# IMPLICATION OF INTRODUCING BODY CHECKING IN ICE HOCKEY AT DIFFERENT AGES

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Wade Wiggins, BPhed, BEd

0-612-33464-3

ABSTRACT

The main purpose of this research was to compare the rate of body checking injuries between two Provinces that introduce body checking at different ages (age 12 versus 14). Three teams from Ontario (body checking introduced at age 12) and three teams from Quebec (body checking introduced at age 14) were used in each of the 10 and 11, 12 and 13, and 14 and 15 year old levels. A total sample of 294 players were involved in the study for one full hockey season, from August of 1993 to April of 1994.

A comparison of the different ages led to the conclusion that whenever body checking is introduced, it significantly increases the rate of injury per player. A comparison between a representative sample of players in Ontario and Quebec for the increase in injury rates did not result in statistical significance, and therefore, it can be concluded that introducing body checking at the 12 and 13 , or the 14 and 15 year old age level does differ statistically.

It was found that those who were injured from checking demonstrated a significantly lower body weight. Based on the findings of this study, the majority of body checking injuries are bruises which result in a considerable amount of pain and discomfort to the injured player, but do not generally keep the player out of game action.

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Without the commitment and cooperation of all teams, and specific individual team trainers, this study would not have been possible. A sincere thank you to all the recorders who helped make this study a reality. In Ontario, these individuals came from Quintee, Nepean, St. Catharines, and Oshawa. The Quebec teams were recruited and gladly cooperated from Northshore, Salaberry, Lac St. Louis East, and Lac St. Louis West.

My acknowledgments would not be complete without recognizing some of my past colleagues who were important in the completion of this paper. I would like to thank McGinnis for his help, and a genuine thank you to both Pookie and Ricer for their continued pressure to finish my degree and be "just like them".

## DEDICATION

This thesis, and degree, would never have been possible without the endless support and love from my parents, ***Wayne and Jewel***. One could not have been pleased more with the birth into a family so caring and understanding. Wherever I am, my thoughts are with you both. Also, to my sister and her husband, Rhonda and Todd, whose unknowing guidance has always been appreciated. To my new nephew, Jack, who I hope will someday benefit from this study if he chooses to participate in hockey.

This thesis was completed three countries away from Lakehead University, and my home. Dedication would not have prevailed, and I would not have won if it were not for the countless hours of support from my truest love, ***Margaret***. You are clearly my best friend, and yes, you do complete me.

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# CHAPTER ONE

## Introduction

The first known ice hockey game was played in the harbour of Kingston, Ontario on Christmas Day in 1855. The participants, the Royal Canadian Rifles, used field hockey sticks, a lacrosse ball, and ice skates strapped to the base of their boots. The first organized or sanctioned competition occurred in Montreal in 1879. Written rules were constructed and in 1890, the Ontario Hockey Association, the parent of all hockey organizations, was formed in Toronto and the game rapidly spread across Canada (Mogan, 1990).

Today, ice hockey is often viewed as one of the fastest (Axtman, 1989; Hayes, 1975; Sproule, 1988) and most violent sports in the world (Bancroft, 1993; Mogan, 1990; Sim, Simonent, Melton, & Lehn, 1987), with a reputation for roughness and physical risk (Bernard, Trudel, Marcotte, & Boileau, 1993). According to Sim and Chao (1978), hockey is a game played with clubs (hockey sticks), knives (skates), and bullets (pucks).

Sutherland (1976) reported that hockey is not a game of stops and starts as the player does not stop in order to change direction, but simply leans into a turn. It was noted by Sim et al. (1987) that the player who is able to obtain maximal skating speed in the shortest possible time has a tremendous asset. Hayes (1972) indicated that many senior players skate in excess of 48 km/h, and Sim et al. found the skating velocities were more than 32 km/h even for 12 and 13 year old Pee Wee players.

The hockey puck, 6 oz of hard rubber, measures 7.6 cm in diameter and 2.5 cm in thickness (Bancroft, 1993). The puck can reach velocities of up to 192 km/h in professional hockey, 144 km/h in senior recreational, and more than 80 km/h in hockey played by 12 and

13 year olds (Daly, Sim, & Simonet, 1990). Sticks, currently made of wood, fiberglass, aluminium, or graphite composite, were observed by Sim and Chao (1978) to reach angular velocities of 20 to 40 rad/sec. This equates to 100 to 200 km/h assuming there is 1.4 m from stick centre of rotation to puck contact (Daly et al., 1990).

Continuous acceleration and gliding is performed on an ice surface of two basic configurations: the North American surface with tight corners and dimensions of 26 by 61 m, and the European surface with larger radius corners and larger dimensions of 30 by 60 m (Keating & Norris, 1993). The surface is enclosed by immovable wooden boards slightly higher than one metre with upward glass sections. The ice surface may be large, but when 10 players and two goaltenders are on the ice at one time, the ice surface is often not big enough to escape from the opposition. Stuart, Smith, Nieva, and Rock (1995) explain that the "potential for injury is due to speed, body contact, and unique equipment including skates, sticks, and the puck - factors that become more dangerous as players become bigger, stronger and faster" (p. 350).

Most players from 12 years of age to professional have a ruling to allow body checking with another player. In 1980, the Canadian Amatuer Hockey Association (CAHA) announced a national ruling that banned body checking in the Pee Wee division which, at this time, was played by 11 to 12 year olds. In 1985, the age classifications were changed and Pee Wee was increased from 11 and 12 to 12 and 13 years old. With the new age classification, the no body checking rule was reconsidered. The decision was made to introduce body checking at age 12 within the CAHA, and the rule went into effect for the 1985-86 season.

This new ruling brought about concern in some Provinces and after some serious consideration, the Quebec Ice Hockey Federation (QIHF) decided to disregard the ruling. This Federation applied pressure for the CAHA to follow, but the national organization refused to change the ruling (Roy, Bernard, Roy, & Marcotte, 1989). As a result, body checking is introduced at age 12 in Ontario, but postponed to age 14 in Quebec.

## Purpose

The main purpose of this research was to compare the rate of body checking injuries between two Provinces that introduce body checking at different ages (age 12 versus age 14). This research identified the physical characteristics of players and the position of individuals most likely to be injured from body checking, or to initiate a body check which could lead to an injury. This research created a profile of the types of injuries caused by body checking, and identified when these injuries were most likely to occur in respect to time of season, time during the game, and type of game.

## Hypotheses

It was hypothesized that introducing body checking at a later age and level of experience would result in a significantly higher rate of player injury. Research indicates that a great variation in physical size exists with 14 and 15 year old boys and they are significantly heavier than younger boys. Furthermore, skating is a learned fundamental skill in the game of ice hockey. Since the amount of force produced depends on mass and skating speed, older players should be capable of producing a greater amount of impact with collisions.

It was also hypothesized that lighter individuals are at greater risk of obtaining significantly more injuries due to body checking than heavier players. Light individuals are more vulnerable to impact injuries due to force produced by a heavy players. It was hypothesized that forwards are significantly smaller than defencemen, and for this same reason, they will receive significantly more body checking injuries.

Rationale for the Study

Tom Nease (personal communication, February, 1992) from the federal government's Fair Play Commission noted that registration for children entering hockey was at an all-time high. When examining the CAHA statistics for the past ten years (Appendix A), one notices that Ontario increased registration by 13,856 male, and 8,171 female players. In the 1995-96 hockey season, measures revealed that there were 30,645 registered male hockey teams, accounting for 482,987 players. In Ontario, there were 12,132 registered teams with an affiliation of 176,847 players (Appendix B).

When examining the various levels of play nationally (Appendix B), it is noticed that registration continues to increase until age 10 and 11 (Atom), and then the number of players registered starts to decrease. This statistic reveals that a large number of children are quitting hockey before the age of 12. In a study conducted by the CAHA, Moro (1990) noted that the primary reason for players dropping out of hockey was conflicting activities. A 1989 survey in the Alberta Amateur Hockey Association (AAHA) found that the primary reason was cost, followed by body contact, and perceived poor coaching. Lovering (1992) reveals that offering one type of hockey with body checking, and another without, has directly attributed to the decline of registration. Some players would rather quit than play without body checking, which is what they personally feel, an inferior brand of hockey.

Injuries sustained when players are in their early teens may affect them for the rest of their lives. At this stage of growth and development, puberty often accounts for great differences in height, weight, and strength. Contact sports increase the risk of serious accidents for individuals in the growth stage. Injuries involving the growth plate, for example, may cause permanent growth impairment and have serious lifelong consequences (Regnier et al., 1989; Brust, Leonard, Pheley, & Roberts, 1992; Lovering, 1992).

Past studies indicate that body checking accounts for the majority of all injuries (Bernard et al., 1993; Brust et al., 1992; Hayes, 1975; Lorentzon, Wedrèn, & Pietilä, 1988; McKnight, Ferrara, & Czerwinska, 1992; Ontario Ministry of Tourism and Recreation, 1990; OSMSAB, 1987; Pelletier, Montelpare, & Stark, 1993; Regnier et al., 1989; Rielly, 1982; Roy et al., 1989; Sim & Chao, 1978; Stuart & Smith, 1995; Tator & Edmonds, 1984; Tator, Edmonds, & Lapczak, 1993). Regnier et al. (1989) recorded that 88% of 25 fractures at the 12 and 13 year old level were related to body checking. In 1992, Calgary Minor Hockey concluded that 40% of the 149 injuries recorded were caused by body checking. Finally, Bernard et al. (1993) reported that body checking caused 46% of all minor injuries, and 75% of all major injuries, during two seasons at the 14 and 15 year old age level.

Past studies have shown that injury rates are higher in leagues permitting body checking versus those without checking (Ontario Ministry of Tourism and Recreation, 1990; OSMSAB, 1987; Regnier et al., 1989; Roy et al., 1989). The Ontario Ministry of Tourism and Recreation (1990) also found that the injury rate was more than twice as high for Representative teams than for House league teams. These studies, however, did not use a matched comparison sample. In neglecting to do so, these studies compared two different leagues which did not have the same talent level. Moreover, the stature of the players involved in injuries is not known. As recent as 1995, Stuart et al. recommended that future studies must begin to identify which players are at added risk of sustaining injuries and which players are at added risk of causing them to others.

In 1986, the Ontario Sport Medicine and Safety Advisory Board (OSMSAB) established the Hockey Injuries and Safety Review Committee as a result of increased public concern about injuries in hockey. The Committee challenged the government to recognise and accept hockey as an important part of community life in every region of Ontario. They suggested that the government should support efforts of dedicated individuals and specific organizations who are attempting to re-establish the true spirit and intent of the game (OSMSAB Vol.1, 1987). On January 13, 1987, the Minister of Tourism and Recreation announced initiatives to begin to build an environment in Ontario in which safety would become an integral part of amateur sport, fitness, and recreation (OSMSAB Vol.1, 1987).

The current study questioned whether the difference in body size, the age when body checking was introduced, or a combination of both were associated with the large number of body checking injuries in minor hockey. This research was valuable as the findings from a study of this magnitude may eventually lead to rule adaptations, which may result in decreased incidence of injury.

## Definition of Terms

Body Check: A legal separation of the puck carrier from the puck by physical contact which is allowed in all areas of the ice and may occur while travelling in opposite directions (Canadian Amatuer Hockey Association Coaching Committee, 1991).

Body Contact: Contact which results from movement of the puck carrier, but not including action where the puck carrier is pushed, checked or shoved into the boards (Canadian Amatuer Hockey Association Coaching Committee, 1991).

Injury: A disability, trauma or disorder that is ice hockey related which causes a change in the normal, healthy state of an individual and requires medical attention from a trainer and/or medical doctor (adapted from Brust et al., 1992; Hayes, 1975, 1978; Manton & Bishop, 1987).

Injury Rate: "In order for a count to be descriptive of a group it must be seen in proportion to it; ie., it must be divided by the total number in the group" (Friedman,. 1980, p.9). He added that certain kinds of proportions are often referred to as rates. Injury rate, for the purpose of this research, is represented by the number of injuries per person per season. It may also be referred to as injury incidence rate per season.

## Limitations

Arena: It was assumed that the teams all played in the exact same conditions with regards to the arena (i.e. quality and type of ice, the size of the ice surface, the design of boards, nets and glass).

Data collection: Since this study involved hockey teams across two Provinces, it was not feasible for the injuries to be recorded by the same individual. Hence, an Injury Report Form (Appendix C) was distributed and data collection depended entirely on the cooperation and accuracy of the coaching staff.

Definition of a body check: Body contact may have been confused by some recorders for body checking which would affect data collection.

Definition of an injury: It is difficult to compare past epidemiological studies as there is no one accepted definition of a hockey injury (Canadian Academy of Sports Medicine, 1991; Daly et al., 1990; Gilder & Grogan, 1993; Mogan, 1990; Stuart & Smith, 1995; Stuart et al., 1995). The fact that an injury is defined differently by some recorders may have posed problems.

Equipment: Both quantity and quality of equipment worn by the players was assumed to be equal.

Measure of severity: This variable partially involved a subjective measure from the coaching staff accounting for how much pain and discomfort was experienced by the player at the time of the injury.

Medical treatment: It was assumed all teams had the same availability and quality of immediate treatment by means of a certified trainer.

Philosophy: Since all teams were of the same calibre, it was assumed that the philosophies, attitudes, and styles of all parents, coaches, and trainers were equivalent between the two Provinces.

Reporting of injuries: Dedicated and determined players at the highest calibre of minor hockey may not have reported an injury to the coaching staff in fear of it affecting their playing time.

Warm-up: To prevent an injury, it was assumed all teams had the same duration to warm-up and properly stretch appropriate muscles before a contest.

## Delimitations

All teams were selected from the highest calibre of hockey in Ontario and Quebec in order to have teams as equally matched as possible in regards to the talent level, and thus, intensity of games. This study was restricted to children ranging from 10 to 15 years of age as of December 31, 1992. The sample used approximately 100 male hockey players at each of the 10 and 11, 12 and 13, and 14 and 15 year old age classifications.

Observations were delimited to games from August 1993 to April 1994, and recording began once the entire team had been selected. Teams were selected to participate in the study if they played a minimum of 60 games, but not more than 75 games. Recorded injuries were those obtained only from ice hockey, or ice hockey related participation during game play. Communication was restricted to the English language for this study.

# CHAPTER TWO

## Review of Related Literature

In the 1989 Manual of Operations for the Ontario Minor Hockey Association (OMHA), it was stated that "now the 'Largest Minor Hockey Organization in the World' is the result of many years of hard work by men sincerely interested in the welfare of the boys in Ontario, and in the game of Hockey, Canada's National Winter Sport" (OMHA Manual of Operations, 1989, p. 6). Although in 1867 lacrosse was named Canada's national sport, hockey was born in Canada, nurtured here, and has grown here (Sutherland, 1976). Gilbert, Gingras, and Trudel (1995) used the analogy that if baseball is America's pastime, hockey is its counterpart in Canada. Hockey has now grown so much and gained such popularity that many, including the OMHA and Sproule (1988), refer to it as Canada's national sport.

In spite of this tremendous popularity among Canadians, hockey has, and continues to have problems. It is important to report what has happened in regards to body checking rules in our country over the past few years. This review of literature explains the background to this controversial issue, information about growth spurts of boys during puberty, and the effects this has on the sport and related rulings. This review will also compile information on body checking injuries in respect to when they happen, and who is getting injured.

### Historical Background of Body Checking in Canada

In 1980, the CAHA announced a ruling that banned body checking in the Pee Wee division which, at this time, was played by 11 to 12 year old players. Regnier et al. (1989) outlined that the following were the main arguments in favour of the ruling: (a) learning of technical skills is hindered due to fear of being hurt from a body check; (b) danger of injuries is increased due to major differences in height, weight, and skills; (c) the presence of larger players creates fear and discourages smaller players from participating; and (d) coaches do not possess the knowledge, nor have the time necessary to teach the skill of body checking.

In 1985, the CAHA raised all age groups by one year making Pee Wee the present 12 and 13 year old category. With this new age classification, the no body checking rule was reconsidered. The decision was made to permit checking at the 12 and 13 year old level, and the rule went into effect for the 1985-86 season.

A continuous process for hockey authorities, researchers, and the public has been to try and improve player safety (Sim & Simonet, 1988; Sullivan 1990; Watson, Singer, & Sproule, 1996). As a result of increased public concern surrounding injuries in hockey, the OSMSAB established the Hockey Injuries and Safety Review Committee in 1986. Reports received by this Committee addressed the need to 'clean up' the game, and make it 'safer for kids to play'. Most criticism related to deliberate acts of intimidation, aggressive use of the stick, and excessive body contact which were viewed as tactics which were becoming an acceptable part of amateur hockey. Before the committee was even formed, the OSMSAB received a letter signed by more than 300 parents, coaches, and players, saying that permissive body contact had a negative effect on the development of life skills and positive attitudes by young people. One of the main issues illustrated from the group's concern was that "the adjustments in CAHA age groupings exposed younger hockey players to body contact before they were physically and mentally prepared; this increased the risk of injury to smaller boys who lack physical strength and, possibly the technical skills to compete on equal terms with bigger boys" (OSMSAB Vol.2, 1987, p. 99).

Michael Smith (as cited in OSMSAB Vol.2, 1987) of York University informed the Hockey Injuries and Safety Review Committee about kinds of violent behaviour. They range on a scale of legitimacy from acts within the rules of a particular sport, to acts that are clearly criminal. One of these latter kinds of behaviour, according to Smith, is brutal body contact. He revealed that characteristics of this behaviour are: (a) generally accepted within the rules of play; (b) the most frequent form of violent behaviour; and (c) can result in considerable damage to the body (OSMSAB Vol.2, 1987).

If body contact is taken beyond what is required to play effectively, it begins to take on a life of its own. One of these costs, Smith (as cited in OSMSAB Vol.2, 1987) explained, is an inevitable increase in the rate of injuries. He concluded that "while violence may not figure quite as strongly as accidents in producing injuries, research strongly suggests that brutal body contact...greatly increase the probability of injuries" (p. 102).

When the CAHA introduced body checking at age 12 in 1985, it was questioned by the province of Quebec because of the dangers that are present when players of different sizes engage in body checking (Roy et al., 1989). Following the results of several studies (which were supported by the Quebec Sport Safety Board), the QIHF eventually decided to disregard the ruling. These studies investigated differences in anthropometric and biomechanical parameters, and compared incidence and type of injuries obtained in leagues permitting body checking and those that did not.

Investigating the incidence of injury with players age 12 and 13, Roy et al. (1989) recorded four times more injuries among teams that allowed body checking. In leagues allowing body checking, 55.5% ($\underline{n}$ = 30) of all injuries were caused by an opponent, whereas in leagues without body checking, the corresponding figure was only 18.8% of 16 injuries. It was also revealed that of the 25 fractures that occurred, 20 were sustained by players receiving a body check and two by players giving one (three were not caused by body checking). The number of injuries caused by an opponent was ten times greater in the checking leagues and was greater than all other causes of injury combined (Roy et al., 1989). This finding is somewhat misleading as the study compared teams that were of low calibre where a great variation in playing ability is often evident. Secondly, the researchers observed a different number of games for the two leagues. Finally, the games were observed in the latter part of the season and in playoffs when the intensity would likely be much higher.

It was not until 1993, when Bernard et al. performed a similar study at the Bantam level (14 and 15 years old) in Quebec, that great variations were found with the older age group. Differences in height and weight ranged 41 cm and 48 kg respectively for boys playing against one another. As well, body checking caused 46% of minor injuries, and accounted for 75% of the major physical trauma.

## Growth and Development

Safety of young hockey players is relative to their individual height, weight, chronological age, and skeletal age (Beunen, Ostyn, Simons, Renson, & VanGerven, 1981). In the study by Beunen et al., they found that skeletal age explains a far larger part of most body dimensions than chronological age for boys between 12 and 19 years. These researchers were convinced that in the age range of 13 to 16 years, age-maturity categories instead of a classification based on chronological age would lead to fairer competition in youth sports. They believed that age-maturity classification could probably eliminate problems for the young competitors, regardless of whether they are early or late maturers.

An age-maturity category would require individuals to be equated by bone, or skeletal age. This is possible since the skeleton continues its maturity development throughout the entire period of growth. X-rays of bones in the hand and wrist presently provide the primary basis for assessing the skeletal maturity in the developing child (Malina & Bouchard, 1991).

Malina and Bouchard (1991) found that statural growth occurred at a constant decelerating rate during childhood. It was apparent that the rate reached its lowest at the age of 12, just before initiation of the adolescent spurt. At this time the rate accelerated quite rapidly for a couple of years, and then started to drop off again (see Figure 1).

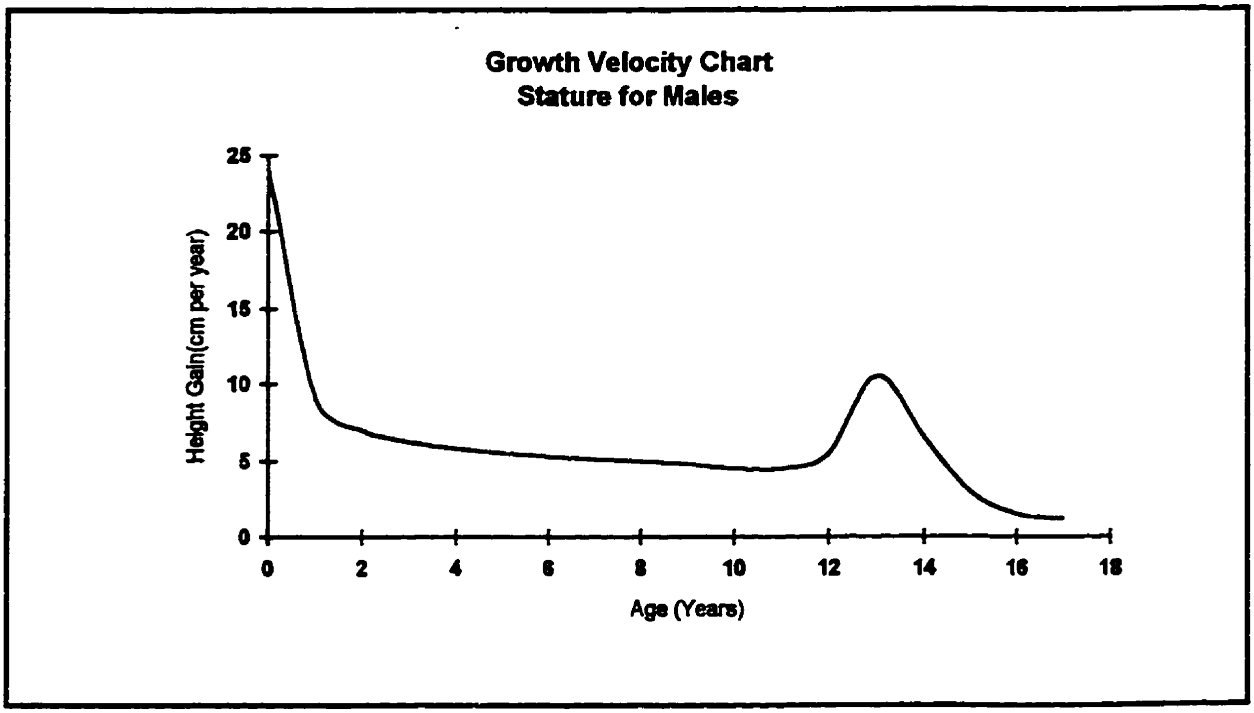


**Figure 1.** Male Growth Velocity Chart of Height
**Note.** From "Growth, maturation, and physical activity" by Malina and Bouchard, 1991, Champaign, IL: Human Kinetics.

It was also found by Malina and Bouchard (1991) that weight growth occurred at a constantly accelerating rate, except for an early childhood decrease. Again at the age of 12, the rate escalated for a couple of years before dropping back off (see Figure 2).

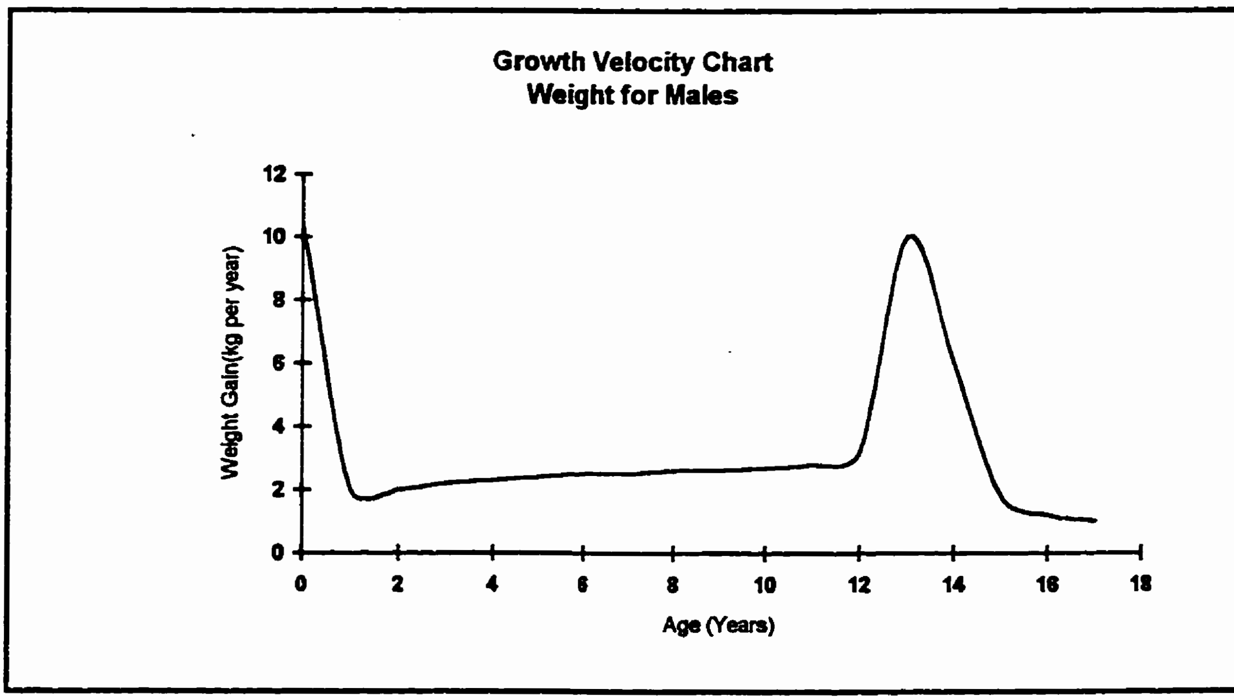


**Figure 2.** Male Growth Velocity Chart of Weight
**Note.** From "Growth, maturation, and physical activity" by Malina and Bouchard, 1991, Champaign, IL: Human Kinetics.

During the adolescent growth spurt, the rates of both height and weight increase or accelerate. Dyment (1989) noted that there was a wide variation of size at the time which boys entered puberty. This is the same time frame when children are first being introduced to body checking.

Between the ages of 12 and 13 years, boys are at many different stages of physical development (Marshall & Tanner, 1970). Regnier et al. (1989) discovered that an analysis of the human growth curve indicated an accelerated period of growth between the ages of 12 and 14. The Canadian Academy of Sports Medicine (CASM) (1991) revealed that large variability in player size in the 12 to 15 year old age group, and the reality of injuries as a result of body checking, makes it inappropriate to have full body contact at these ages in any category of hockey. They added that "pee wee (ages 12-13) hockey coincides with a peak growth spurt and increased risk of injury. There should be no intentional body contact at this age" (p. 142).

Rarick and Seefeldt (as cited in Regnier et al., 1989) and Dyment (1989) reported that a group of 13 year old boys can have a skeletal age that varies by as much as five years, and weight that varies by 45 kilograms. Regnier et al. (1989) found that on the average, the biggest players at this age are two times heavier, two times stronger, and 30 cm taller.

Roy et al. (1989) found that there was a 100% difference in grip strength between the largest and smallest boys playing at the 12 and 13 year old level simultaneously. They added that grip strength is indicative of a person's overall strength.

It has become apparent from researchers recording physical characteristics of many age levels that the most variation often occurs when players are in higher age levels. Brust et al. (1992) recorded in their study of 13 to 15 year olds, a difference of 55 cm and 53 kg from the smallest and largest players. More recently Stuart et al. (1995) performed preseason screening tests on their subjects and discovered large variations in height and weight, especially among players who were ages 13 and 14. Bernard et al. (1993) found height and weight differences ranging 41 cm and 48 kg respectively for 14 and 15 year old players, and tested a 200% difference in grip strength between the smallest and largest players. It was concluded that "large discrepancies between the players .... indicate a high risk of injury at the

Bantam level [14 and 15 year old] where body checking is permitted. Consequences associated with those injuries could have unfortunate sequels because players at that age are in a critical phase of their growth" (p. 54).

Impact Resulting in Injury

It was noted that injuries obtained in ice hockey are an area that has been accepted, and which one must accept if he/she chooses to participate in the game (Hayes, 1978). Blanchard and Castaldi (1991) agree, and add that in fast-moving contact sports such as hockey, injuries are bound to occur despite all efforts of prevention.

Several researchers have noted that the incidence and severity of injury increases with the player's age and skill. Injuries are lowest in the youngest age groups, increasing to a maximum in the older teens and young adults, before decreasing again in recreation and oldtimer leagues (CASM, 1991; Hayes 1978; Ontario Ministry of Tourism and Recreation, 1990; Sproule, 1988; Stuart et al., 1995).

Hockey is a game involving impact extremes with blows ranging from the high velocity-low mass type, as a puck or stick, to the high mass-low velocity blow which comes from body contact (Hayes, 1978). Combining these types of blows with the great speed of the game within a confined ice surface, the probability of an injury happening is very great. The two types of impact, high velocity-low mass and high mass-low velocity, distinguish the kinds of injuries that will result from each. Low mass objects often tend to cause bruises, lacerations, or concussions, whereas the larger mass impacts result in fractures and ligamentous damage (Sutherland, 1976).

It was noted by Sutherland (1976) that the severity of injury which results from contact can be decreased, if the impact is distributed over a large area and absorbed as much as possible. With this being true, a larger child can absorb more of an impact than a smaller one. To support this theory, Brust et al. (1992) found that injured players between ages 9 and 15 had a mean weight of 51 kg in comparison with uninjured players whose mean weight was 63 kg. Further, Dyment (1989) noted that a lighter and slower athlete is less susceptible to serious injury when colliding with someone of similar stature.

Sutherland (1976) reported many hockey injuries result from impact, and impact is the product of mass and speed. Reference was made to Newton's second law stating that force equals mass times acceleration (or mass times velocity divided by time, where time may be considered as the duration of impact). Since larger children have a greater mass, they are able to produce more of a force than a player of a smaller frame. One could infer larger players within the same age level are likely to cause body checking injuries. Thus, a lighter child playing against a significantly heavier child is at a disadvantage in the physical element, and could potentially be the recipient of a dangerous impact.

Regnier et al. (1989) found that larger players in the 12 and 13 year old level had a 70% greater impact force than the smaller players. More recently, Bernard et al. (1993) discovered a difference of 150% in the force of impact between the two extreme statures. The same measurements were taken for 14 and 15 year old players by Bernard et al., and an escalated 357% difference in the force of impact during body checking was discovered between the strongest and weakest players. This was related to both size variation, and the difference of 2.3 m/sec skating speed between the slowest and fastest skaters.

## Who Gets Injured

Forwards penetrate deep into both zones giving some explanation as to why forwards experience a higher incidence of injury than defencemen. Also, since there are three forwards, two defencemen and one goaltender, one would expect forwards to have a higher incidence of injury (Hayes, 1975). Forwards have been found to obtain about 56% to 70% of injuries (Pelletier et al., 1993), and defencemen 30% to 38% (Benton et al., 1983; Brust et al., 1992; Calgary Minor Hockey, 1992; Hayes, 1975; McKnight et al., 1992). A pilot study conducted with the Thunder Bay Amatuer Hockey Association indicated forwards obtained 67.6% of the 71 injuries, defencemen recorded 25.4%, and goalies 7%. Finke et al. (1988) discovered that forwards acquired 72.5% of the injuries (n = 44), and of these, 55% were obtained while on offence.

On the contrary, Bancroft (1993) found that defencemen were most likely to sustain an injury with 58% of all recorded, and forwards only 37%. Similar findings were projected by Lorentzon et al. (1988) and Pettersson and Lorentzon (1993) who also found the defence position to be at highest risk. Bancroft admitted that the contrast may be due to the small number of injuries (n = 19) in his study and the study conducted by Lorentzon et al. (n = 95).

## Profile of Hockey Injuries

A profile of an injury involves when the injury takes place, as well as the type, location, and severity of the injury. Studies concerning when injuries take place involve three areas. These include timing in the season, which period within the game, and whether the injury occurred during a practice or game.

Season

Hayes (1975, 1978) and Benton et al. (1983) noted that the risk of injury is higher in early months and decreases as the season continues. The reasons they gave for this conclusion were: poor conditioning, players overworking in order to make the team, new systems, new teammates, playing unfamiliar positions, and poor or inadequate equipment. Benton et al. explained competition for playoff positions resulted in a higher incidence at the end of the second half of the season.

Stuart and Smith (1995) condensed the hockey season into thirds. They found the practice injury rate was significantly higher in the first third than in the final two thirds of the season. No difference was found in the injury rate of games in each third of season.

Period

In addition to seasonal differences, concerns regarding the time of injury during the game have been investigated. Brust et al. (1992) and Lorentzon et al. (1988) found that injuries increased as the game progressed with 14%, 25%, and 45%, and 27%, 30%, and 36% respectively through the three periods. Hayes (1975) recorded that significantly fewer injuries occurred in the first period (25%) as opposed to the second (37%) and third (37%) periods of a game. Similarly, Stuart and Smith (1995) found the game injury rate was higher in the third (135 per 1000 hours) versus the first and second periods (75 per 1000 hours). Rationales for the higher injury rate in the third period included both fatigue and aggression.

On the contrary, both Tegner and Lorentzon (1991) and Pelletier et al. (1993) found a higher injury percentage in the second period. The same trend was reported with both researchers as the most injuries (38% and 36%, respectively) happened in the second period, and the fewest injuries occurred (28% and 27%, respectively) in the third period.

Type of Ice Session

The type of ice session incorporates either a game or practice situation. Findings are very consistent in that the majority of injuries (from 58% to 88%) occur during games (Brust et al., 1992; Finke et al., 1988; Lorentzon et al., 1988; McKnight et al., 1992; Ontario Ministry of Tourism and Recreation, 1989; OSMSAB Vol.2, 1987; Pettersson & Lorentzon, 1993; Stuart & Smith, 1995; Tegner & Lorentzon; 1991). An explanation for this finding is simply that intensity increases between opposing teams during game situations which is either absent or diminished during practice sessions (Sproule, 1988).

The OSMSAB found that 88% of the 92,000 recorded injuries for minor hockey throughout Canada occurred during competition and only 8% during practice (OSMSAB vol. 2, 1987). The specific age levels of this study had 76% (n = 70), 88% (n = 123), and 75% (n = 250) of injuries occur during games for 10 and 11, 12 and 13, and 14 and 15 years old respectively (Ontario Ministry of Tourism and Recreation, 1989). Finally, Brust et al. (1992) discovered that 79% of 52 injuries, to players aged 9 to 15, were in games. They revealed practice injuries were only of minimal (player kept from physical activity for 1 day or less) or minor (player kept from physical activity for 2 to 7 days) severity, and required no professional medical care.

Treatment of Injuries

In April 1985, the OSMSAB was established to advise on safety in amateur sport, personal fitness, and physical recreation. The Board was to investigate and recommend the means by which all participants in sport, fitness, and recreation may work to reduce the number of injuries in those activities. In 1986, the OSMSAB found that the 494,000 participants in minor hockey ranked second largest for those involved in any one particular sport. Registering with 92,000 injuries, the sport of hockey ranked first as the largest single generator of injuries in the survey (OSMSAB Vol.2, 1987).

Injuries require time, care, and often money to heal. Of the 92,000 hockey injuries, two-thirds of the participants needed some form of medical treatment. For children in minor hockey, 68% received treatment at the hospital emergency department. Visits to a physician and the purchase of medical supplies were the next most common forms of treatment. The Ontario Ministry of Tourism and Recreation (1990) concluded from their study that in Ontario, 134 injuries in the 12 and 13 year old division alone resulted in 10% of the players spending time in the hospital. These players averaged 1.14 nights in the hospital.

Lost productivity must also be accounted for in the significance of an injury. This is necessary as some players may be injured, but refrain from getting medical treatment. About two-thirds of the 92,000 injured children returned to their regular activities immediately after sustaining their injury, but 4% were forced to take 3 weeks or more off from school (OSMSAB Vol.1, 1987). Similarly, the Ontario Ministry of Tourism and Recreation (1990) found 29% of the injuries sustained with 12 and 13 year old players in Ontario resulted in an average 3.19 days lost from school.

Cost of Injuries

The average cost of a minor hockey injury in 1986 totalled $455. Most of this expense was from hospital costs (52%) and the cost of Sports Medicine clinics (31%).

Treatment costs varied for both the type of injury and the part of the body that was injured. For example, the average cost to treat a sprain was $1,091 whereas inflammations cost only $151. Similarly, the average cost to treat an injured knee was $794, as opposed to an arm costing an average of $162 (OSMSAB Vol.2, 1987).

The 1986 annual cost of medical services was calculated solely for minor hockey in Ontario and totalled $130,764,000 (OSMSAB Vol.2, 1987). When this magnitude of money is being spent on health care, due to a high incidence of injury, there is a definite reason to decrease the occurrence. "Even a 10 percent reduction in injuries would result in a significant savings to the public purse" (OSMSAB Vol.1, 1987, p. 23). This statement magnifies the financial need for a study such as this.

The OSMSAB (1987) noted that the economic cost of a sport injury involves far more than simply money. A summary has been displayed in Figure 3 to explain the various aspects to consider when calculating the cost of any injury.

## Alternatives to Elimination of Body Checking

Much concern still remains on the debatable issue of when to introduce body checking in hockey in Canada. A report by Robson in 1991 indicated that within the CAHA, there was a situation where one-half of the branch members voted to support the introduction of body checking at age 12, and one-half wanted to increase the age of introduction. Lovering (1992), and more recently a manager within the CAHA, Jamie McDonald, informed the author personally that this stalemate still exists (Personal Communication, February, 1993).

The fact that injuries result from body checking is not debatable. Children who are participating are still getting injured, and something needs to be done.

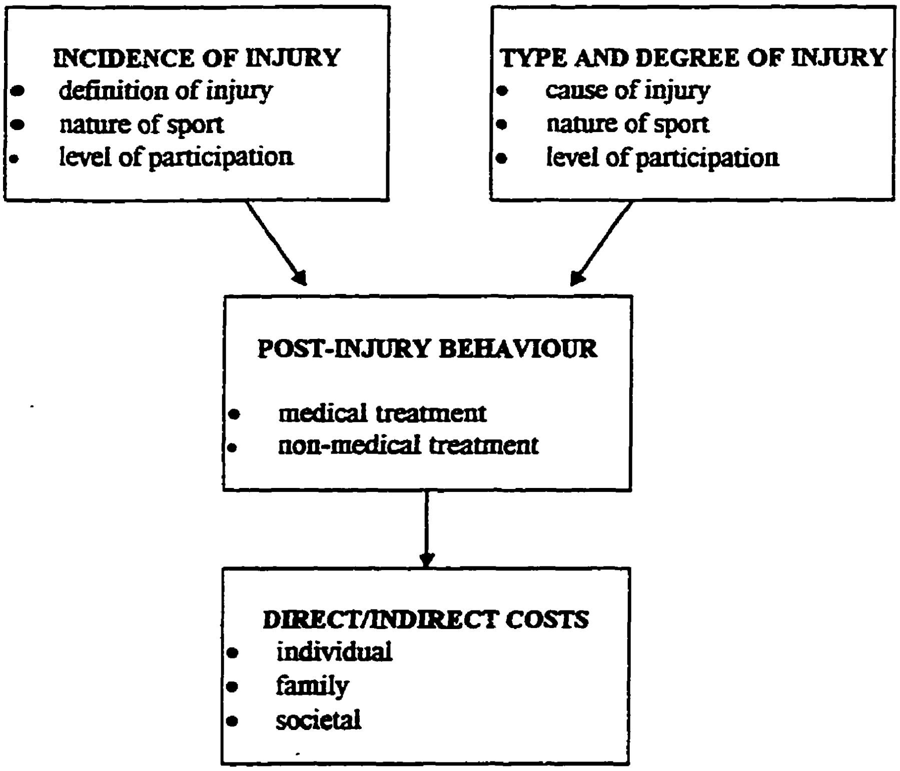


**Figure 3.** Cost of a Sport Injury
**Note.** From "The report and recommendations on safety in amateur sport, personal fitness and physical recreation in Ontario" by OSMSAB, 1987, Ontario: Ministry of Tourism and Recreation.

New Divisions

The CASM supplied a position statement about the issue of violence in the game of ice hockey and its impact on player safety. They suggested eliminating body checking from hockey that is not designed as a training program for professional ranks (Sullivan, 1990). If this were followed, body checking would be eliminated from all levels in the recreational or house leagues, but the representative or all-star teams would continue to institute training in body checking at an appropriate age level. Cunningham (1979) reported that at 9 years of age, young boys begin to be assigned to either the all-star stream or the house leagues.

Conditioning

An area that is often overlooked is the relationship between conditioning and injuries of hockey players. As a physiotherapist, Axtman (1989) commented that preseason training should be a mandatory part of every teams' plan to help prevent injury and aid in the recovery after an injury. Bancroft (1993) stated that a proper physical training program should be supervised and is essential to ensure a strong body capable of producing and absorbing force.

One study by Gilder and Grogan (1993) took many training recommendations and applied them to their investigation of assessing the effects of strength and conditioning in relation to hockey injuries. Seven players were put on a structured twelve-week off-season program. Although there were twice as many players in the nonprogram group, they had three times the injuries. The researchers concluded that the training program increased the integrity of the joints and the durability of the muscles which helped to absorb physical contact, and thus, reduce the number of injuries and the amount of time out from injuries.

Improved Coaching

Trudel and Côté (1996) studied the behaviours of youth ice hockey coaches during games. It was found that at the 14 and 15 year old level, coaches spent over half the time simply observing, without interacting with players. Only about 11% of game time was devoted to teaching skills which included giving information, positive evaluation, and negative evaluation of performance. They noted of particular concern with these findings was the fact that so little teaching occurs during games, while the ratio of games to practice is high and skill level is low.

The AAHA felt that coaches in Canada have almost totally avoided the transferable skill of giving or taking a body check. This association believed the best approach to the body checking rule situation was to develop a supplementary coaches course aimed specifically at all coaches gaining body checking levels.

In a survey performed in the United States, it was found that only two-thirds of Pee Wee (age 11 through 13) and Bantam (ages 13 through 15) players ($\underline{n}$ = 90) received instructions in giving and taking checks (Brust et al., 1992). In 1988, 78% of 14 and 15 year old players ($\underline{n}$ = 302) in the Metropolitan Toronto Hockey League responded to a questionnaire revealing that their coach had instructed them how to take a hit on the boards, and how to deliver a check. However, 80% still felt that a special clinic on body checking would be useful (Gardner, 1988). As well, Moro (1990) discovered from a survey of minor hockey players from ages 10 to 15 ($\underline{n}$ = 205) that the large majority of players have been taught, or at least know, the defensive skills of body checking including angling (78%), puck protection (97%), pinning (90%), read and react (92%), taking a hit (97%), and gap control (71%).

Blanchard and Castaldi (1991) revealed that coaching skills have now improved so players are being taught how to 'take and give a hit', and 'stay out of trouble along the boards'. Lovering (1992) indicated that the Hockey Development Council has part of a mandate to put more emphasis on both effective coaching and referee development. Several instructional videos are now available to aid the coach in teaching the skill of checking. The International Hockey Centre of Excellence in Calgary, Alberta has produced two videos: one is titled 'Body Checking' and the second is titled 'Beginning Checking'. The CAHA Coaching Committee have also produced a video for the National Coaching Certification

Program on the instruction of checking skills.

Fair-Play

Based partly on the work of Vaz in 1979, a fair-play concept was developed to include sportsmanship in the final standings of a competition. Vaz believed that increasing penalties was not effective in curtailing violence in hockey, but the use of sportsmanship worked more effectively. Competing teams have points added to the game total for staying under a certain preestablished limit of team penalties. Also, individuals who exceeded the allotted limit can be suspended from future games. Furthermore, coaches can also be suspended if their team is regularly penalized for illegal play (Marcott & Simard, 1993).

Teams that have played under fair-play rules in Quebec have averaged 1.2 less injuries per game, compared to those without the fair-play (Marcott & Simard, 1993). In university intramurals, Gilbert, Trudel, and Bloom (1995) gave each team six behaviour points at the start at every game. Each minor or major penalty resulted in the loss of one point until the team exceeded the set limit. In a tournament, Roberts, Brust, Leonard, and Herbert (1996) used fair-play rules and found the ratio of fair-play to regular-rules injuries was 1:4.8.

Gradual Progression

The AAHA Referees Committee (1984) believed most injuries from body checking occur when the player is checked into the boards, and seldom result from 'open-ice' hits. Therefore, the gradual progression recommended by them is to permit only open-ice checking at the 12 and 13 year old level and postpone full body checking on the entire ice surface until age 14 (AAHA Referees Committee, 1984).

The CASM believes serious injuries do not begin until age 12 and 13, and for this reason, full body checking should not be introduced until 16 and 17. They feel that a coach should begin teaching fundamentals in the 14 and 15 year old level (Sullivan, 1990).

The CAHA Coaching Committee (1991) stated in a position paper that "body checking should be removed from the Pee Wee category (12-13 years) and replaced with a 'body contact' rule. Body checking should be re-introduced at the Bantam category (14-15 years)" (p. 1). The committee believed that a sudden change from no body checking to full contact through one division may result in an increased risk of serious injury. Body contact permitted a player to legally block or stop the progression of the offensive puck carrier. They could not hit the offensive player by going in the opposite direction, so the contact must be the result of the puck carrier. Body checking was classified as the legal separation of the puck carrier from the puck through physical contact. It was permitted on all areas of the ice and collisions in opposite directions were legal. In other words, the contact did not need to be the result of the puck carrier. The CAHA Coaching Committee speculated that the game would improve significantly with the removal of body checking and a replacement of body contact at age 12 and 13. The committee concluded that improvements would occur in the areas of safety, fun, skill development, and long term participation.

A gradual progression of introducing contact, and moving toward checking, is what the minor hockey players of Calgary Minor Hockey indicated they would prefer. Moro (1990) found that after watching an instructional video on the issue, "the majority of players believe that body contact should be introduced at the novice [age 8 and 9] and atom [age 10 and 11] levels ... body checking should be introduced at the pee wee level [age 12 and 13]" (p. 24).

## Summary

Hockey is an extremely important sport in the lives of many individuals in Canada, and over the past decade, the number of participants registering in hockey has continued to increase (see Appendix A). When the CAHA adjusted the age classifications in 1985 to allow players 12 and 13 years old to body check, some concern was raised. It has been a common finding that at age 12, boys enter a period of accelerated growth and greater variations of height and weight exist (Dyment, 1989; Malina & Bouchard, 1991; Regnier et al., 1989).

Many injuries occur from body checking. The impact is produced from the force of the players colliding, which is the product of mass and speed (Sutherland, 1976). Since larger players have greater mass and are able to produce more force than players of a smaller frame in the same age level, one can speculate who is at greater risk of incurring an injury from body checking. The result is that players are getting injured in hockey. In 1986, the annual cost of medical services in Ontario to treat injuries in hockey totalled $130,764,000. When this amount of money is being spent on something that could be decreased, the importance of this study is increased.

Several researchers have found that the incidence and severity of injuries increases with age and skill (CASM, 1991; Hayes 1978; Ontario Ministry of Tourism and Recreation, 1990; Sproule, 1988; Stuart et al., 1995). Others found that when players are permitted to body check, this accounts for the majority of all injuries (Bernard et al., 1993; Brust et al., 1992; Hayes, 1975; McKnight et al., 1992; Ontario Ministry of Tourism and Recreation, 1990; OSMSAB, 1987; Pelletier et al., 1993; Regnier et al., 1989; Rielly, 1982; Roy et al., 1989; Sim & Chao, 1978; Stuart & Smith, 1995; Tator & Edmonds, 1984; Tator et al., 1993).

A controversy still exists as to the ideal time to introduce body checking. Several ideas have been supplied to alleviate the body checking problem, but the dilemma has not been solved. The idea of better conditioning, creating new divisions, improving coaching, and gradually introducing body checking have been reviewed in this literature.

Hockey is viewed as one of the fastest and most violent sports in the world with a reputation for roughness and physical risk. Some believe participants must accept the risk of injuries in ice hockey as they are bound to occur. Nonetheless, a slight reduction in the number of injuries would equate to less discomfort for the injured player, and a significant savings to the public tax payer.

# CHAPTER THREE

## Methodology

### Purpose

The main purpose of this research was to compare the rate of body checking injuries between two Provinces that introduce body checking at different ages (age 12 versus age 14). This research identified the physical characteristics of players and the position of individuals most likely to be injured from body checking, or to initiate a body check which could lead to injury. This research created a profile of the types of injuries caused by body checking, and identified when these injuries were most likely to occur in respect to time of season, time during the game, and type of game.

### Participants

The CAHA was approached in order to obtain contacts within Ontario and Quebec. An invitation was sent to teams of the highest calibre of minor hockey in Ontario which is labelled 'AAA', and 'AA' in Quebec. This was matched in order to get a sample with approximately the same number of games, practices, training, and most importantly, perceived intensity within the games. Further, it was expected that players within the same calibre would be of similar talent and would thus, enable comparisons.

Three teams in Ontario and three teams in Quebec were used in each of the 10 and 11, 12 and 13, and 14 and 15 year old age levels. Thus, the current study incorporated 18 teams each made up of approximately 17 players each. The total sample consisted of 294 players (see Table 1). The participants were involved in the study for one full hockey season, from August of 1993 to April of 1994.

**Table 1**
Number of Participants in Each Province and Level

| | Age Level | | | Overall |
|---|---|---|---|---|
| | 10 and 11 | 12 and 13 | 14 and 15 | |
| Ontario | 49 | 46 | 50 | 145 |
| Quebec | 48 | 49 | 52 | 149 |

## Instruments

An Injury Report Form (Appendix C) was used as the means of data collection. The Injury Report Form (adapted from the Ontario Hockey Development Centre) was a check list requiring the observer to simply check off or circle the appropriate answer concerning each criteria. The variables included in the Injury Report Form were name, date, type of ice session, period within game, cause, type, location, and severity of injury.

The forms were designed to enable simple, yet detailed injury reporting. Completion of an Injury Report Form required approximately one minute per injury. Brust et al. (1992) noted in their study that injury reports were reliable since there was little variation with injury information provided by different recorders.

## Procedures

Verbal consent was received from the president of each region permitting the recruitment of individual teams. With their approval, the names and phone numbers of prospective coaching staffs within their jurisdiction were then provided. A cover letter (Appendix D) was sent to the president of each league explaining the study.

Initial telephone contact was made with each coach on each team to introduce the researcher, describe the study, and evaluate the coaches interest and cooperation level. This conversation was also used to relay full, proper instructions on when, why, and how to complete the Injury Report Form. It was recommended that an Injury Report Form be completed after each game to indicate whether an injury occurred or not. It was hoped that this procedure would increase the consistency as recorders would 'get in the habit' of completing forms. Every time a player was injured, regardless of the severity, the Injury Report Form was to be completed thoroughly.

Following this conversation, a package was sent to interested teams to provide the specifics of the study. Enclosed in this package was a cover letter to the coaching staff (Appendix E), a consent form (Appendix F), a player profile sheet (Appendix G), a phone list, numerous Injury Report Forms, an exposure to injury form (Appendix H), and two self-addressed stamped envelopes.

Similar to the Manton and Bishop study (1987), 25 hockey Injury Report Forms were originally sent for the trainer (or other qualified personnel) to complete for each game injury. A survey of the Metropolitan Toronto Hockey League found that 78% of the 302, 14 and 15 year old respondents had a qualified trainer with the team (Gardner, 1988). All teams in this study had a certified or qualified trainer as the current study dealt with teams in the highest calibre of minor hockey in both Ontario and Quebec.

The coaching staff first returned the consent, player profiles, and phone list. The player profile sheet requested information including the size in terms of height and weight, as well as date of birth and position. Mid-way through the season, the exposure to injury form, as well as the completed Injury Report Forms were collected. The exposure form was used to verify the number of games, practices, and pre-season training, again to keep the sample as closely matched as possible.

The Injury Report Forms were returned in the mail twice; one shipment was mid-way through the season, and the remainder of reports upon completion of their playing year. This procedure also followed Manton and Bishop (1987) as completed report cards were collected both in November and at the end of each team's season with self-addressed envelopes.

After reception of the first group of report forms, a thank you letter was sent to the coaching staff for their participation, along with more report forms and a third self-addressed stamped envelope. Manton and Bishop (1987) encouraged the teams to obtain extra report cards as needed throughout the season. However, it was felt that this responsibility should not be that of the participants but of the researcher.

The current research was restricted to games due to the consistent finding that the majority of injuries (from 58% to 88%) occur during games (Brust et al., 1992; Finke et al., 1988; Lorentzon et al., 1988; McKnight et al., 1992; Ontario Ministry of Tourism and Recreation, 1989; OSMSAB Vol.2, 1987; Pettersson & Lorentzon, 1993; Stuart & Smith, 1995; Tegner & Lorentzon; 1991). It was hoped that this limitation would again increase the consistency of completing Injury Report Forms as it would be less tedious for the recorders to concentrate on only games rather than every time the players step on the ice.

<u>Pilot Study</u>

A pilot study was conducted with six 12 and 13 year old teams affiliated with the Thunder Bay Amateur Hockey Association. One of the main purposes of the study was to refine an Injury Report Form and get constructive feedback from the recorders. Some notable problems with the pilot study Injury Report Form were corrected such as reducing the severity Likert scale from 10 points to 5 points. After interviewing coaches, suggestions to increase consistency included: (a) the recorder should ask the players if they received an injury rather than waiting for the player to approach the recorder; and (b) place a report form with the game sheet to aid as a reminder.

The coaches suggested that the researcher should inform the players that they were involved in a graduate research study, and that they should honestly report any injuries. Another common suggestion from the recorders was to maintain contact with the coaching staff and/or recorder in order to improve consistency.

## Data Analyses

### Verification of Control

A *t*-test was conducted at each level to investigate differences in weight between Ontario and Quebec. A Levene's test identified if the homogeneity of variance was significantly different. The levels involved boys of the same age groupings in both Provinces, and thus, all teams were expected to have the same variation of sizes within each level.

The number of games, hours of practice, and pre-season training hours were each investigated with a *t*-test to evaluate exposure to injury across Provinces. For each variable, at each level a Levene's test was used to verify homogeneity of variance between players from Ontario and players from Quebec.

Rate of Body Checking Injuries

The body checking injury incidence rate served as the dependent variable for a 2 x 3 (province by age level) Factorial ANOVA. A 2 x 2 (province by introduction time) Factorial ANOVA investigated if there was a significant difference between introducing body checking earlier or later.

Players at Risk

It is known that weight is a critical variable in producing force. A 2 x 2 (injury acquired by age levels with body checking) Factorial ANOVA was used to investigate if weight differed significantly between players injured from body checking, and those not injured, once the teams were permitted to body check.

A 2 x 3 (position by age level) Factorial ANOVA investigated height and weight differences between forwards and defencemen for all three age levels. The two positional groupings were then divided into five specific positions, and a one-way ANOVA was used to investigate height and weight.

Finally, a 2 x 3 (position by age level) Factorial ANOVA investigated the rate of body checking injuries per player between forwards and defencemen, and age levels. Injury rates were investigated for the five specific playing positions using the one-way ANOVA procedure.

Predicting a body checking injury. A forward regression analysis was conducted for leagues with body checking to predict which variables predisposed a player to incur a body checking injury. Variables of height, weight, and position were included in the procedure with the frequency of injury as the dependent variable.

Profile of Injuries

In order to get a representation of the type of injury produced by a body check, variables of type, location, and severity were reported from descriptive analysis. Investigating when these injuries occurred in terms of time of game, and type of game added to the injury profile. No comparisons were made between the Provinces or the age levels, as all variables were reported as the frequency of total body checking injuries. Furthermore, the profile of injuries was investigated strictly from a descriptive perspective as it was not the intent to determine significance.

# CHAPTER FOUR

## Results

### Verification of Control

In designing this study, age levels and calibre of play were matched between Ontario and Quebec, and it was hoped that in doing so weight would also be matched. The Provinces were also matched on variables such as the amount of pre-season training, number of games played, and hours of practice. This design was created so as not to confound the interpretation of data.

### Physical Size

No significant difference was observed between the weights of 10 and 11 year olds from Ontario and Quebec. Significant difference was observed for 12 and 13 year olds ($t_{(93)} = 2.48$, $p < .05$) and 14 and 15 year olds ($t_{(100)} = 4.03$, $p < .05$) from Ontario and Quebec (see Table 2). A Levene's test for homogeneity of variance did not identify any significant differences ($p > .05$) between the two Provinces at any level.

**Table 2**
Weight of All Players

| | | Age Level | | |
|---|---|---|---|---|
| | | 10 and 11 ($n = 97$) | 12 and 13 ($n = 95$) | 14 and 15 ($n = 102$) |
| | | M (SD) | M (SD) | M (SD) |
| Weight (kg) | Ontario ($n = 145$) | 43.3 (7.0) | 51.4 (8.8) | 62.8 (8.2) |
| | Quebec ($n = 149$) | 41.4 (7.0) | 55.5 (7.5) | 69.7 (9.1) |

Exposure to Injury

The different types of games were compared between Ontario and Quebec to verify that the teams were matched for exposure to injury with respect to number of competitions. T-tests did not indicate any significant difference ($p > .01$) for the total games (including pre-season, league, tournament, and post-season) in any of the levels. Other exposure variables such as practice time and hours of pre-season training were not significantly different ($p > .01$). This verified that the teams were matched for exposure to injuries, and non-significant Levene's tests verified that the variances were similar (see Appendix I).

Rate of Body Checking Injuries

A 2 x 3 (province by age level) Factorial ANOVA was designed to investigate the rate of body checking injuries for players at each level and in each province. There was a main effect between the age levels ($F_{(2,288)} = 17.10$, $p < .01$) and an interaction effect ($F_{(2,288)} = 4.40$, $p < .05$) (see Figure 4). There was no Province main effect.

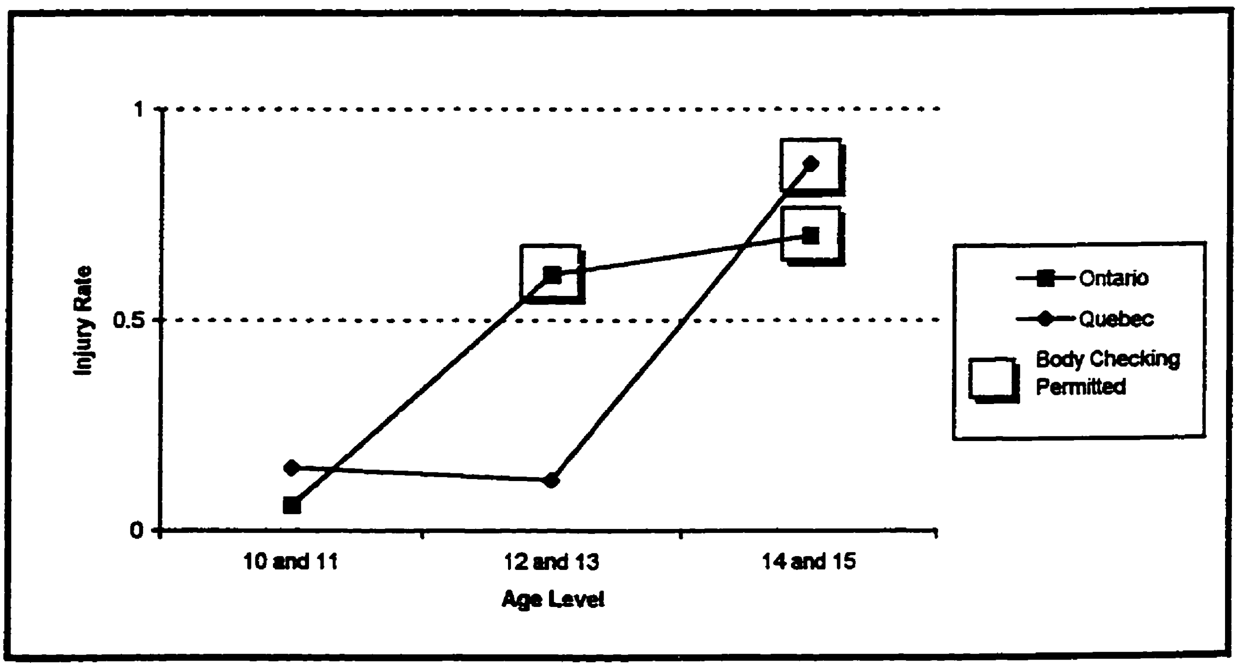


**Figure 4.** Rate of body checking injuries per player by province and age level.

A Tukey's Honestly Significant Difference (HSD) post-hoc test for the age level main effect indicated the mean rate of body checking injuries per player in the 12 and 13 year old level (0.36 injuries per player) differed significantly ($p < .05$) from the 14 and 15 year old level (0.78 injuries per player). Moreover, the mean rate in the 10 and 11 year old level (0.10 injuries per player) differed significantly ($p < .05$) from the mean in the 14 and 15 year old, but not in the 12 and 13 year old. In other words, there was no significant increase in body checking injuries per player per season from the 10 and 11 year old level to the 12 and 13 year old level, but there was a significant increase in from the 12 and 13 year old level to the 14 and 15 year old level.

A Tukey's HSD post-hoc test for the significant interaction effect indicated the rate of body checking injuries in Ontario increased significantly ($p < .01$) from 10 and 11 years old, to the 12 and 13 years old age level (when body checking is introduced). The post-hoc test indicated that the rate of body checking injuries in Quebec increased significantly ($p < .01$) from 12 and 13 years old, to the 14 and 15 year old age level. This is the level body checking is introduced in Quebec.

A 2 x 2 (province by introduction time) Factorial ANOVA was used to investigate the difference of introduction time. A significant main effect for the introduction time indicated the mean rate of body checking injuries increased significantly for both Ontario and Quebec when the rule was introduced ($F_{(1,192)} = 26.85$, $p < .01$). There was no significant main effect between the provinces or an interaction effect (see Table 3).

**Table 3**

Injury Rate Before and After the Introduction of Body Checking for Ontario and Quebec.

| | Introduction Time | | Overall |
|---|---|---|---|
| | Before ($\underline{n}$ = 98) | After ($\underline{n}$ = 98) | |
| Ontario ($\underline{n}$ = 95) | 0.06 | 0.61 | 0.33 |
| Quebec ($\underline{n}$ = 101) | 0.12 | 0.87 | 0.50 |

## What Players Are at Risk?

To assure that the same participant was not being injured repetitively, the frequency of injuries was investigated to determine the number of body checking injuries each of the 294 participants incurred. Considering that some teams in this study were not permitted to body check, the results indicated most participants did not incur a body checking injury. Three players were injured five times, but most were only injured once or twice throughout the season (see Figure 5).

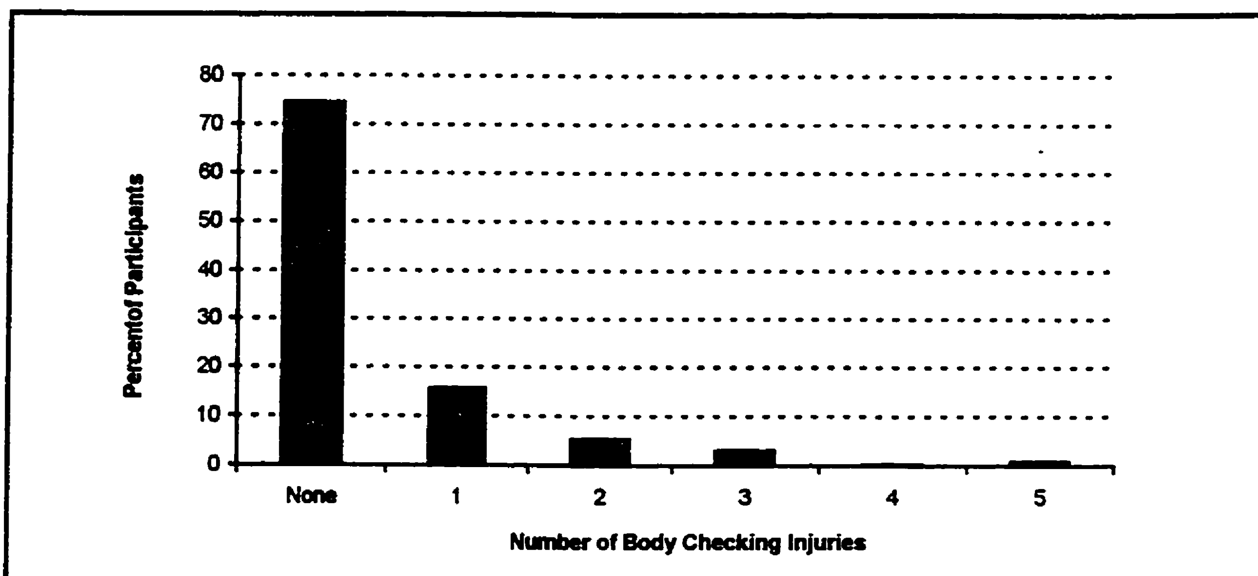


**Figure 5.** Frequency of body checking injury per participant

Measurements of Physical Size

It is known that weight is a critical factor in an impact. In the leagues which permit body checking (only Ontario at 12 and 13, and both provinces at 14 and 15), a comparison was conducted for those players who did not obtain a body checking injury throughout the season to those who were injured at least once. A 2 x 2 (injury acquired by age levels with body checking) Factorial ANOVA was conducted. There was a main effect with the age levels ($F_{(1,144)} = 90.97$, $p < .01$), and there was a main effect when comparing the mean weight of players with or without body checking injuries ($F_{(1,144)} = 7.42$, $p < .01$), but no interaction effect. In other words, the 60 players who were injured from body checking during the season had a significantly lower weight than the 88 who were not injured from a body check (see Table 4).

**Table 4**
Weight of Players Injured and Not Injured in Leagues Permitting Body Checking.

| | Age Level | | Overall |
|---|---|---|---|
| | 12 and 13 ($n$ = 46) | 14 and 15 ($n$ = 102) | |
| | $M$ ($SD$) | $M$ ($SD$) | $M$ ($SD$) |
| Players Not Injured ($n$ = 88) | 52.7 (9.2) | 68.2 (9.0) | 62.9 (11.7) |
| Players Injured ($n$ = 60) | 49.0 (7.7) | 63.9 (9.2) | 59.9 (11.0) |

Concerns with Position

Goalies did not obtain any body checking injuries, and as such, were omitted from statistical procedures involving positions. Maintaining consistency with past research, forwards were grouped to consist of left wing, centre, and right wing. The position of defence included both left and right defence.

Physical difference with positions. A 2 x 3 (position by age level) Factorial ANOVA indicated that the mean height of 164 forwards (161.0 cm) was significantly different ($F_{(1,252)} = 12.26$, $p < .01$) than the mean height of 94 defencemen (164.9 cm). A significant age level main effect ($F_{(2,252)} = 232.38$, $p < .01$), and a Tukey's HSD post-hoc test indicated that the height of players increased significantly ($p < .05$) with an increase in age level. A significant interaction effect resulted ($F_{(2,252)} = 3.20$, $p < .05$). The post-hoc test indicated that the means of the two positions differed significantly ($p < .05$) at the 12 and 13 year old level, as well as at the 14 and 15 year old level.

A similar procedure indicated that the mean weight of forwards (53.2 kg) was significantly different than defencemen (57.4 kg) ($F_{(2,252)} = 14.93$, $p < .01$). There was also a significant main effect for age level ($F_{(2,252)} = 215.46$, $p < .01$), and a Tukey's HSD post-hoc indicated the weight of players increased significantly ($p < .05$) with an increase in level (see Table 5). In this procedure, there was no interaction effect.

A one-way ANOVA indicated that none of the five specific playing positions (left wing, right wing, centre, left defence, and right defence) differed significantly in either height or weight.

Rate of injury. The rate of body checking injuries was compared between forwards and defencemen using a 2 x 3 (position by age level) Factorial ANOVA. Forwards had a significantly higher injury rate than defencemen ($F_{(1,252)} = 7.99$, $p < .01$). A post-hoc for an age level main effect ($F_{(2,252)} = 18.31$, $p < .01$) indicated the rate increased significantly

**Table 5**
Height and Weight of Forwards and Defencemen

| | Age Level | | | Overall |
|---|---|---|---|---|
| | 10 and 11 ($n$ = 85) | 12 and 13 ($n$ = 83) | 14 and 15 ($n$ = 90) | |
| | M (SD) | M (SD) | M (SD) | M (SD) |
| Height (cm) | | | | |
| Forwards ($n$=164) | 149.3 (6.5) | 159.7 (11.6) | 173.7 (5.9) | 161.0 (13.1) |
| Defencemen ($n$=94) | 149.4 (6.7) | 166.2 (9.3) | 177.9 (5.1) | 164.9 (13.9) |
| Weight (kg) | | | | |
| Forwards | 41.6 (7.7) | 52.9 (7.7) | 64.7 (7.9) | 53.2 (12.2) |
| Defencemen | 43.1 (6.6) | 57.2 (9.6) | 70.6 (9.6) | 57.4 (14.0) |

($p < .05$) from 12 and 13 to 14 and 15 years old. The interaction effect in this procedure was also calculated ($F_{(2,252)} = 2.89$, $p = .058$) (see Figure 6).

All five individual playing positions were included in a one-way ANOVA to discover if there was a significant difference in the rate of body checking injuries at specific positions.

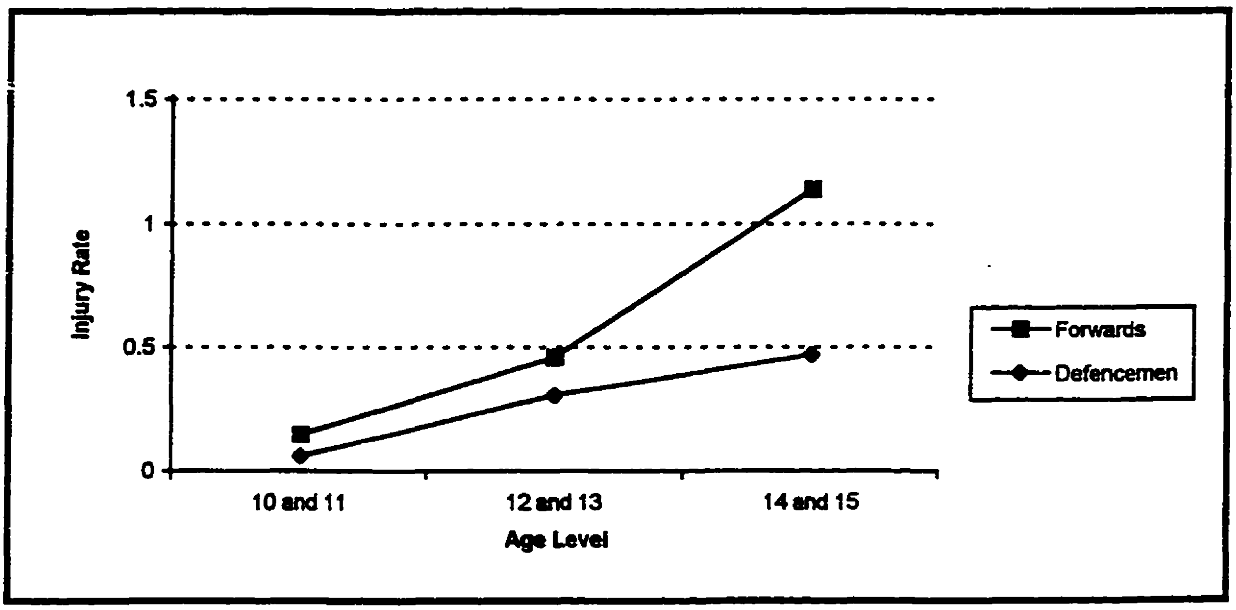


**Figure 6.** Rate of body checking injuries by position (forwards and defencemen) and level.

Significance was found ($F_{(4,253)} = 3.18$, $p < .05$) and a Tukey's HSD post-hoc was utilized to determine where the difference existed. The post-hoc indicated that the mean rate of body checking injures for a centre (0.83) was significantly greater ($p < .05$) than the left defence (0.25) (see Figure 7).

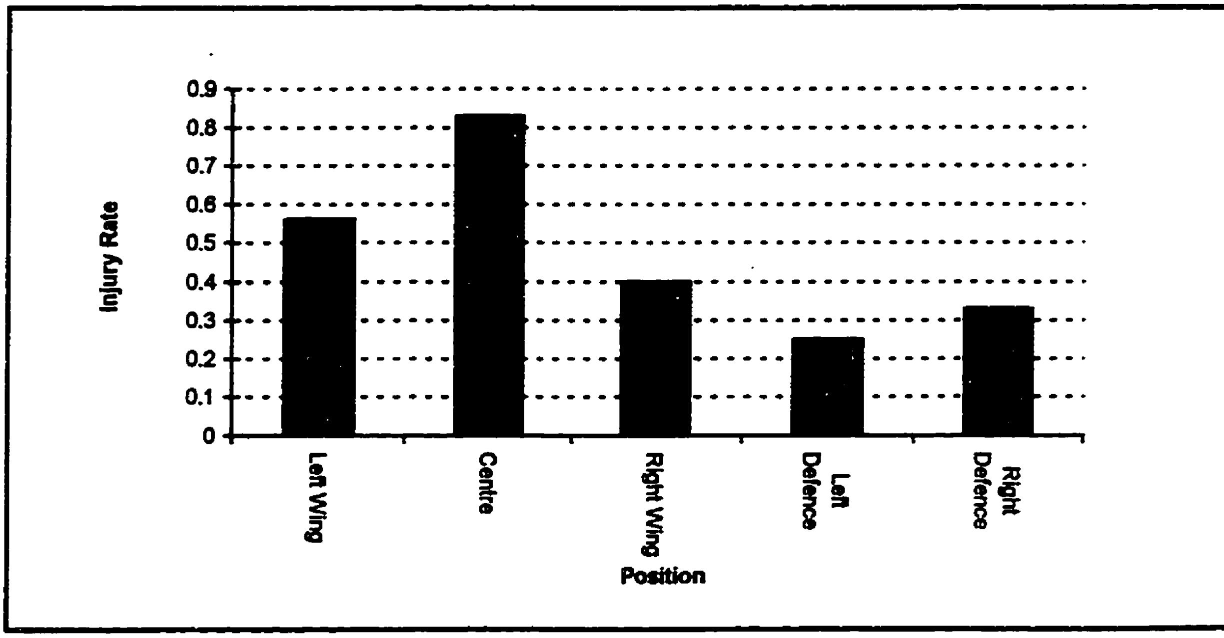


**Figure 7.** Rate of body checking injuries by specific position.

Predicting a Body Checking Injury

The forward regression analysis was restricted to those players who were permitted to body check. Height, weight, and position were included in the analysis to investigate which variables significantly predict who is most likely to obtain a body checking injury during a hockey season, or conversely, cause an injury.

The strongest predictor of a player obtaining a body checking injury was their position ($R^2 = .11$, $p < .01$). After adding weight into the regression equation, the total variance explained for both variables remained significant ($R^2 = .14$, $p < .05$). The height of the player did not factor into the equation as a significant predictor of a player obtaining a body checking injury (see Table 6).

**Table 6**
Prediction of a Body Checking Injury

| Variable | r | $R^2$ | B | SE B | β | t |
|---|---|---|---|---|---|---|
| Position | -.333 | .11 | -0.51 | 0.12 | -.32 | -4.18** |
| Weight | -.203 | .14 | -0.02 | 0.01 | -.18 | -2.38* |

* $p < .05$ ** $p < .01$.

## Profile of Injuries

Descriptive statistical procedures were used to get a representation of what kind of injury is produced from body checking. Several variables, including type, location, severity, and time, were reported to produce characteristics of a body checking injury.

### Type of Injuries

From 124 body checking injuries recorded in this research, 120 Injury Report Forms indicated the type of injury obtained by the player. The most common injury accounting for 34.2% ($n = 41$) was a bruise. There was a big gap to the second most common type of injury which was a fracture. This type had a frequency of 18 or 15.0% of all injuries. Fourteen muscle strains were the next most common (11.7%), followed closely by 13 concussions (10.8%) (see Figure 8, and Appendix J for a breakdown of the types by province).

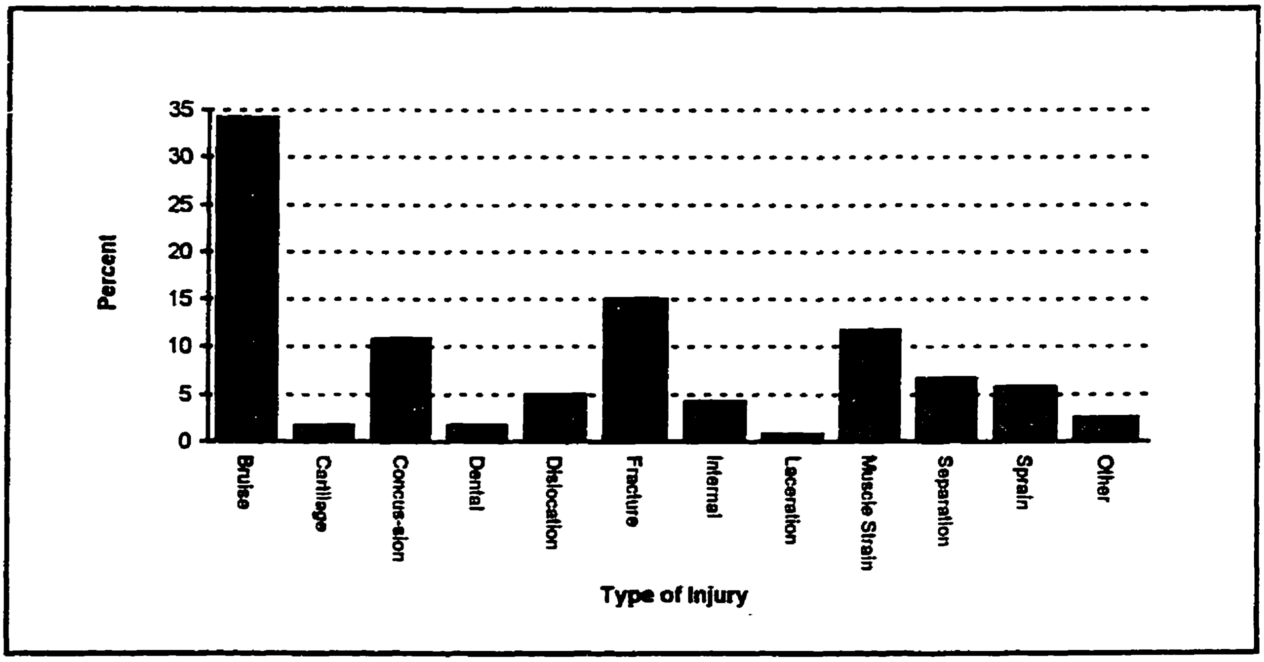


**Figure 8.** Type of body checking injury and frequency percentage.

<u>Location of Injuries</u>

The Injury Report Form included 31 possible locations for anatomical location, however, only 21 were recorded as the site of a body checking injury. From the body checking injuries incurred by players in this study, the primary location for an injury to occur was the shoulder with 16.9% (n = 21). The second most common location was the knee with 12.9% (n = 16), followed by the head with 12.1% (n = 15).

The anatomical location was recoded into four general locations of head, body, leg, and arm. The arm received the most injuries due to body checking (30.6%, n = 38), followed by the body (26.6%, n = 33), the leg (20.2%, n = 25), and then the head (17.7%, n = 22) respectively (see Appendix K for a breakdown of all location sites and differences between provinces).

Severity of Injuries

Pain and discomfort. A subjective measure was added to the Injury Report Form to evaluate the pain and discomfort the player was experiencing as a result of the injury. Using a five point Likert scale, from "minimal" to "excruciating", the recorders submitted 120 ratings. The majority of all body checking injuries were classified as a four on the Likert scale which fell between "bearable" and "excruciating". This rating accounted for 37.5% (n = 45) of all injuries. The third and second point on the scale were second and third most common, with 34.2% (n = 41) and 15.0% (n = 18) respectively. Only 5.8% (n = 7) were rated as "minimal" pain and discomfort, and 7.5% (n = 9) of the 120 recorded injuries were evaluated to be at the "excruciating" level (see Appendix L).

Time loss from hockey. Four categories were available based on forced time loss from hockey due to the injury. "Minor" injuries meant the player was injured but returned to action during that game, and accounted for 36.6% or 45 cases. "Moderate" was the second rating, and the second most common time loss rating with 32.5% (n = 40). This meant the player missed the remainder of the game but returned to competition within a week. A "major" injury (22.8%, n = 28) required the injured player to miss more than a week of competition, but return before 3 weeks of absence. Only 8.1% of the injuries (n = 10) were classified as "severe" and forced the player to miss more then 3 weeks of hockey (see Appendix L).

Days missed from school. The third variable to evaluate the severity of an injury caused by body checking was the forced days to miss school. It would take a fairly serious injury to necessitate the withdrawal from school, and thus, almost 80% of the 116 body checking injuries recorded for this variable indicated the player missed no days of school

(77.6%, n = 90). Eleven players (9.5%) were forced to miss a single day of school. The longest stay away from school which resulted from body checking required one child to be out for 7 days (see Appendix L).

Who provided assistance? Of the 124 Injury Report Forms indicating who cared for the injured player, the most common response (54.0%, n = 67) was the team's trainer. A doctor was necessary for 41 injuries which equated to 33.1%. Ten, or 8.1%, of the injured players required follow-up rehabilitation with a physiotherapist. Only one body checking injury resulted in a oro-facial injury requiring the player to visit a dentist. Two of the injured players sought chiropractic treatment following their injury (see Appendix L).

Time of Injuries

Period. The results showed a steady increase in the number of body checking injuries as the game progressed. Of the 119 recordings for this variable, the percentage increase across the first, second and third periods were 26.9%, 33.6% and 38.7% respectively. No body checking injuries occurred in overtime (see Table 7, and Appendix M).

**Table 7**
Time of Body Checking Injuries Within a Game

| | n | % |
|---|---|---|
| Period | | |
| First | 32 | 26.9 |
| Second | 40 | 33.6 |
| Third | 46 | 38.7 |

Type of game. The pre-season accounted for the lowest percent of body checking injuries with only 10.5% (n = 13) and the majority occurred during the regular season (51.6%, n = 64). Coaches were asked to predict the number of games they would play throughout the year, and this enabled an injury rate to be calculated. Although the lowest percent of body checking injuries occurred in the pre-season, this type of game also had the fewest number of approximated games. Consequently, the pre-season had the highest approximate rate of body checking injuries per game with 0.12. The lowest rate (0.07) was in the post-season (see Table 8, and Appendix M).

**Table 8**
Type of Game with Calculated Rate of Injuries per Game

| | n | % | Approx. Number | Approx. Rate |
|---|---|---|---|---|
| Pre-season | 13 | 10.5 | 111 | 0.12 |
| League | 64 | 51.6 | 614 | 0.10 |
| Tournament | 30 | 24.2 | 265 | 0.11 |
| Post-season | 14 | 11.3 | 190 | 0.07 |
| Other | 3 | 2.4 | -- | -- |

Note. Dashes indicate a rate was not possible due to no recordings for "other" games.

# CHAPTER FIVE

## Discussion

Considerable research has been conducted in the area of injuries in minor hockey. It is generally accepted that body checking accounts for the highest percentage of all injuries. Some studies have found that the rate of injuries is higher in leagues permitting body checking versus those without (Ontario Ministry of Tourism and Recreation, 1990; OSMSAB, 1987; Regnier et al., 1989; Roy et al., 1989). Others have found body checking injuries are more common in representative, or all-star leagues, versus the less competitive house leagues (Ontario Ministry of Tourism and Recreation, 1990).

Quebec introduces body checking at a later age than Ontario, and thus, the rate of body checking injuries between these two provinces were compared. This is the first study to compare two leagues that introduce body checking at different ages. Also, this is the first study which compared players in the highest calibre of minor hockey to investigate this difference in rates.

### Importance of Similar Samples

It is known that force is the product of mass times acceleration. Although measurements were not taken to verify that fundamental skills were equitable, the same calibre of play should equate to the same development of fundamental skills. Skating is the acceleration variable in the impact equation, and it was assumed that the fundamental skill of skating would be similar in Ontario and Quebec at each age level.

The other important differentiating variable of impact is weight. A significant difference in weight between the Provinces for the 12 and 13 year old level does not confound the interpretation of data. Quebec players aged 12 and 13 were significantly heavier, but since Quebec does not permit body checking at this age level, the comparison of body checking injuries between Provinces was not necessary. The significant weight difference at the 14 and 15 year old level is of concern because body checking is allowed at this age level. One would expect Quebec players to produce on average a greater force upon impact due to the fact that the mean weight of players is higher.

Since heavier players are capable of producing more force upon impact on lighter players who share the same ice surface, another important interpretation of the weight data is the variance of measurements. A Levene's test indicated there were no significant differences in data variance for weight between Ontario or Quebec, at any of the age levels. In other words, although Quebec was significantly heavier in the 14 and 15 year old age level, the players involved in the study recorded a similar distribution of weight at each age level. Thus, the Quebec players are likely capable of producing on average more force upon impact as they are significantly heavier, but it is this impact of the heavier players on the lighter players within the same level which is going to increase injury rates, and Ontario had a similar variance of measurements. In other words, the lighter players in Ontario in each age level are equally as susceptible to incur an injury from body checking as the lighter players in Quebec.

Another measurement which was required to be the same between Ontario and Quebec at all levels was the exposure to injury. Each team played a certain amount of games throughout their season, ranging from 60 to 74 games. When the variance for total games (including pre-season, league, tournament, and post-season) was compared, the two provinces did not differ at any age level. Practice time was compared as one team may have access to more instruction than another. Variance was again found not to differ between Ontario and Quebec for practice time. The length of the playing season and pre-season training were also not significantly different. Since no variables defining the exposure to injury differed significantly at any of the age levels, it was verified that each player in the study had the same exposure to receive, or produce, an injury due to body checking.

## The Effects of Introducing Body Checking

With only Ontario permitted to body check in the 12 and 13 year old level and both provinces permitted at the 14 and 15 years old level, one would expect to discover an overall increase in the mean number of injures from one level to the next, as was indicated with a significant ($p < .01$) Factorial ANOVA. Ontario had two age levels with body checking in this study whereas Quebec only had one, and results indicated the overall mean rate of injuries was actually lower in Quebec than Ontario. This occurs as the interaction indicated whenever body checking is introduced, the number of injuries increase significantly. This suggests that the longer a province, or an association, goes without permitting body checking, the lower the overall rate of injury will be.

It was hypothesized that introducing body checking at a later age and level would result in a significantly higher increase in the rate of player injury . Although the number of increased body checking injuries was more when introduced at age 14, the increases did not prove to be significantly different. In conclusion, whatever age body checking is introduced, the injury rate per player increases significantly. Furthermore, the rate of injuries is not significantly different whether body checking is introduced at age 12, or at age 14 (see Figure 4).

## Who is at Risk?

Before attempting to answer this question, it is important to mention that rarely did any one player get injured repetitively from a body check. In other words, it was not the same small player who was getting injured all the time, but the injured participants were often different players (see Figure 5). Thus, when comparing physical characteristics, it is known that conclusions were made based on injures from the majority of participants and can be implied to a general population of the same age and skill level.

### Influence of Weight

Body checking injuries result from the force of two players colliding. This impact is the result of mass times acceleration. The physical measurement which was most critical when investigating which players were at risk of acquiring injuries, and which were at added risk of causing body checking injuries, was weight. One could suspect, merely from mathematical equations, that lighter players sharing the ice surface with heavier players would be at greater risk of attaining an injury from impact. This hypothesis was supported by a significant main effect ($p < .01$) between the weight of players who were injured from body checking, and players who did not get injured (see Table 4).

Boys in their growth spurt are simply going to have varying quantities of weight. Boys that play hockey are no different. It has been concluded by Brust et al. (1992) and supported by the current research that those who get injured from body checking are significantly lighter than those uninjured. Children cannot be asked to lose weight, but they can increase their weight by as altering diet or exercise habits to create a more equitable size to their opponents.

Injuries Due to Playing Position

In past research, investigators reported that forwards receive more injuries than defencemen (Benton et al., 1983; Brust et al., 1992; Calgary Minor Hockey, 1992; Hayes, 1975; McKnight et al., 1992; Pelletier et al., 1993). Rationales such as forwards penetrate deep into both zones, and simply because there are more forwards than defence on the ice have been supplied. One area of explanation to the injury difference has been neglected. When players enter hockey, a coach will often select the largest players, ask them to play defence, and then teach them the fundamental skill of skating backwards. This strategy is common practice because when attacking offensively, it is more difficult for a player to manoeuver around a larger defenceman than a smaller one.

Aware of these coaching strategies, this research compared the physical size of individuals playing either forward or defence, and then compared the size of all five specific playing positions. Although the differences in height and weight were small in the youngest age level, a commonality did appear and it was concluded that, in general, forwards were significantly shorter and lighter ($p < .01$) than the defencemen in every level (see Table 5). Players can not do much to increase their height, but once again, it is possibly to slightly increase weight measurements.

Researchers reported forwards receive more injuries than defencemen, but past research has not attempted to discover if the difference was significant. Taking into consideration the number of players at each position, the mean body checking injury rate for forwards (0.59) and defencemen (0.29) was significantly different ($p < .01$) which enables the conclusion that forwards are injured from body checking significantly more than defencemen. (see Figure 6). Also, a significant difference ($p < .05$) between players at the centre position (a forward position), and left defence (a defenceman position) further lend support to the previous conclusion (see Figure 7).

It was not the scope of this research to investigate how body checking injuries occurred, but simply that they occurred. It may prove interesting to discover the direction of skating when the player was injured. For example, a forward will rarely skate backwards in a game, whereas the defencemen often skates backwards. It is a belief that when skating backwards with the attacking player there is a tendency to angle the player toward the boards in attempt to retrieve the puck, and simply use body contact. If the two players make impact when traveling in a forward direction at one another, the result is a body check. Due to the fact that defencemen skate backwards more than a forward player, they would tend to use more body contact than a forward. This may suggest another reason why defencemen receive less injuries from body checking.

Predicting Who Will be Injured

If researchers could predict what predisposes a player to a body checking injury, considerable discomfort to a player and expense to the tax payer could be avoided. It was indicated from variables included in a regression analysis that the strongest predictor variable was the individual's position. Weight also figured to be a significant predictor of a player obtaining an injury from body checking (see Table 6). A causal conclusion cannot be drawn from the regression, however, it appears from the analysis that a light forward is most susceptible to getting a body checking injury. Conversely, a defenceman who is heavy will be most likely to inflict a body checking injury on others sharing the ice surface. This is in agreement with what one would expect and supports the hypotheses that lighter players are more vulnerable to an injury from body checks that can be delivered by heavier players, and that forwards will receive significantly more body checking injuries.

Knowing that position and weight are significant factors predisposing players to a body checking injury, concerned individuals should attempt to alleviate this situation. No coach is likely to remove a large player from defence and place a small person in his/her place simply because it is known that forwards get injured more, but other precautionary measures could be taken. Height cannot be altered, but the regression analysis indicated this variable was not a predicting factor. Weight, on the other hand, is one physical characteristic that people can fluctuate with either a desire to increase or decrease. It may also be advantageous to increase the amount or quality of protective equipment that lighter forwards wear. This study assumed both quality and quantity was equal for all participants, but possibly an increase with those who appear to obtain more injuries would be a sound preventative measure. Also, the results of this study indicated that the arm was the area most often injured from a body check, and the head was least common. If a concerned parent was preparing to buy a new piece of equipment, they may wish to evaluate where the most protection is needed for this age level and sport.

## Profile of Body Checking Injuries

As mentioned earlier, the current research did not record how the body checking injuries were attained, but did create a profile of the kinds of injuries caused by body checking, and identified when these injuries were most likely to occur in respect to time of season, time during the game, and type of game. The injuries were analysed with only descriptive statistics as it was strictly the intent to describe the characteristics of a body checking injury.

What Type of Injuries

Due to the strict definition of an injury in the current study, it was not surprising that the main type of injury from body checking was a bruise (see Figure 8). In the act of body checking, individuals produce a high mass-low velocity impact Hayes (1978). Sutherland (1976) reported that large mass objects often produce injuries that are more serious such as fractures and ligamentous damage. Not ironically, the second most common type of injury was fractures. The 14 and 15 year old category (where once again, there is the largest standard deviation of weight values for all players) did record more types of serious injuries. For example, of all the body checking injuries in the oldest age level, 18.2% (n = 14) were fractures whereas only 8.8% (n = 3) occurred in the 12 and 13 year old level. This supports that players who are significantly heavier and skate faster will produce more impact than lighter and slower players.

Severity Measures

Bernard et al. (1993) discovered a 357% difference in the force of impact between the largest and smallest players in the 14 and 15 year old level, as opposed to 150% for 12 and 13 year old boys. If it is known that older boys can produce more force because they can skate faster and are significantly heavier than younger players (as well as the largest standard deviation of weight as supported by this study), then it only seems logical that the injuries which result from body checking would be more severe in the 14 and 15 year old age level.

The severity profile.in the descriptive analyses supported the hypothesis that heavier players could produce more impact when body checking smaller players. For all variables, 14 and 15 year old players had more severe body checking injuries than the 12 and 13 age level as indicated by a higher percentage of injuries at the most extreme end. For example, the longest a 12 and 13 year old player missed school from a body checking injury was 3 days. Contrary, one player in the 14 and 15 year old level was forced out of his educational institute for 7 days.

With older players recording more severe injuries than younger players, we can speculate something needs to be corrected. Is it simply that players are heavier and produce more force that creates the increased severity? It may be possible the injuries which create this higher severity are resulting from another reason. Players who are in the 14 and 15 year old level are approaching their "draft years". It could be suggested that the players may use more aggression or take more risks than when younger to impress a scout. Older players may also be dating by this age and want to impress someone else in the stands. Again, this research did not attempt to discover how or why body checking injuries happen, just simply that they do.

Time of Body Checking Injuries

If the competition is close, it is only natural that intensity within a game increases as the time remaining in a game decreases. Consequently, most past studies found that injuries increased as the game progressed (Brust et al., 1992; Hayes, 1975; Lorentzon et al., 1988; Stuart et al., 1995). These studies included all injuries, but this research found the same trend with only body checking injuries (see Table 7).

Past research found that risk of injury is higher in the early months, and decreases as the season continues (Benton et al, 1983; Hayes, 1975, 1978). Reasons such as poor conditioning, players overworking to make a team, new systems, new teammates, playing unfamiliar positions, and inadequate equipment have all been supplied to answer why this occurs. Past research has also found that significantly more injuries occur in games as opposed to practices (Brust et al., 1992; Finke et al., 1988; Lorentzon et al., 1988; McKnight et al., 1992; Ontario Ministry of Tourism and Recreation, 1989; OSMSAB Vol.2, 1987; Pettersson & Lorentzon, 1993; Stuart & Smith, 1995; Tegner & Lorentzon; 1991). The type of game an injury occurs in, however, has not been investigated thoroughly. The coaches provided an approximate quantity of each type of game, and it was calculated that the highest rate of body checking injuries per game (0.12) occurred in the pre-season. The lowest injury rate (0.07) was in the post-season (see Table 8). These results support the rationales produced by past research. It may also suggest that a decreasing injury rate results from the fact that players improve their fundamental skill of body checking, and learn how to properly give and receive a check in order to avoid injuries.

## Summary and Conclusion

The main purpose of this research was to compare the rate of body checking injuries between two provinces that introduce body checking at different ages (age 12 versus age 14). It was concluded that whenever body checking is introduced, the rate of injuries increase significantly. Furthermore, although the increase in injury rate was higher when introducing body checking later, it was concluded that age of introduction does not result in statistical significance.

Comparing the physical size of those who were injured from body checking and those who were not, lighter individuals were at an significant disadvantage and increased risk of incurring a body checking injury. Moreover, players in the defence position were significantly taller and heavier than forwards, and perhaps due to this fact, the rate of body checking injuries between the two positions was significantly different. The regression analysis indicated player position is the most significant variable in predicting who will obtain a body checking injury. The individual's weight was also a significant predictor. Therefore, it can be predicted that a light forward is most likely to get injured, and a heavy defenceman will most likely inflict the body checking injury.

Most body checking injuries involved a considerable amount of pain and discomfort to the injured player, but the injury usually did not keep the player out of game action and rarely required the player to stay home from school. Furthermore, the team trainer was able to attend to the player during the game in more than half the circumstances. Moreover, the rate of body checking injuries per game appears to decrease as the season progresses.

## Future Research Directions

In similar studies, it would certainly enhance the validity of the research if the games were personally observed, or perhaps videotaped. This would enable the Injury Report Forms to be completed by the researcher him/herself. Personal observation would definitely require more time and money, but the results would be better consistency and accuracy with the completion of the Injury Report Forms.

It is recommended that studies of a similar design test for matching variables that influence impact. It was assumed calibre was the same in this study, but if variables such as speed and agility were tested, a better match would be verified. Also, weight could be tested before the data collection begins to assure teams equal in all aspects of physical size.

Another research direction involves measuring the force of impact with players in the 10 and 11 year old category. Players at this age do not presently body check in Canada. These players have not entered the growth spurt and should be relatively close in physical size. Provided their skating speed is the same, these players should produce approximately the same impact when body checking. A suggestion to introduce body checking, or body contact, at this age may be realistic with results and conclusions of impact testing at this age level.

If players were followed longitudinally, this would improve the control, and thus, validity of conclusions. The players could be introduced before they have body checking, and participate until they have been playing with the rule for an extended period of time. Thus, a study of this design may wish to longitudinally follow players into the next age level (16 and 17 years old) to discover the difference of injury rate when playing with body checking for more than one or two years.

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# APPENDICES

| BRANCH | | SR AAA & SR.AA | SENIOR OTHER | ADULT REC | MAJOR JR. | JR. A | JUNIOR OTHER | HIGH SCHOOL | JUVENILE | MIDGET | BANTAM | PEE WEE | ATOM | NOVICE | INITIAT/ BEGIN. | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAHA | PLAYERS | 84 | 200 | 824 | | 735 | 629 | | 642 | 3,712 | 6,681 | 8,397 | 23,037 | | | 44,941 |
| (1) | TEAMS | 3 | 7 | 55 | | 21 | 22 | | 43 | 247 | 445 | 559 | 1,536 | | | 2,938 |
| AHA | PLAYERS | 75 | 1,748 | 499 | | 229 | 1,459 | | | 4,394 | 6,751 | 9,582 | 13,381 | 19,225 | | 57,343 |
| | TEAMS | 3 | 76 | 31 | | 11 | 78 | | | 227 | 421 | 630 | 892 | 1,278 | | 3,647 |
| AHA | PLAYERS | 113 | 3,583 | 572 | | 365 | 385 | | 90 | 2,904 | 4,087 | 5,072 | 5,632 | 5,453 | 4,575 | 32,831 |
| | TEAMS | 5 | 159 | 31 | | 13 | 17 | | 6 | 167 | 256 | 340 | 422 | 402 | 333 | 2,151 |
| AHA | PLAYERS | 145 | 1,039 | 50 | 190 | 196 | 335 | 945 | 202 | 1,451 | 3,126 | 4,236 | 4,595 | 3,296 | 4,861 | 24,667 |
| (2) | TEAMS | 6 | 47 | 2 | 8 | 9 | 17 | 58 | 10 | 89 | 197 | 306 | 340 | 252 | 389 | 1,730 |
| BAHA | PLAYERS | | | 20 | | 20 | 103 | | 61 | 486 | 767 | 1,091 | 1,218 | 1,109 | 973 | 5,848 |
| | TEAMS | | | 1 | | 1 | 5 | | 4 | 32 | 47 | 73 | 85 | 74 | 57 | 379 |
| HF | PLAYERS | 180 | 0 | 1,410 | 348 | 980 | 2,130 | 120 | 3,266 | 11,620 | 19,238 | 28,551 | 32,581 | 33,386 | 12,740 | 146,530 |
| (5) | TEAMS | 6 | 0 | 94 | 16 | 40 | 100 | 8 | 225 | 795 | 1,339 | 1,973 | 2,259 | 2,301 | 910 | 10,066 |
| DHA | PLAYERS | | | | 21 | 210 | 546 | | 358 | 1,987 | 3,322 | 4,295 | 4,611 | 4,539 | 4,580 | 24,469 |
| | TEAMS | | | | 1 | 10 | 26 | | 28 | 128 | 220 | 304 | 335 | 330 | 305 | 1,687 |
| HF | PLAYERS | | 90 | 5,145 | 288 | 228 | 3,173 | 210 | | 8,520 | 14,715 | 18,330 | 19,320 | 10,305 | 21,278 | 101,580 |
| (3) | TEAMS | | 6 | 343 | 14 | 12 | 167 | 14 | | 568 | 981 | 1,222 | 1,288 | 687 | 628 | 5,930 |
| BAHA | PLAYERS | | 441 | 166 | | 81 | 207 | 746 | 71 | 1,319 | 2,285 | 2,687 | 2,427 | 4,305 | | 14,735 |
| (4) | TEAMS | | 19 | 12 | | 2 | 8 | 36 | 4 | 77 | 136 | 161 | 147 | 263 | | 865 |
| SHA | PLAYERS | 132 | 96 | | | 172 | 378 | | 149 | 1,355 | 2,285 | 2,750 | 2,970 | | 4,949 | 15,236 |
| | TEAMS | 4 | 4 | | | 4 | 9 | | 6 | 50 | 95 | 94 | 88 | | | 354 |
| EIHA | PLAYERS | | 208 | 88 | | 42 | 100 | | 94 | 461 | 623 | 751 | 757 | 1,020 | 318 | 4,462 |
| | TEAMS | | 9 | 7 | | 2 | 5 | | 4 | 30 | 42 | 51 | 51 | 66 | 21 | 288 |
| AHA | PLAYERS | | 374 | 237 | | | 324 | | | 1,227 | 1,375 | 1,719 | 1,733 | 1,338 | 1,298 | 9,625 |
| | TEAMS | | 16 | 20 | | | 12 | | | 76 | 86 | 108 | 108 | 86 | 80 | 592 |
| WHL | PLAYERS | | | | 720 | | | | | | | | | | | 720 |
| | TEAMS | | | | 18 | | | | | | | | | | | 18 |
| TOTAL | PLAYERS | 729 | 7,779 | 9,011 | 1,545 | 3,238 | 9,769 | 2,021 | 4,933 | 39,436 | 65,255 | 87,461 | 112,262 | 83,976 | 55,572 | 482,987 |
| | TEAMS | 27 | 343 | 596 | 57 | 125 | 466 | 116 | 330 | 2,486 | 4,265 | 5,821 | 7,551 | 5,739 | 2,723 | 30,645 |

Appendix C

## INJURY REPORT FORM

(Please Print)

**NAME OF PLAYER**__________________________ **DATE**__________________

**TYPE OF ICE SESSION** **PERIOD** 1 2 3 4 unknown

| | |
|---|---|
| pre-season | tournament |
| regular season | play-off |

Is this a recurring injury? Yes No

**Cause of injury:**

| | |
|---|---|
| boards | goalpost |
| body check | puck |
| collision | skate |
| fell on ice | stick |

other ______________________

**NOTE:** if multiple injuries were obtained from one cause, please indicate this on a second injury report form

**Type:**

| | | |
|---|---|---|
| bruise | fracture | separation |
| concussion | internal (abdominal) | sprain |
| dental | laceration | cartilage |
| dislocation | muscle strain | |

other ______________________

**Location:**

| Head | Body | Leg | Arm |
|---|---|---|---|
| ear | abdomen | ankle | elbow |
| eye | chest | foot | finger |
| face | hip/pelvis | groin | forearm |
| head | lower back | knee | hand |
| jaw/chin | ribs | lower leg | shoulder |
| neck/throat | spine | toe | upper arm |
| nose | tailbone | upper leg | wrist |
| mouth | upper back | | |

other __________________

**Severity:**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| (minimal) | | (bearable) | | (excruciating) |

- time loss from hockey:

| | |
|---|---|
| minor | (continued to play) |
| moderate | (remainder of game but < 1 week) |
| major | (1 to 3 weeks) |
| severe | ( > 3 weeks) |

- school missed__________days
  __________weeks

- seen by a:

| | | |
|---|---|---|
| dentist | chiropractor | trainer |
| doctor | physiotherapist | other__________ |

LAKEHEAD UNIVERSITY

Oliver Road. Thunder Bay. Ontario. Canada P7B 5E1

School of Physical Education and Athletics
Telephone (807) 343-8544
Fax (807) 343-8944

May, 1993

Dear President,

My name is Wade Wiggins and I am a graduate student at Lakehead University. My area of interest lies in preventative sports medicine which is the reason for this letter.

The master's thesis which I am working on, in conjunction with Dr. Ian Newhouse, is concerned with injuries in minor hockey. I am interested in the causative factors which lead to various injuries. More specifically, I am interested in the effects of body checking on the players in Pee Wee. I realize this is presently a controversial topic among Canadian Amatuer Hockey Association, and I hope my study can further clarify the issue.

To retrieve the essential data, I am turning to you and your hockey association, and asking for cooperation and effort. I hope to utilize approximately 5 teams in both Quebec and Ontario, in each of the major Atom, minor Pee Wee, major Pee Wee, and minor Bantam leagues. These teams all need to be of the AAA calibre, and should be spread out throughout the province so as to get the most representative sample of the style of hockey at this level. It will not matter where the teams are located. I am asking for your cooperation in providing me with several names and phone numbers of coaches and/or teams that would fit the criterion.

Following your approval, I will provide each team with ample injury report forms that are designed for easy application each time a player on the team sustains an injury. I have enclosed a sample of a report form which I will use to collect the data. The completion of a report form should not inconvenience the coaching staff as it will only take a couple minutes to finish.

I greatly appreciate your time and cooperation, and if there are any questions regarding the study, please feel free to call collect at (416) 344-7471 during the summer months, or at (807) 577-8796 during the school year. Also, you may contact me, or leave a message via Dr. Ian Newhouse at Lakehead University at (807) 343-8074.

Thank you,

Wade Wiggins, HBPhed
Dr. Ian Newhouse, PhD

LAKEHEAD UNIVERSITY
Oliver Road, Thunder Bay, Ontario, Canada P7B 5E1
School of Physical Education and Athletics
Telephone (807) 343-8544
Fax (807) 343-8944

July, 1993

Dear Coaching Staff,

My name is Wade Wiggins and I am a graduate student at Lakehead University in Thunder Bay, Ontario. My area of interest lies in preventative sports medicine which is the reason for this letter.

The master's thesis which I am working on, in conjunction with Dr. Ian Newhouse, is concerned with injuries in minor hockey. I am interested in the causative factors which lead to various injuries. More specifically, I am interested in the effects of body checking on the players in Pee Wee. I realize this is presently a controversial topic among Canadian Amateur Hockey Association, and I hope my study can further clarify the debating issue.

To retrieve valuable data for my thesis, I am turning to you, the coaching staff, and asking for your cooperation and effort. I wish to use your team as subjects in the study, however, their participation will only require them to play the game that they enjoy.

I have spoke with the President of your hockey organization and they have agreed to let me record injuries occurring with your team for the entire season if you are willing to cooperate. The commitment I am requesting of you, as the coaching staff, is to dedicate one individual (ie. the **trainer**) who will be responsible for completing the supplied injury report forms. Please indicate on the phone list who this individual will be. The injury report forms have been produced so that recording should only take a matter of minutes. To maintain consistency throughout the study, the following information should be familiar to the recorder.

For the purpose of this study, an **injury** is defined as "a disability, trauma or disorder that is ice hockey related which causes a change in the normal, healthy state of an individual and requires medical attention from a trainer and/or medical doctor". Therefore, minor injuries (such as bruises) are of great importance to this study and should all be recorded. Any injury that draws the attention of the trainer, whether the player 'goes down' or not, should be recorded.

A **body check** is defined as "a legal separation of the puck carrier from the puck by physical contact which is allowed in all areas of the ice and may occur while travelling in opposite directions". It is important to note the difference between body checking and body contact, or collision, which is often the result of the puck carrier and is not usually intensional.

A subjective measure is required from the recorder indicating the **severity** of the injury . This measure will reflect the amount of pain and discomfort to the player with a five-point scale; one is minimal, three is bearable, and five is excruciating.

The injury report forms need to be completed each time an injury occurs in game action. This is to say, recorded injuries should be those that occur only on the ice, and only in games.

Accompanying this package, please find enclosed:

1. consent form
2. player profile
3. phone list
4. report forms
5. exposure to injury form
6. two self-addressed envelopes

If the recorder and team are willing to assist me in this study, please complete the consent form, player profile, exposure to injury form, and phone list, and return them at the earliest date possible. The larger, second envelope may be used to return completed injury report forms mid-season. At that time, I will issue more report forms and another return envelope to you.

I wish to emphasize once more that this study will involve the players as subjects, but it will not require them to do anything other than play their game. It will only take your cooperation and dedication for simply a couple of minutes after each game an injury occurs in.

I greatly appreciate your cooperation, and if there are any questions regarding the study, please feel free to call collect at (416) 344-7471 during the summer months, or at (807) 577-8796 during the school year. Also, a collect call message may be left for myself via Dr. Newhouse at the University at (807) 343-8074.

Thank you,

Wade Wiggins, HBPhed
Dr. Ian Newhouse, PhD

LAKEHEAD UNIVERSITY

Oliver Road. Thunder Bay, Ontario. Canada P7B 5E1

School of Physical Education and Athletics
Telephone (807) 343-8544
Fax (807) 343-8944

CONSENT FORM

I ____________________________ agree to record any injuries that are obtained throughout the year on the report forms provided for me. I am aware that I, and/or the players, may be contacted for a telephone interview with the researcher pertaining to any of the injuries.

Furthermore, I am aware that any information recorded is confidential, but will be available to me upon request. Finally, I am also aware that my consent may be withdrawn at any time during the study.

Date ____________________________________

Signature ____________________________

Thank you for your time and cooperation.

Wade Wiggins, HBPhed

Dr. Ian Newhouse, PhD

Appendix G

## PLAYER PROFILE

Team Name ______________________________

| Player's Name | Position (RW,LW,C LD,RD,G) | Date of Birth (day/month/yr) | Height (inches) | Weight (lbs) |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |
| 6. | | | | |
| 7. | | | | |
| 8. | | | | |
| 10. | | | | |
| 11. | | | | |
| 12. | | | | |
| 13. | | | | |
| 14. | | | | |
| 15. | | | | |
| . | | | | |
| . | | | | |
| . | | | | |

Appendix H

## EXPOSURE TO INJURY

1. How many players are there on this team? ________________

2. How long is the playing season for this team? From when to when?

   1st 2nd 3rd 4th week of ____________ to the
   1st 2nd 3rd 4th week of ____________

3. Approximately how many games per regular season (once CAHA registered) would the team be involved in:

   pre-season _______
   league __________
   post-season _______
   tournament _______
   Total _______

4. Approximately how many players turn out for each game? _______

5. Approximately how many hours a week does the team practice during the season? __________

6. Approximately how many players turn out for each practice? ___

7. Approximately how many hours of dryland/off-ice training does this team have prior to beginning the season? ________

Appendix I: Results of Exposure to Injury

Mean Hours of Practice per Week

| | Age Level | | |
|---|---|---|---|
| | 10 and 11 | 12 and 13 | 14 and 15 |
| | M (SD) | M (SD) | M (SD) |
| Ontario | 1.8 (0.3) | 2.5 (0.9) | 2.3 (0.6) |
| Quebec | 1.8 (0.3) | 2.0 (0.9) | 2.1 (0.8) |
| | ($t_{(4)} = 0$, $p > .01$) | ($t_{(4)} = 0.7$, $p > .01$) | ($t_{(4)} = 0.3$, $p > .01$) |

Mean Hours of Pre-season Training

| | Age Level | | |
|---|---|---|---|
| | 10 and 11 | 12 and 13 | 14 and 15 |
| | M (SD) | M (SD) | M (SD) |
| Ontario | 0.33 (0.6) | 1.3 (2.3) | 2.5 (3.5) |
| Quebec | 0.66 (1.2) | 1.0 (1.0) | 2.0 (2.6) |
| | ($t_{(4)} = -0.45$, $p > .01$) | ($t_{(4)} = 0.23$, $p > .01$) | ($t_{(3)} = 0.18$, $p > .01$) |

Mean of Total Games Played in Season

| | Age Level | | |
|---|---|---|---|
| | 10 and 11 | 12 and 13 | 14 and 15 |
| | M (SD) | M (SD) | M (SD) |
| Ontario | 0.33 (0.6) | 1.3 (2.3) | 2.5 (3.5) |
| Quebec | 0.66 (1.2) | 1.0 (1.0) | 2.0 (2.6) |
| | ($t_{(4)} = -0.69$, $p > .01$) | ($t_{(4)} = 1.06$, $p > .01$) | ($t_{(3)} = 1.24$, $p > .01$) |

Appendix J: Type of Injuries Caused by Body Checking

| | Total (n = 120) | | Ontario (n = 63) | | Quebec (n = 57) | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Bruise | 41 | 34.2 | 24 | 38.1 | 17 | 29.8 |
| Cartilage | 2 | 1.7 | 2 | 3.2 | - | - |
| Concussion | 13 | 10.8 | 6 | 9.5 | 7 | 12.3 |
| Dental | 2 | 1.7 | 1 | 1.6 | 1 | 1.8 |
| Dislocation | 6 | 5.0 | 2 | 3.2 | 4 | 7.0 |
| Fracture | 18 | 15.0 | 12 | 19.0 | 6 | 10.5 |
| Internal/Abdomen | 5 | 4.2 | - | - | 5 | 8.8 |
| Laceration | 1 | 0.8 | - | - | 1 | 1.8 |
| Muscle Strain | 14 | 11.7 | 8 | 12.7 | 6 | 10.5 |
| Separation | 8 | 6.7 | 2 | 3.2 | 6 | 10.5 |
| Sprain | 7 | 5.8 | 3 | 4.8 | 4 | 7.0 |
| Other | 3 | 2.5 | 3 | 4.8 | - | - |

Appendix K: Location of Body Checking Injuries

| | Total Injuries (n = 124) | | Ontario (n = 66) | | Quebec (n = 58) | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| HEAD | | | | | | |
| Head | 15 | 12.1 | 8 | 12.1 | 7 | 12.1 |
| Jaw/Chin | 2 | 1.6 | - | - | 2 | 3.4 |
| Neck/Throat | 2 | 1.6 | 2 | 3.0 | - | - |
| Nose | 1 | 0.8 | 1 | 1.5 | - | - |
| Mouth | 2 | 1.6 | 1 | 1.5 | 1 | 1.7 |
| TOTAL | 22 | 17.7 | 12 | 19.4 | 10 | 17.9 |
| BODY | | | | | | |
| Abdomen | 6 | 4.8 | 4 | 6.1 | 2 | 3.4 |
| Chest | 4 | 3.2 | 1 | 1.5 | 3 | 5.2 |
| Hip/Pelvis | 5 | 4.0 | 1 | 1.5 | 4 | 6.9 |
| Lower Back | 8 | 6.5 | 3 | 4.5 | 5 | 8.6 |
| Ribs | 5 | 4.0 | 4 | 6.1 | 1 | 1.7 |
| Tailbone | 5 | 4.0 | 4 | 6.1 | 1 | 1.7 |
| TOTAL | 33 | 26.6 | 17 | 27.4 | 16 | 28.6 |
| LEG | | | | | | |
| Ankle | 2 | 1.6 | 1 | 1.5 | 1 | 1.7 |
| Groin | 2 | 1.6 | 1 | 1.5 | 1 | 1.7 |
| Knee | 16 | 12.9 | 11 | 16.7 | 5 | 8.6 |
| Upper Leg | 5 | 4.0 | 3 | 4.5 | 2 | 3.4 |
| TOTAL | 25 | 20.2 | 16 | 25.8 | 9 | 16.1 |
| ARM | | | | | | |
| Elbow | 7 | 5.6 | 4 | 6.1 | 3 | 5.2 |
| Forearm | 1 | 0.8 | - | - | 1 | 1.7 |
| Hand | 3 | 2.4 | 2 | 3.0 | 1 | 1.7 |
| Shoulder | 21 | 16.9 | 9 | 13.6 | 12 | 20.7 |
| Upper Arm | 1 | 0.8 | - | - | 1 | 1.7 |
| Wrist | 5 | 4.0 | 2 | 3.0 | 3 | 5.2 |
| TOTAL | 38 | 30.6 | 17 | 27.4 | 21 | 37.5 |
| OTHER | 6 | 4.8 | 4 | 6.1 | 2 | 3.4 |

Appendix L: Four Measurements of Severity for Body Checking Injuries

Amount of Pain and Discomfort to the Injured Player

| Likert Scale Rating | Total (n= 120) | | Ontario (n = 65) | | Quebec (n = 55) | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Minimal | 7 | 5.8 | 5 | 7.7 | 2 | 3.6 |
| 2 | 18 | 15.0 | 15 | 23.1 | 3 | 5.5 |
| Bearable | 41 | 34.2 | 22 | 33.8 | 19 | 34.5 |
| 4 | 45 | 37.5 | 21 | 32.3 | 24 | 43.6 |
| Excruciating | 9 | 7.5 | 2 | 3.1 | 7 | 12.7 |

Time Loss From Hockey Due to Injury

| Rating | Total (n= 123) | | Ontario (n = 66) | | Quebec (n = 57) | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Minor | 45 | 36.6 | 33 | 50.0 | 12 | 21.1 |
| Moderate | 40 | 32.5 | 15 | 22.7 | 25 | 43.9 |
| Major | 28 | 22.8 | 15 | 22.7 | 13 | 22.8 |
| Severe | 10 | 8.1 | 3 | 4.5 | 7 | 12.3 |

School Days Missed Due to Injury

| Days | Total (n= 116) | | Ontario (n = 59) | | Quebec (n = 57) | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| 0 | 90 | 77.6 | 50 | 84.7 | 40 | 70.2 |
| 1 | 11 | 9.5 | 3 | 5.1 | 8 | 14.0 |
| 2 | 10 | 8.6 | 5 | 8.5 | 5 | 8.8 |
| 3 | 3 | 2.6 | 1 | 1.7 | 2 | 3.5 |
| 4 | - | - | | | - | - |
| 5 | 1 | 0.9 | | | 1 | 1.8 |
| 6 | - | - | | | - | - |
| 7 | 1 | 0.9 | | | 1 | 1.8 |

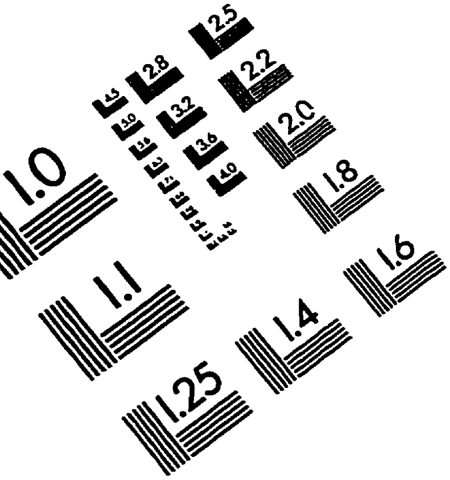
Who Treated the Injured Player

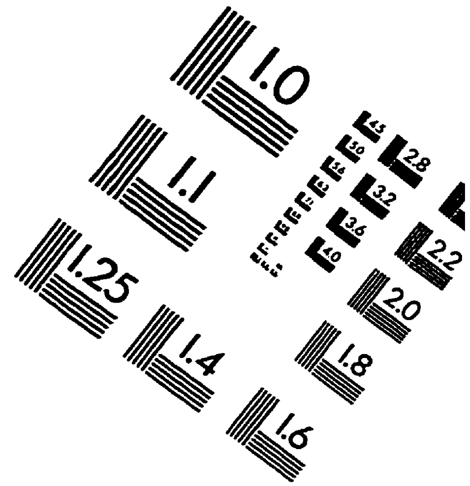
| Rating | Total (n= 124) | | Ontario (n = 66) | | Quebec (n = 58) | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Chiropractor | 2 | 1.6 | 1 | 1.5 | 1 | 1.7 |
| Dentist | 1 | 0.8 | 1 | 1.5 | - | - |
| Doctor | 41 | 33.1 | 22 | 33.3 | 19 | 32.8 |
| Physiotherapist | 10 | 8.1 | 2 | 3.0 | 8 | 13.8 |
| Team Trainer | 67 | 54.0 | 39 | 59.1 | 28 | 48.3 |
| Other | 3 | 2.4 | 1 | 1.5 | 2 | 3.4 |

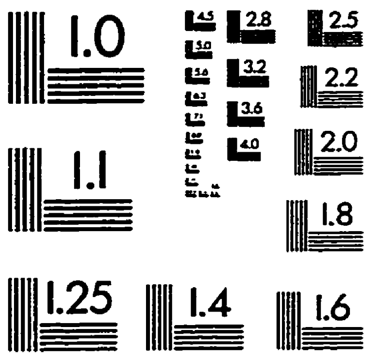
## Appendix M: Time Variables of Body Checking Injuries

| Variable | Total n | Total % | Ontario n | Ontario % | Quebec n | Quebec % |
|---|---|---|---|---|---|---|
| Period | (n = 119) | | (n = 64) | | (n = 55) | |
| first | 32 | 26.9 | 19 | 29.7 | 13 | 23.6 |
| second | 40 | 33.6 | 21 | 32.8 | 19 | 34.5 |
| third | 46 | 38.7 | 23 | 35.9 | 23 | 41.8 |
| unknown | 1 | 0.8 | 1 | 1.6 | - | - |
| Type of Game | (n = 124) | | (n = 66) | | (n = 58) | |
| pre-season (111) | 13 | 10.5 | 6 | 9.1 | 7 | 12.1 |
| league (614) | 64 | 51.6 | 35 | 53.0 | 29 | 50.0 |
| tournament (265) | 30 | 24.2 | 17 | 25.8 | 13 | 22.4 |
| post-season (190) | 14 | 11.3 | 6 | 9.1 | 8 | 13.8 |
| other | 3 | 2.4 | 2 | 3.0 | 1 | 1.7 |

# IMAGE EVALUATION TEST TARGET (QA-3)

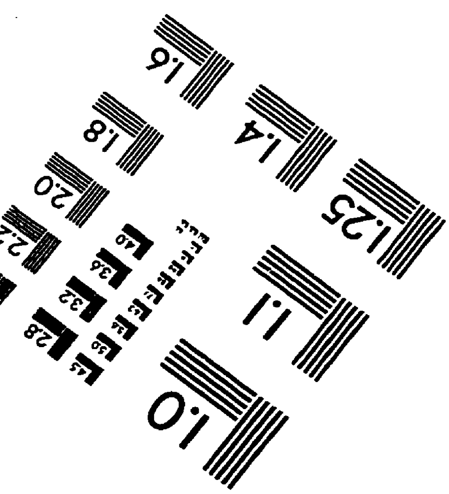


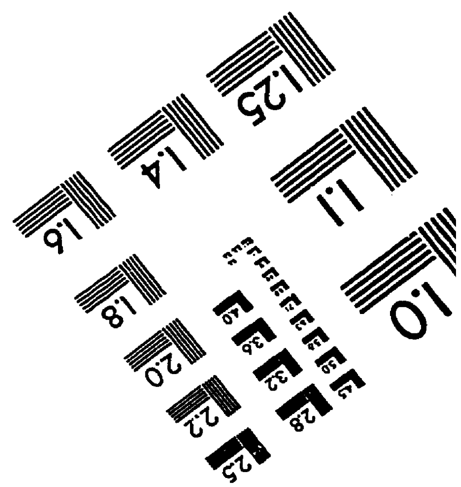




150mm

6″





APPLIED IMAGE . Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989