%	64%	68%	76%
Requiring young athletes to follow a "Return to Play" policy - steps they must take before returning to normal activity after a suspected concussion	92%	88%	91%	92%	94%	92%	94%	95%	90%	95%
Requiring young athletes to obtain a doctor's permission before returning to sports after a suspected concussion	92%	91%	89%	92%	94%	91%	94%	93%	90%	93%
Requiring coaches to be educated on the risks of concussions as a condition of their eligibility to coach	95%	93%	92%	95%	94%	95%	96%	93%	93%	96%
Not allowing kids under the age of 14 to play contact sports	43%	42%	32%	30%	39%	40%	58%	38%	42%	44%

Overall, the benefits of kids playing organized sports far outweigh the risks of concussion:

	Total	Region							Gender	
		BC	AB	SK	MB	ON	QC	ATL	M	F
<b>Strongly agree</b>	29%	24%	34%	37%	36%	29%	28%	28%	31%	27%
<b>Moderately agree</b>	38%	35%	34%	25%	31%	41%	40%	36%	36%	39%
<b>Moderately disagree</b>	14%	20%	12%	17%	14%	12%	14%	11%	13%	14%
<b>Strongly disagree</b>	9%	11%	11%	9%	10%	9%	7%	12%	10%	8%
<b>Not sure</b>	10%	9%	9%	12%	10%	10%	10%	13%	9%	11%

If my child got a concussion playing sports, the coaches/trainers would handle the situation well:

	Total	Region							Gender	
		BC	AB	SK	MB	ON	QC	ATL	M	F
<b>Strongly agree</b>	16%	15%	16%	6%	14%	18%	16%	14%	16%	16%
<b>Moderately agree</b>	52%	57%	58%	62%	55%	52%	44%	64%	52%	53%

<b>Moderately disagree</b>	<b>26%</b>	<b>25%</b>	<b>20%</b>	<b>27%</b>	<b>24%</b>	<b>26%</b>	<b>32%</b>	<b>17%</b>	<b>26%</b>	<b>26%</b>
<b>Strongly disagree</b>	<b>5%</b>	<b>2%</b>	<b>5%</b>	<b>5%</b>	<b>7%</b>	<b>4%</b>	<b>8%</b>	<b>5%</b>	<b>5%</b>	<b>5%</b>

Schools in my province have a good plan to prevent concussions as much as possible:										
	Total	Region							Gender	
		BC	AB	SK	MB	ON	QC	ATL	M	F
<b>Strongly agree</b>	<b>14%</b>	<b>9%</b>	<b>17%</b>	<b>10%</b>	<b>16%</b>	<b>18%</b>	<b>13%</b>	<b>7%</b>	<b>14%</b>	<b>15%</b>
<b>Moderately agree</b>	<b>49%</b>	<b>47%</b>	<b>57%</b>	<b>64%</b>	<b>41%</b>	<b>49%</b>	<b>46%</b>	<b>52%</b>	<b>48%</b>	<b>50%</b>
<b>Moderately disagree</b>	<b>27%</b>	<b>34%</b>	<b>19%</b>	<b>19%</b>	<b>36%</b>	<b>23%</b>	<b>30%</b>	<b>36%</b>	<b>28%</b>	<b>26%</b>
<b>Strongly disagree</b>	<b>9%</b>	<b>9%</b>	<b>7%</b>	<b>6%</b>	<b>7%</b>	<b>10%</b>	<b>11%</b>	<b>5%</b>	<b>10%</b>	<b>9%</b>

Youth leagues in my province have a good plan to prevent concussions as much as possible:										
	Total	Region							Gender	
		BC	AB	SK	MB	ON	QC	ATL	M	F



<b>Strongly agree</b>	15%	15%	17%	28%	11%	16%	13%	10%	15%	15%
<b>Moderately agree</b>	54%	63%	49%	51%	43%	58%	51%	48%	56%	53%
<b>Moderately disagree</b>	24%	19%	20%	15%	36%	19%	30%	38%	21%	27%
<b>Strongly disagree</b>	7%	3%	14%	5%	10%	7%	6%	3%	9%	4%

Too many parents would allow their child to play sports too soon after a concussion:										
	Total	Region							Gender	
		BC	AB	SK	MB	ON	QC	ATL	M	F
<b>Strongly agree</b>	25%	19%	23%	23%	25%	26%	29%	20%	23%	27%
<b>Moderately agree</b>	51%	47%	55%	48%	50%	47%	55%	60%	49%	52%
<b>Moderately disagree</b>	19%	26%	20%	23%	21%	21%	15%	13%	23%	16%
<b>Strongly disagree</b>	5%	7%	3%	6%	4%	7%	2%	8%	5%	5%

Too many coaches would allow their youth athlete to play sports too soon after a concussion:

	Total	Region							Gender	
		BC	AB	SK	MB	ON	QC	ATL	M	F
<b>Strongly agree</b>	<b>28%</b>	<b>21%</b>	<b>23%</b>	<b>22%</b>	<b>34%</b>	<b>24%</b>	<b>38%</b>	<b>32%</b>	<b>23%</b>	<b>34%</b>
<b>Moderately agree</b>	<b>49%</b>	<b>51%</b>	<b>54%</b>	<b>48%</b>	<b>44%</b>	<b>50%</b>	<b>46%</b>	<b>51%</b>	<b>53%</b>	<b>46%</b>
<b>Moderately disagree</b>	<b>18%</b>	<b>23%</b>	<b>19%</b>	<b>25%</b>	<b>17%</b>	<b>20%</b>	<b>14%</b>	<b>14%</b>	<b>21%</b>	<b>16%</b>
<b>Strongly disagree</b>	<b>4%</b>	<b>5%</b>	<b>3%</b>	<b>4%</b>	<b>4%</b>	<b>6%</b>	<b>1%</b>	<b>3%</b>	<b>4%</b>	<b>4%</b>

Thinking about the role of government in youth sports, which statement is closest to your own point of view?										
	Total	Region							Gender	
		BC	AB	SK	MB	ON	QC	ATL	M	F
<b>Provincial governments need to step in with laws/regulations to better protect young athletes from concussions</b>	<b>65%</b>	<b>69%</b>	<b>54%</b>	<b>43%</b>	<b>69%</b>	<b>65%</b>	<b>73%</b>	<b>59%</b>	<b>63%</b>	<b>68%</b>
<b>There's no need for government oversight; coaches and parents are doing well enough protecting young athletes from concussions</b>	<b>35%</b>	<b>31%</b>	<b>46%</b>	<b>57%</b>	<b>31%</b>	<b>35%</b>	<b>27%</b>	<b>41%</b>	<b>37%</b>	<b>32%</b>

Of the following sports, which, if any, would you be concerned about children playing because of the risk of concussions? Pick up to three:

	Total	Region							Gender	
		BC	AB	SK	MB	ON	QC	ATL	M	F
<b>Soccer</b>	13%	13%	15%	11%	14%	14%	12%	15%	10%	17%
<b>Hockey</b>	81%	76%	75%	72%	79%	84%	82%	85%	79%	82%
<b>Basketball</b>	3%	7%	2%	5%	0%	1%	2%	3%	2%	3%
<b>Baseball</b>	4%	6%	1%	6%	4%	4%	3%	5%	3%	4%
<b>Gymnastics</b>	5%	3%	4%	4%	4%	6%	4%	6%	3%	6%
<b>Figure Skating</b>	6%	4%	3%	10%	5%	6%	9%	5%	4%	8%
<b>Rugby</b>	48%	56%	47%	35%	57%	56%	36%	39%	50%	47%
<b>Football</b>	79%	78%	81%	74%	86%	82%	73%	76%	80%	77%
<b>Tennis</b>	0%			1%		0%	1%		1%	
<b>Martial Arts</b>	10%	9%	15%	12%	13%	7%	13%	6%	12%	8%
<b>Field Hockey</b>	5%	2%	4%	8%	9%	5%	5%	5%	4%	5%
<b>Lacrosse</b>	9%	12%	11%	12%	5%	9%	5%	10%	10%	8%
<b>None</b>	7%	6%	8%	12%	4%	5%	9%	9%	8%	6%