A Systematic Review of the Association Between Body Checking and Injury in Youth Ice Hockey

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Objective: The objective of this study is to systematically examine the risk of injury associated with body checking in youth ice hockey.

Data Sources: A systematic review of the relevant electronic databases was conducted including PubMed and Web of Science. The main search terms included "hockey, ice hockey, injury, body checking, child, adolescent, and pediatric."

Study Selection: The initial search identified 898 potential articles, and, after verifying inclusion criteria, 260 articles were selected for further assessment. The Downs and Black instrument for non-randomized studies (Downs 1998) was used to assess the quality of the articles.

Data Extraction: Studies included reported on body checking as a mechanism of injury and compared injury rates in checking to non-checking leagues in children 20 years or younger.

Data Synthesis: Twenty studies met the inclusion criteria and they predominantly found increased injuries associated with body checking. The relative risk of injury associated with body checking in comparative studies ranged from 0.6 to 39.8. Checking was the reported mechanism of injury between 2.9% and 91% of injuries. All but 1 study that met our inclusion criteria found an increased risk of injuries when body checking was permitted.

Conclusions: Increased injuries attributable to checking were found where checking was allowed. This study supports policies that disallow body checking to reduce injuries in young children.

Key Words: body checking, child, hockey, injury, sports

(*Clin J Sport Med* 2009;19:134–144)

INTRODUCTION

Ice hockey is a popular sport around the world, especially in northern countries, and is considered one of Canada's national sports. In Canada, more than 500 000 young players are registered.[1] The United States has more than 250,000[2] children playing the game, whereas European countries like Finland have more than 60 000 registered players.[3] One important element of hockey at the professional level among adults is body checking, which is defined by Hockey Canada as "an individual defensive tactic designed to legally separate the puck carrier from the puck. The action of the defensive player is deliberate and forceful in an opposite direction to which the offensive player is moving."[4]

There has been controversy associated with the age at which body checking should be permitted and legal in the preprofessional setting. Professional and competitive leagues permit body checking, but most recreational leagues for children do not. Hockey Canada groups the players based on age into Initiation (5, 6 years), Novice (7, 8 years), Atom (9–10 years), Peewee (11–12 years), Bantam (13–14 years), and Midget (15–17 years).[2]

Ontario has been at the forefront of the body checking debate because the Ontario Hockey Association implemented a trial where body checking is introduced in the competitive Atom (9-year-olds) leagues.[5,6] Recently, the Ontario Hockey Federation rescinded that decision and will allow checking in the competitive leagues in the Peewee (11–12 years) division and above in the 2008–2009 season.[7] Other provinces, including Quebec, do not start checking until Bantam (13-year-olds), whereas many European countries never allow checking.[2,3] The heterogeneity of rules leads to debate on the risks and benefits of early introduction to checking.

Burden of Injury

Hockey is associated with high rates of injury; of particular concern are the rates of traumatic brain injury. Up to 5% of sport injuries are concussions, and the US Centers for Disease Control and Prevention estimates that 300 000 sport-related concussions occur yearly in the United States, but that number includes only athletes who lost consciousness.[8] Hockey-related fatality and injury rates are more than twice as high as those in football.[6] Nonfatal catastrophic spinal cord and brain injury rates are 2.6 per 100 000 for hockey players and 0.7 per 100 000 for football players, among high school athletes.[6] In Ontario alone, more than 3000 children aged 16 years or below visited emergency departments during the 2002–2003 season.[2]

Without conclusive evidence, changing the policies related to body checking within the younger age groups in the game remains controversial. Proponents of body checking

Submitted for publication June 10, 2008; accepted December 10, 2008.
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The authors state that they have no financial interest in the products mentioned within this article.
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claim that it is an integral part of the game, and teaching this skill early prevents injuries in later years of play.[6] Opponents of body checking for young children, such as the Canadian Academy of Sport Medicine,[9] believe that body checking is the most common source of all injury types in hockey and that it should be eliminated from all recreational levels and only introduced in the elite levels at the Bantam (13–14 years) age or Midget (15–17 years) age. The American Academy of Pediatrics[10] echoes these sentiments and recommends banning body checking at 15 years of age and below.

The objective of this article is to conduct a systematic review of the literature to summarize the reported association between body checking and injuries in youth ice hockey.

METHODS

Literature Search

Articles were found mainly through electronic databases with a combination of key medical subject headings and Boolean operators. The search consisted of terms including "("body-checking" OR "body checking") AND (hockey OR "ice hockey") AND athletic AND injury AND (child OR adolescent OR pediatric)." Articles were limited through a "limit" function to prospective, retrospective, cohort, random, case, and cross-sectional designs. The initial search identified 898 potential articles as seen in Table 1. After verifying inclusion criteria, 260 unique articles were selected for further assessment and deemed potentially relevant.

Relevant references in selected articles were retrieved through "snowballing" techniques. In addition to literature searches using electronic databases, articles were also found through specific searches on Web sites including the Canadian Hospitals Injury Reporting and Prevention Program, Canadian Institute for Health Information, Google Scholar, Ontario Hockey Federation, and Hockey Canada. Finally, international experts were contacted and asked for published or unpublished data.

TABLE 1. Electronic Search Strategy

Electronic Database	No. of References
PubMed	13
MEDLINE	11
HealthSTAR	12
CINAHL	5
SportDiscuss	7
EMBASE	9
Web of Science	5
Canadian Electronic Library	4
Physical Education Index	1
PsycINFO	1
Health Sciences	0
Early Canadiana	0
BioOne Abstracts	0
Cochrane Database of Systematic Reviews	0
Allied and Complementary Medicine	0
OLDMEDLINE	0
Compendex	0

Study Selection

After the identification of possible studies for inclusion using the search strategy listed above, 2 of the authors independently assessed the studies against inclusion criteria (Table 2). Twenty studies met the inclusion criteria. There were no disagreements between authors on study inclusion.

Quality Assessment

The Downs and Black instrument for nonrandomized studies (Downs 1998) was used to assess the quality of studies. The reviewers used the instrument to rate the studies. The instrument consists of a 27-item checklist that rates studies on the following key areas: reporting, external validity, internal validity, bias, confounding, and power. A narrative approach was adopted to discuss the performance of each included study on these methodological areas.

Data Extraction and Synthesis

Data were extracted that measured the association between body checking and injury. Data from several studies[11–15] were extracted and synthesized into usable data for this review. All other data were extracted as recorded in the original studies. A narrative approach was adopted to describe and synthesize the results due to the heterogeneity of the data and the uniqueness of methodological design for each included study.

RESULTS

Description of Studies

The 20 studies that met the inclusion criteria are presented in Table 3. Studies were from around the world, including 9 from Canada, 9 from the United States, and 2 from Finland. Scores on the articles from the Downs and Black instrument ranged from 19 to 25, which is in the fair to good range. Studies were categorized as comparative if they had a clear comparison between a checking and non-checking group and as descriptive if they did not include a calculable or clear relative risk, odds ratio, or rate ratio.

The association between body checking and injury in each of the comparative studies is presented in Table 4. The relative risk of injury associated with body checking ranged from 0.63 to 39.79. Body checking was described as the mechanism of injury for 2.9%–91% of injuries. Only the Montelpare study[12] found no evidence of a harmful effect.[12]

TABLE 2. Inclusion and Exclusion Criteria

Inclusion criteria	
	Studies involving hockey players 20 years of age or less (male or female)
	Study must include an assessment of both body checking and injuries
	Injury must be sustained in ice hockey
	Studies must have original data
	All study designs except letters and case reports
Exclusion criteria	
	Studies on a broad range of ages (no specific age range)
	Studies on a broad range of sports (no specific data on ice hockey)
	Non-English articles

TABLE 3. Description of Included Studies

Study	Design (P/R)	Age, y	Duration of Study (No. of Seasons and Year)	No. of Participants	No. of Teams	Data Collection Source	Setting	Objective	Main Conclusions
Analytic									
Emery and Meeuwisse[16]	P	9–16	1 (2004–2005)	986	71	Trainer	Teams were followed for a season in Calgary, Alberta	Implementation and validation of injury surveillance system to examine mechanisms of injury	Significant differences in injury rates were found by age and division of play. The public health significance of body checking injury in minor hockey is great. Future research will include expansion of surveillance to further examine body checking injuries and prevention strategies in minor hockey.
Hagel et al[1]	R	10–12	4 (2000–2004)	278	NA	Hospital database	Players admitted to Emergency Room in Edmonton, Alberta	Examined injury rates, risk factors and mechanisms on effects of policy change	The introduction of body checking to 11-year old players was associated with a large increase in injury rates. From a public health perspective, the age at which body checking is introduced in minor hockey should be raised.
Macpherson et al[1]	R	10–15	8 (1995–2002)	4736	NA	CHIRPP database	Examined the CHIRPP database in Ontario and Quebec	Compared body checking injuries in areas where checking was and was not allowed	Increased injuries attributable to checking were observed where checking was allowed. This study supports policies that disallow body checking to reduce ice hockey injuries in children.
Willer et al[11]	P	4–18	2 (2002–2004)	2002: 263 2003: 2639	NA	Trainer	Injury that resulted in a visit to a physician in Buffalo, New York	To determine injury rates in youth hockey due to body checking	The study findings suggest that the introduction of body checking at age 9 to competitive youth hockey causes an immediate but relatively short-term increase in injury rates. The period of adjustment that accompanies body checking should be taken into account when determining the age at which body checking is introduced.

TABLE 3. (*continued*) Description of Included Studies

Study	Design (P/R)	Age, y	Duration of Study (No. of Seasons and Year)	No. of Participants	No. of Teams	Data Collection Source	Setting	Objective	Main Conclusions
Montelpare [12]	P	10–11	3 (1998–2001)	Year 1: ODMHA 1035, OHF 1515 Year 2: ODMHA 885, OHF 1515 Year 3: ODMHA 4232, OHF 33 920	Year 1: 143 Year 2: 160 Year 3: 136	Self-report	Ottawa District Minor Hockey (no checking) and players in the Ontario Hockey Federation (checking)	To evaluate the influence of introducing body checking at the atom age level on the "flow of the game" in a sample of control and experimental subjects	Body checking, which includes body contact is considered by many to be a skill within the game of ice hockey that can be taught at the younger age levels in a manner that does not lead to a higher incidence of injuries, or unfavourable changes in dthe game.
Stuart et al[13]	P	9–14	1 (1993–1994)	66	4	MDs	Minnesota Community	To determine the incidence and type of injuries in hockey players current methods of surveillance	Further research is necessary to determine whether injuries in youth ice hockey can be reduced by changes in playing rules, enforcement of existing rules, improvements in protective equipment, alteration in coaching techniques, and institution of educational programs.
Regnier et al[14]	P	12–13	1 (1985–1986)	279	BC (AA): 6 BC (CC): 22 NBC (CC): 21	Survey	Peewee division in Quebec hockey league	To determine the effects in ice hockey related to the introduction of checking in the Peewee division	The results are discussed in light of regulating actions taken in Quebec and the Canadian provinces toward body checking in the Peewee division.
Roy et al[15,17]	R	12–13	1 (1985–1986)	279	BC (AA): 6 BC (CC): 22 NBC (CC): 21	Quest./ survey	Two studies of the incidence and types of injuries in competitive leagues in Quebec	To determine the effects of body checking at the Peewee level	Following the multidisciplinary study, the president of the Quebec Sport Safety Board met with leaders of the Quebec Hockey Federation and decided to abolish body checking for Peewee players.
Descriptive									
Molsa et al[3]	R	<12–19	1 (1996–1997)	<12: 13 706 12–14: 13 363 15–19: 11 157	NA	Insurance	Analyzed upper extremity injuries in Finland	To investigate mechanisms of upper extremity ice hockey injuries	Ongoing surveillance and an exact reporting system are needed for establishing the trends in the number and severity of the injuries.

(*continued on next page*)

TABLE 3. (*continued*) Description of Included Studies

Study	Design (P/R)	Age, y	Duration of Study (No. of Seasons and Year)	No. of Participants	No. of Teams	Data Collection Source	Setting	Objective	Main Conclusions
McFaull et al[18]	R	10–17	1 (1998–1999)	1551	NA	CHIRPP database	The CHIRPP database was reviewed for Canada	To investigate the mechanisms and types of injuries in youth hockey players	The CHIRPP data and other studies indicate that body contact is the predominant mechanism of injury for males playing organized minor hockey. Further epidemiologic research should focus on the detailed circumstances of such injuries and the effectiveness of various control measures.
Dryden et al[19]	P	Mean 14.7	1 (1997–1998)	314	33	Interview	Female players in Edmonton, Alberta	To examine the incidence and nature of injuries suffered by female recreational ice hockey players	The observed injury rate was lower than the rates reported for male recreational and collegiate ice hockey players.
Reid et al[20]	P	7–18	1 (1995–1996)	103	NA	Emerg. Quest.	Children's Hospital in St Paul, Minnesota	To assess the implementation of published injury prevention strategies and factors contributing to youth ice hockey injuries	Elimination of checking would potentially reduce the number of significant injuries more than would the enforcement of existing rules.
Roberts et al[21]	P	11–19	1 (1993–1994)	807	NA	Trainer	Hockey tournaments in Minnesota	To prospectively document the incidence of game injury rates in youth ice hockey tournaments	In boys' games, 65% of "all" injuries and 77% of "significant" injuries were related to collisions. The girls' rules of play do not allow body checking, and there were no significant injuries in girls' games.
Smith et al[22]	P	15–19	1 (1994–1995)	86	6	MDs	High schools in Minnesota	To determine both the incidence of injury and the influence of physical, situational, and psychosocial factors	Injuries occurred more often in games than in practices, usually as a result of collisions.

TABLE 3. (*continued*) Description of Included Studies

Study	Design (P/R)	Age, y	Duration of Study (No. of Seasons and Year)	No. of Participants	No. of Teams	Data Collection Source	Setting	Objective	Main Conclusions
Roberts et al[23]	P	<20	1 (1994–1995)	273	16	Athletic trainers	Minnesota Community	To determine the rate, type and severity of injuries incurred during a tournament	The fair-play concept can reduce injury rates, penalty rates, and severity of penalties and should be considered for ice hockey at all levels of play.
Bernard et al[24]	P	14–15	2 (1987–1989)	NA	37	Survey	Three leagues in Quebec and 2 in Outaouais, Ontario	To determine the incidence and type of injuries in hockey players in 5 leagues	Body Checking was identified as the cause of 75% of al major physical trauma recorded during both seasons.
Bjorkenheim et al[25]	P	9–18	1 (1990–1991)	1437	54	Quest.	Organized hockey league in the area of Helsinki, Finland	To study the risk and type of injuries in competitive hockey and examine the nature and cause of hockey traumas	Prevention of ice hockey injuries is multifactorial, including stricter rule enforcement, improved protective equipment, and better understanding of the forces involved.
Brust et al[26]	P	9–15	1 (1990–1991)	150	9	Coaches	Community-organized hockey program in Minnesota analyzing injury	To determine the rate, type and severity of injuries in child hockey players and their attitudes and knowledge	Eliminating violence and body checking for prepubertal boys while emphasizing rule enforcement and good sportsmanship are recommended.
Finke et al[27]	R	14–18	2 (1982–1984)	480	12	Quest.	High schools in Minnesota	To document rates, types, and severities of shoulder injuries in high school athletes	More than 54% of the injuries were caused by contact with the boards surrounding the ice surface and, reportedly, 43% of the injuries were associated with illegal activities.
Gerberich et al[28]	R	Mean 16.1	1 (1982–1983)	251	12	Quest.	High schools in Minnesota	To document rates, types, and severities of injuries in high school varsity athletes	Increased risks of injury were associated with multiple health-care provision variables and equipment utilized.

BC (AA) body checking, level AA; BC (CC) body checking, level CC; CHRPP, The Canadian Hospitals Injury Reporting and Prevention Program; Emerg., emergency; MD, medical doctor; NA, not available; NBC (CC), no body checking, level CC; ODMHA, Ottawa District Minor Hockey Association; OHF, Ontario Hockey Federation; P, prospective; Quest., questionnaire; R, retrospective.

TABLE 4. Numerical Data from Included Studies

Study	No. of Injuries	Injury Rate per Game	Injury Rate per 100 Players	Injury Rate per 1000 Hours	Mechanism of Injury BC, %	Groups Compared	Comparator	Outcome (95% Confidence Interval)
Analytic								
Emery and Meeuwisse[16]	296	—	30.02	4.13	45	Injury risk in nonchecking, Atom (9–10) versus checking in Peewee (11–12), Bantam (13–14), and Midget (15–17)	Relative risk	Peewee: 2.97 (1.63–5.8) Bantam: 3.72 (2.08–7.14) Midget: 5.43 (3.14–10.17)
Hagel et al[1]	Peewee (BC): 151 Atom (NBC): 82	—	Peewee (BC): 8.55 Atom (NBC): 4.06	—	Peewee (BC): 52.3 Atom (NBC): 26.8	Eleven-year-old checking (Peewee) versus nonchecking (Atom)	Rate ratio	1.84 (1.4–2.4)
Macpherson et al[5]	Ontario (BC): 2540 Quebec (NBC): 2196	—	—	—	10–11 (BC): 49, (NBC): 41 12–13 (BC): 48 (NBC): 27	Checking injuries as a proportion of all hockey injuries for 10- to 13-year-olds in Ontario (checking) versus Quebec (nonchecking)	Odds ratio	2.65 (2.21–3.18)
Willer et al[11]	2002: 45 2003: 56	—	1.96	—	—	Teams with checking vs teams without checking (Atom to Bantam)	Rate ratio	Minor Atom: 39.8 (13.6–116.8) Atom: 13.7 (3.6–52.4) Minor Peewee: 27.0 (7.1–103.2) Peewee: 2.92 (1.17–7.26) Minor Bantam: 26.0 (8.8–77.4) Bantam: 8.91 (3.0–26.1)
Montelpare[12]	Year 1: ODMHA 12, OHF 6 Year 2: ODMHA 16, OHF 25 Year 3: ODMHA 63, OHF 273	—	Year 1: ODMHA 1.16, OHF 0.54 Year 2: ODMHA 1.81, OHF 1.65 Year 3: ODMHA 1.49, OHF 0.80	—	OHF (BC): 10.3 ODMHA (NBC): 2.9	Injury risk in Atom (9–10) nonchecking ODMHA versus checking OHF players	Rate ratio	Year 1: 0.81 (0.5–1.5) Year 2: 0.63 (0.36–1.08) Year 3: 0.75 (0.44–1.25)
Stuart et al[13]	14	—	—	9–10: 1.0 11–12: 1.8 13–14: 4.3	50	Bantam and Peewee players (checking) versus Squirt (no checking)	Rate ratio	Peewee: 1.8 (0.2–19.7) Bantam: 4.3 (0.18–14.32)

TABLE 4. (*continued*) Numerical Data from Included Studies

Study	No. of Injuries	Injury Rate per Game	Injury Rate per 100 Players	Injury Rate per 1000 Hours	Mechanism of Injury BC, %	Groups Compared	Comparator	Outcome (95% Confidence Interval)
Regnier et al[14]	BC (AA): 19 BC (CC): 26 NBC (CC): 7	—	—	—	Fractures: BC (AA): 91 BC (CC): 86 NBC (CC): 0	Eleven-year-old (Peewee) checking versus nonchecking leagues. Six Rep (AA) teams with checking to 21 Rep (CC) teams no checking and 22 (Rep) CC teams with checking to 21 (Rep) CC teams no checking	Rate ratio	6.72 (2.91–15.54) 2.94 (1.30–6.67)
Roy et al[15,17]	BC (CC): 54 NBC (CC): 16	BC (CC): 284 NBC (CC): 0.67	—	—	BC (CC): 55.5 NBC (CC): 18.8	Eleven-year-old (Peewee) checking versus nonchecking in Rep (CC) leagues	Odds ratio	3.38 (2.08–5.48)
Descriptive								
Molsa et al [3]	Upper extremity only: <12: 20 12–14: 126 15–19: 304	—	—	Injuries per 1000 player years: <12: 1.5 12–14: 9.4 15–19: 27.2	<12: 30 12–14: 53.2 15–19: 54.6	—	—	—
McFaull[18]	Atom: 202 Peewee: 469 Bantam: 629 Midget: 251		Atom: 3.54 Peewee: 6.6 Bantam: 10.17 Midget: 8.87		Atom: 46 Peewee: 50.9 Bantam: 44.6 Midget: 52.5	—	—	—
Dryden et al[19]	125	—	—	7.5	40	—	—	—
Reid et al	113	—	—	—	57	—	—	—
Roberts et al[22]	Boys: 60 Girls: 4	—	—	Boys: 117.3 Girls: 50.5	Boys: 65 Girls: 50	—	—	—
Smith et al[21]	27	—	—	80	74.1	—	—	—
Roberts et al[22]	29	—	—	135.6	67.9	—	—	—
Bernard et al[23]	Minor: 632 Major: 132	Minor: 2.08 Major: 0.12	—	—	Minor: 51.4 Major: 76.5	—	—	—
Bjorkenheim et al[24]	128	—	<12: −0.88 −12–15: −12. 4 15–18: −25.3	—	44.5	—	—	—
Brust et al[25]	52	—	35		86	—	—	—
Finke et al[26]	45 (shoulder only)	—	9.4		24.4	—	—	—
Gerberich et al[27]	189	—	75	5	74.4	—	—	—

BC (AA), body checking, level AA; BC (CC), body checking, level CC; NBC (CC), no body checking, level CC; ODMHA, Ottawa District Minor Hockey Association; OHF, Ontario Hockey Federation.

TABLE 5. Injuries by Type and Location

Study	Type					Anatomical Location				
	Total No. of Injuries	Concussion, %	Fracture, %	Laceration, %	Sprain/Strain, %	Head/Face	Arms/Hand	Shoulder/Trunk	Back/Neck	Leg/Foot
Regnier et al[14]	BC (AA): 19 BC (CC): 26 NBC (CC): 7	BC (AA): 5 BC (CC): 15 NBC (CC): 43	BC (AA): 58 BC (CC): 54 NBC (CC): 13		BC (AA): 21 BC (CC): 23 NBC (CC): 29	—	—	—	—	—
Roy et al[15,17]	BC (CC): 54 NBC (CC): 16	BC (CC): 1.9 NBC (CC): 6.3	BC (CC): 46.3 NBC (CC): 6.3	BC (CC): 1.9 NBC (CC): 0	BC (CC): 3.7 NBC (CC): 6.3	BC (CC): 16.7 NBC (CC): 12.5	BC (CC): 16.7 NBC (CC): 12.5	BC (CC): 9.3 NBC (CC): 18.8	BC (CC): 31.5 NBC (CC): 18.8	BC (CC): 24.1 NBC (CC): 37.5
Montelpare[12]	OHF (BC): 229 ODMHA (NBC): 46	—	—	—	—	OHF (BC): 14 ODMHA (NBC): 0	OHF (BC): 56 ODMHA (NBC): 26	OHF (BC): 0.4 ODMHA (NBC): 0.0	OHF (BC): 24 ODMHA (NBC): 17	OHF (BC): 2 ODMHA (NBC): 2
Hagel et al[1]	Peewee (BC): 151 Atom (NBC): 82	Peewee (BC): 12.6 Atom (NBC): 6.7	Peewee (BC): 23.9 Atom (NBC): 16.7	Peewee (BC): 3.8 Atom (NBC): 4.4	Peewee (BC): 18.9 Atom (NBC): 15.6	Peewee (BC): 23.9 Atom (NBC): 20.0	Peewee (BC): 37.7 Atom (NBC): 41.1	Peewee (BC): 11.3 Atom (NBC): 5.6	Peewee (BC): 8.8 Atom (NBC): 12.2	Peewee (BC): 18.2 Atom (NBC): 21.1
Macpherson et al[5]	Ontario (BC): 2540 Quebec (NBC): 2196	10–11: Ontario (BC): 4 Quebec (NBC): 3 11–12: Ontario (BC): 3 Quebec (NBC): 2	10–11: Ontario (BC): 29 Quebec (NBC): 25 11–12: Ontario (BC): 30 Quebec (NBC): 25	—	—	—	—	—	—	—

BC, body checking; BC (AA), body checking, level AA; BC (CC), body checking, level CC; NBC, no body checking; NBC (CC), no body checking, level CC; ODMHA, Ottawa District Minor Hockey Association; OHF, Ontario Hockey Federation.

All other studies found an increased risk of injury due to checking.

Fractures were the most numerous type of injury with a consistently higher percentage of those injuries occurring to those in checking leagues as seen in Table 5. Additionally, there are a higher percentage of injuries across anatomical locations in the body checking groups with the exception of the leg and foot.

DISCUSSION

Increased injuries attributed to checking were observed where checking was allowed. Body checking was often cited as the leading mechanism of injuries across age levels and divisions of play.[1,5,11,13,16] Body checking has also been established as an important contributing factor for fractures and other types of injury.[1,5,14,15] All but 1 study that met our inclusion criteria found an increased risk of injuries due to body checking.[12] The results of this study have been questioned on the definition of the study denominator and possible underreporting of injuries in the body checking group. Some authors have suggested that the results need to be regarded with caution.[29–31]

Several studies have highlighted the need for caution when allowing young children to body check in organized hockey.[1,2,5,6,16] The results of our review support their conclusions. Recommendations have been published by several organizations including the American Academy of Pediatrics and Canadian Academy of Sport Medicine to increase the age at which checking is introduced.[9,10] Currently, the Canadian Hockey Association allows body checking at the Peewee (11–12 years) age level, and, at the time of the study, Ontario allowed checking at the Atom level (9 and 10 years). Body checking at this young age is clearly inconsistent with the recommendations made by these bodies. This review adds to and summarizes the growing body of evidence that body checking is a mechanism of injury in the game and describes the unnecessary risk of injury attributable to checking among young athletes.

The debate over the age to introduce checking is controversial and has led to some heated discussion. Some researchers have stated that body checking should be taught at a young age so that the adjustment period to checking can occur when the children are at a younger age.[12] They argue that this will reduce injuries because their bodies are smaller and lighter and therefore less likely to be injured or injure other players. Other researchers have found no such learning effect[1,5,32] and have shown that it is unlikely that there is a protective effect for children who learn to check earlier. The current review did not find evidence related to a protective effect of teaching hockey players to bodycheck at a younger age. If the age at which checking was introduced was raised, the reported spike in injuries at the younger ages might vanish and there would be a significant decrease in the overall burden of injuries. We found no studies that looked prospectively at the protective effect of introducing checking at a younger age. Well-designed research related to this question would contribute to the body of literature on hockey injuries.

Limitations

Several limitations must be noted in our study:

- The majority of the studies were descriptive, lacking a direct analytical comparison of body checking and injury.
- Data collection occurred from a variety of sources.
- The exposure variable (body checking) and the outcome variable (injury) were often not clearly defined. Some studies included stick checks, poke checks, or other hockey-related factors in their definition of checking. Additionally, body contact is often confused with body checking, and injuries resulting from body contact may have been included under body checking, overestimating the results. Surveys with no clearly stated injury definition may underestimate injury rates if data were self-reported, especially concussion rates or injuries that did not require a loss of playing time.
- The validity of the recording mechanisms is not known in many of the studies.
- Several studies did not standardize injury rates (ie, per 100 players or per 100 player hours).
- Study populations were predominantly samples of convenience with no random selection of subjects or baseline testing, a potential source of selection bias.
- A potential source of bias in the reviewed studies was a lack of measurement, control, and reporting of potential confounders. Differences in coaching techniques, conditioning, warm-up routines, protective equipment use, rules, rule enforcement, age, experience level, skill level, position, injury history, and arena characteristics may all have a significant effect on the results.[33]

CONCLUSIONS

Policies that permitted younger players to body check were associated with increased injuries and fractures. Our findings support current recommendations that children play in noncontact hockey leagues until at least Bantam (13 years old) or later. By removing body checking from the younger age groups, the noted spike in injuries attributed to checking is likely to be reduced, thus decreasing the overall burden of injury. This study suggests that the body checking regulations should be reviewed for the safety of our youth who play the game so passionately.

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