

Occasional Essay

Bodychecking and concussions in ice hockey: Should our youth pay the price?

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Ice hockey, considered Canada's national sport, has more than 500 000 registered players,¹ many of whom aspire to play in the National Hockey League (NHL). With the drive to win at any cost permeating the game, it is not surprising that aggression is a commonly used tactic and has helped to turn hockey into a collision sport.² Nor is it surprising that youth often idolize and emulate the professional enforcers who protect their team's leading scorers.³

Bodychecking, thought by some a useful skill for winning games, is a major risk factor for injury.^{2,4-7} With the rising incidence of traumatic brain injury in hockey,^{8,9} too many Canadian youth are exposed to the lasting effects of such injuries, some of which are not fully realized until the brain completes its maturation.

Before the start of the 2002–2003 season, Hockey Canada (previously known as the Canadian Hockey Association), reversed its 20-year stance and decided to permit players as young as 9 years old to bodycheck in games.^{10,11} Although the research¹² that was used to justify this policy was later deemed flawed by its author and others,¹³ the policy stood. This ignited a debate that resounded throughout arenas, homes and league boardrooms across the country. Previously, only those aged 12–13 years and older could bodycheck, although some provinces such as British Columbia had a threshold of 14–15 years. Hockey Canada reversed its decision in May 2003 and decided to raise the starting age to 11; however, it continues to allow bodychecking starting at age 9 in an “experimental” fashion in 4 of some of the largest hockey associations in Canada.¹⁴⁻¹⁶ The meaning of “experimental” does not appear in Hockey Canada news releases.

Those in favour of bodychecking claim that the game of hockey demands it; youth exposed to bodychecking at only a later age will be ill equipped to avoid injury. They believe that injuries result from improperly delivered or taken bodychecks and that poor technique should not deter leagues from permitting checking. They argue that the focus should be on educating coaches and teaching bodychecking skills at all levels of hockey.

Physicians are often called upon to assess youth with hockey-associated traumatic brain injury and to counsel players and their parents about subsequent return to play.

Although recommendations about return to play are numerous,¹⁷⁻²² none has been extensively validated.^{18,23} A considerable number of youth who return to play on the goodwill of these recommendations sustain repeated traumatic brain injuries.^{18,24-27} None of the recommendations emphasizes the importance of counselling children and their families about the risks of returning to play or the option of not playing in a body-contact league. In our opinion, too much emphasis is placed on *when* to return to play and not enough on *whether* to return after an initial traumatic brain injury. To properly counsel players and inform the debate on allowing bodychecking in hockey, physicians must fully appreciate the medical risks associated with bodychecking in hockey.

What is the relation between bodychecking, injury and concussions?

Bodychecking, the most common cause of trauma in hockey,^{2,28-30} accounts for 86% of all injuries among players 9–15 years old.³¹ Players in contact leagues are 4 times as likely to be injured (among those 9–15 years old) and 12 times as likely to receive a fracture (among those 12–13 years old) as players in non-contact leagues.^{2,32-34} Of reported injuries among players 9–15 years old, 45% are caused by legal bodychecks and 8% by illegal checks, without a significant difference in the injury profiles between the 2 types of checking.³⁵ Stricter enforcement of rules would not, therefore, have much impact on injury rates.

A comparison with football injuries helps highlight the issue of serious injury in hockey. Direct fatality and injury rates for football are half those for hockey: 1.8 per 100 000 football players in high school and 7.0 per 100 000 in college.³⁶ Nonfatal catastrophic spinal cord and brain injury rates are 2.6 per 100 000 hockey players and 0.7 per 100 000 football players among high school athletes.³⁷

Among the serious injuries caused by bodychecking, concussions are of particular concern because of the risk of permanent sequelae. In studies involving youth and adults, concussions have ranged from a brief period of neural dysfunction to loss of consciousness and amnesia.³⁸⁻⁴¹ There may be headache, cognitive, memory and executive-function

disturbances, visual abnormalities, motor and sensory changes,³⁸⁻⁴² and seizures.⁴³ Permanent electrophysiological changes in brain function have been observed in injured junior hockey players 16–20 years old who had recovered and returned to play.⁴⁴ Some reported concussions are shown to be contusions on CT scanning.

Repeated mild brain injuries in youth and adults occurring over months or years can result in cumulative deficits.²⁴⁻²⁶ High school athletes with a history of 3 concussions are 9 times more likely than those with no history of concussion to have changes in their mental status.²⁵ These patients have “long-lasting alterations in neurological motor functions,”²⁷ and some have had to relearn how to stand.⁴⁵

The younger developing brain is at an even higher risk of injury. Repeated concussions may lead to permanent learning disabilities and other neurological and psychiatric problems.⁴⁶⁻⁴⁹ Pre-adolescent youth with a traumatic brain injury may never fully develop the social and cognitive skills characteristic of adults and may be more violent than those without such an injury.^{50,51}

Each season, 10%–12% of minor league hockey players 9–17 years old who are injured report a head injury,⁴⁵ most commonly a concussion.^{38,39,52} Concussions are most often caused by bodychecking^{38-40,53} and rarely by being struck with a puck.³⁸ A

review of the literature published between 1966 and 1997 revealed that youth aged 5–17 years had about 2.8 concussions per 1000 player-hours of ice hockey; the number per 1000 player-hours was about the same among high school players, as high as 4.2 among university hockey players and 6.6 among elite amateurs.³⁸ Among Canadian amateur hockey players over 18 years old, the rate is 4.6–6.0 concussions per 1000 player-hours.³⁹ When 14 years was the age at which bodychecking was first allowed in British Columbia, 15 years was the average age at which players had their first concussion.³⁹ Undoubtedly, this threshold age will decline as the new rules about bodychecking are implemented across the country.

Reports of injuries involving youth and adult hockey players show that, despite advances in equipment design, the number of concussions is increasing.^{8,9,29,52} Based on these findings and Hill’s criteria for causal association,⁵⁴ the link between bodychecking and injury and concussion is convincing. It makes sense, given our knowledge of the disease process. The link is analogous to the association between smoking and lung cancer.⁵⁴ Findings from meta-analyses^{28,38} and prospective^{29,39,40} and retrospective^{39,40,52} studies support the association between bodychecking and concussion. In addition, the incidence rates of concussion and other hockey-related injuries increase with increasing age, when more bodychecking is expected, and with higher

levels of play, which suggests a dose–response effect. Learning to bodycheck when young does not reduce a player’s rate of injury as he or she ages, and it prolongs the risk exposure.^{38,40,55,56}

Return to play?

Even minor concussions are serious injuries^{42,57} because they can lead to second-impact syndrome or cumulative effects in the event of another concussion. Second-impact syndrome is often the main reason for delaying a sports player’s return to play after a concussion. The syndrome is caused when players who remain symptomatic sustain a second blow to the head. Even if this second blow is minor, the brain may swell rapidly, resulting in extensive further injury, or uncal herniation and death, probably because of the loss of autoregulation of the cerebral vasculature.⁵⁸⁻⁶⁰

There are expert guidelines^{17,19,22,24-26,61} on *when* players

can return to play, without specific reference to age, but no mention of *if* players should return to play. Our experience indicates that players who have had a second concussion, or their parents, often wished they had been given the option of whether to return to play at all. Physicians should counsel

patients and their families about the risks and benefits of continued play⁶² and should explain the importance of being realistic about ambitions for a future in hockey — only 1 of every 4000 minor league hockey players will ever play in the NHL,⁶³ and only 1.3 of every 1000 will earn an athletic scholarship to an American university.⁶⁴ Because symptoms often worsen with exercise and because the length of time the brain is vulnerable after a concussion is unknown,⁶⁵⁻⁶⁷ prudence dictates erring on the side of caution when deciding on when or whether athletes should return to play.

Should bodychecking be allowed in youth hockey?

Many proponents of bodychecking argue that it is an important skill that allows players to take control of the puck, creates scoring opportunities and helps with defensive positioning and coverage, making it valuable to overall team play.¹⁸ Teams often have a checking line of 3 players who play against an opposing team’s top scoring line to minimize their scoring opportunities and tire them out. As is evident in any playoff series, this checking is often used as physical and mental intimidation to gain control of the game.^{31,68}

In a study of 1462 recorded penalties in all 18 Stanley Cup final series from 1980 to 1997, teams playing with less violence were more likely to win.

However, the relation between aggressive play and winning is much weaker than the proponents of bodychecking believe. In a study of 1462 recorded penalties in all 18 Stanley Cup final series from 1980 to 1997, teams playing with less violence were more likely to win.⁶⁹ Compared with more violent teams, they had on average over 7 more shots on goal per game and 53 more shots on goal over a 7-game series. Losing teams engaged in more violence early in the game, which suggests that their motivation was not frustration of defeat but, rather, the mistaken belief that violence contributes to winning.⁶⁹

Although the contribution of bodychecking to a team's success is questionable, it is such an integral part of the game at the professional level that it is unlikely to be eliminated soon. However, players should not be introduced to bodychecking until they can make a mature, informed choice regarding the issue. Enforced league policies that disallow bodychecking are still the best hope for reducing young players' injuries.⁷⁰

The risks of bodychecking make it clear that checking is not necessary for play at the Canadian minor league hockey level⁵⁵ — a position supported by the Canadian Academy of Sport Medicine.⁴ The American Academy of Pediatrics recommends limiting bodychecking among players 15 years of age and less.² Variations in body size and strength³⁴ occur in all age groups, but they are most pronounced from 13 to 15 years; differences of 53 kg in body mass and 55 cm in height between the smallest and largest players have been reported in this age group.³¹ Since most physical growth is not complete before a person is 17 or 18 years old, bodychecking and hitting should be banned until at least that age. Leagues with players old enough to give consent should obtain informed consent from players before they join the body-contact league. The standard waiver that players are asked to sign to release leagues of all responsibility in the event of injury does not reach the standard of consent expected in activities with more than minimal potential harm. Also, it is unclear how informed consent will be obtained from the 9-year-old players in the 4 hockey associations who will be participating in Hockey Canada's "experiment"¹⁵ and whether the process conforms to Tri-Council Policy.⁷¹

Awareness of injury prevention is fortunately being raised through programs such as the recently implemented Fair Play in minor hockey leagues.⁷² Such programs have been shown to reduce injury rates.³² Another strategy for maximizing player safety is education.⁷³⁻⁷⁵ Hockey Canada has recognized this need and has launched 2 programs to help coaches improve their skills: the Competency Based Educational Program and the Coaches Mentorship Program.⁵⁵

Although coaches have a responsibility to teach safety techniques and coaches and parents should act as role models for good sportsmanship, these actions rarely happen consistently.⁶⁹ Recently, 22 of 34 minor league coaches

refused to participate in a video about concussion prevention because they thought that watching the video would make their players less aggressive and successful as a team.^{45,73} In one community, players 14–15 years old were less likely than younger players to believe that sportsmanship was "real important."^{31,70} Moreover, 26% of players 12–15 years old who understood that bodychecking from behind could cause serious injury or death reported that they would be willing to do so if they were angry or wanted "to get even."³¹

In addition, parents may be encouraging their children to win at all costs in the hope of their pursuing scholarships and professional contracts.⁷⁶ In one study, 32% of injured players said that they would continue to bodycheck to ensure a win; an additional 6% said they would do so in order to injure another player.⁷⁷ Since aggression may be a learned behaviour rewarded in sport,⁷⁸ youth and the public in general must be educated about its dangers and social unacceptability. Ideally, as role models for youth,⁷⁹ professional players and media personnel should emphasize nonviolence.

Moreover, although the use of protective equipment may prevent some injuries, it may foster the attitude that it can prevent all injuries, it may lead to more lenient enforcement of the rules and, paradoxically, it may increase the number of serious injuries.^{74,75,80-83}

Education and the elimination of bodychecking remain the most effective strategies for preventing concussions and other hockey-related injuries. Eliminating bodychecking could refocus the game on fun and skill — on skating, shooting, passing and team play. Physicians must play their roles as socially responsible citizens: the future of our youth and the game depend on it.

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References

1. Scanlon A, Olsen L, MacKay M, Reid D, Clark M, Metz G, et al. Sports and recreation injury prevention strategies: a systematic review. *British Columbia Injury Research and Prevention Unit (BCIRPU)*. Vancouver: The Unit; 2000. Available: www.injuryresearch.bc.ca/Publications/Posters/Sport%20and%20Systematic%20Review%20Poster.pdf (accessed 2003 June 17).
2. Committee on Sports Medicine and Fitness, American Academy of Pediatrics. Safety in youth ice hockey: the effects of body checking. *Pediatrics* 2000;105(3 Pt 1):657-8.
3. Nash JE, Lerner JE. Learning violence from the pros: violence in youth hockey. *Youth Soc Q* 1981;13:229-44.
4. *Position statement: Violence and injuries in ice hockey* [position statement]. Ottawa:

- Canadian Academy of Sport Medicine; 1988. Available: www.casm-acms.org/Committees/SportSafety/Hockey/PSViolHock.htm (accessed 2003 June 17).
5. Molsa J, Kujala U, Nasman O, Lehtipuu TP, Airaksinen O. Injury profile in ice hockey from the 1970s through the 1990s in Finland. *Am J Sports Med* 2000;28:322-7.
 6. Roberts WO, Brust JD, Leonard B. Youth ice hockey tournament injuries: rates and patterns compared to season play. *Med Sci Sports Exerc* 1999;31(1):46-51.
 7. Daly PJ, Sim FH, Simonet WT. Ice hockey injuries. A review. *Sports Med* 1990;10(2):122-31.
 8. Proctor MR, Cantu RC. Head and neck injuries in young athletes. *Clin Sports Med* 2000;19:693-715.
 9. Kelly KD, Lissel HL, Rowe BH, Vincenten JA, Voaklander DC. Sport and recreation-related head injuries treated in the emergency department. *Clin J Sport Med* 2001;11(2):77-81.
 10. *Ministers want checking age raised* [CBC Sports Online]. Toronto: Canadian Broadcast Corporation; Available: www.cbc.ca/pgi-bin/templates/sportsView.cgi?/news/2003/02/21/Sports/kids_hockey_hitting030221 (accessed 2003 June 17).
 11. Ontario Hockey Federation. OHF responds to CBC "Disclosure" on body-checking. North York (ON): The Federation. Available: www.ohf.on.ca/News%20FILES/2003/bodychecking_in_the_ohf.htm (accessed 2003 June 17).
 12. Montelpare WJ. Final report to the Ontario Hockey Federation and the Canadian Hockey Association: measuring the effects of initiating body-checking at the Atom age level (2001 June). Available: www.bcha.org/mailouts/2002-07-28/2002-19-Iatt%20Bodychecking%20Report%202002-07-18.pdf (accessed 2003 June 17).
 13. Houston W. CHA has bungled over body-checking. *Globe and Mail* [Toronto] 2003 Jan 22; Sect S:1.
 14. CHA Board of Directors carries motions on checking in minor hockey; focus placed on four step teaching progression and research framework [press release]. Hockey Canada; 2003 May 19. Available: www.hockeycanada.ca/e/news/2003/nr054.html (accessed 2003 June 17).
 15. Ontario Hockey Federation. Body checking. CHA AGM decision: pilot study to continue. North York (ON): The Federation; 2003 May 25. Available: www.ohf.on.ca/Bodychecking/body_checking.htm (accessed 2003 June 17).
 16. Quality Standards Subcommittee, American Academy of Neurology. The management of concussion in sports [practice parameter]. *Neurology* 1997;48:581-5.
 17. *Young hockey players banned from body checking* [CBC News Online]. Toronto: Canadian Broadcast Corporation; 2003. Available: www.cbc.ca/stories/2003/05/19/check030519 (accessed 2003 June 18).
 18. Wojtys EM, Hovda D, Landry G, Boland A, Lovell M, McCrea M, et al. Current concepts. Concussion in sports. *Am J Sports Med* 1999;27:676-87.
 19. Cantu RC. Guidelines for return to contact sports after a cerebral concussion. *Phys Sportsmed* 1986;14:75-83.
 20. Schwartz ML, Tator CH. Head injuries in athletics. In: Harries M, Micheli LJ, Stanish WD, Williams C, editors. *Oxford textbook of sports medicine*. London: Oxford University Press; 1998. p. 319-27.
 21. Roos R. Guidelines for the management of concussion in sport: a persistent headache. *Phys Sportsmed* 1996;24:67-74.
 22. Sports Medicine Committee, Colorado Medical Society. *Guidelines for the management of concussion in sports*. Denver: The Society; 1991.
 23. Leclerc S, Lassonde M, Delaney JS, Lacroix VJ, Johnston KM. Recommendations for grading of concussion in athletes. *Sports Med* 2001;31:629-36.
 24. Sports-related recurrent brain injuries — United States. *MMWR Morb Mortal Wkly Rep* 1997;46(10):224-7.
 25. Collins MW, Lovell MR, Iverson GL, Cantu RC, Maroon JC, Field M. Cumulative effects of concussion in high school athletes. *Neurosurgery* 2002;51:1175-9.
 26. Rabadi MH, Jordan BD. The cumulative effect of repetitive concussion in sports. *Clin J Sport Med* 2001;11(3):194-8.
 27. Laurer HL, Bareyre FM, Lee VM, Trojanowski JQ, Longhi L, Hoover R, et al. Mild head injury increasing the brain's vulnerability to a second concussive impact. *J Neurosurg* 2001;95:859-70.
 28. Juhn MS, Brolinson PG, Duffey T, Stockard A, Vangelos ZA, Emaus E, et al; American Osteopathic Academy of Sports Medicine (AOASM). Position Statement. Violence and injury in ice hockey. *Clin J Sport Med* 2002;12(1):46-51.
 29. Biasca N, Simmen HP, Bartolozzi AR, Trentz O. Review of typical ice hockey injuries. Survey of the North American NHL and Hockey Canada versus European leagues. *Unfallchirurg* 1995;98(5):283-8.
 30. Tator CH, Carson JD, Cushman R. Hockey injuries of the spine in Canada, 1966-1996. *CMAJ* 2000;162(6):787-8.
 31. Brust JD, Leonard BJ, Pheley A, Roberts WO. Children's ice hockey injuries. *Am J Dis Child* 1992;146:741-7.
 32. Roberts W, Brust JD, Leonard B, Hebert BJ. Fair-play rules and injury education in ice hockey. *Arch Pediatr Adolesc Med* 1996;150:140-5.
 33. Pinto M, Kuhn JE, Greenfield ML, Hawkins RJ. Prospective analysis of ice hockey injuries at the Junior A level over the course of one season. *Clin J Sport Med* 1999;9(2):70-4.
 34. Regnier G, Boileau R, Marcotte G, Desharnais R, Larouche R, Bernard D, et al. Effects of body-checking in the Pee Wee (12 and 13-years-old) division in the Province of Quebec. In: Castaldi CR, Hoerner EF, editors. *Safety in ice hockey*. Philadelphia: American Society for Testing Materials; 1989. p. 84-103.
 35. McFaul S. Contact injuries in minor hockey: a review of the CHIRPP database for the 1998/1999 hockey season. *CHIRPP News* 2001;19:1-9. Available: www.hc-sc.gc.ca/pphb-dgspsp/publicat/chirpp-schirpt/19jan01/index.html (accessed 2003 June 18).
 36. Cantu RC, Mueller FO. Fatalities and catastrophic injuries in high school and college sports, 1982-1997: lessons for improving safety. *Phys Sportsmed* 1999;27(8):35-48.
 37. Cantu RC. Catastrophic injuries in high school and collegiate athletes. *Surg Rounds Orthop* 1988;Nov:62-6.
 38. Honey CR. Brain injury in ice hockey. *Clin J Sport Med* 1998;8(1):43-6.
 39. Goodman D, Gaetz M, Meichenbaum D. Concussions in hockey: There is cause for concern. *Med Sci Sports Exerc* 2001;33:2004-9.
 40. Tegner Y, Lorentzon R. Concussion among Swedish elite ice hockey players. *Br J Sports Med* 1996;30:251-5.
 41. McCrea M, Kelly JP, Randolph C, Cisler R, Berger L. Immediate neurocognitive effects of concussion. *Neurosurgery* 2002;50:1032-40.
 42. Fick DS. Management of concussion in collision sports. Guidelines for the sidelines. *Postgrad Med* 1995;97(2):53-6, 59-60.
 43. Annegers JF, Hauser WA, Coan SP, Rocca WA. A population-based study of seizures after traumatic brain injuries. *N Engl J Med* 1998;338:20-4.
 44. Gaetz M, Goodman D, Weinberg H. Electrophysiological evidence for the cumulative effects of concussion. *Brain Inj* 2000;14:1077-88.
 45. Cole S. Headed for injury. *Globe and Mail* [Toronto] 2003 Feb 15; Sect F:8.
 46. Segalowitz SJ, Brown D. Mild head injury as a source of developmental disabilities. *J Learn Disabil* 1991;24:551-9.
 47. Ponsford J, Willmott C, Rothwell A, Cameron P, Ayton G, Nelms R, et al. Cognitive and behavioral outcome following mild traumatic head injury in children. *J Head Trauma Rehabil* 1999;14:360-72.
 48. Zimmerman RA, Bilaniuk LT. Pediatric head trauma. *Neuroimaging Clin N Am* 1994;4:349-66.
 49. Nolan KA, Volpe BT, Burton LA. The continuum of deep/surface dyslexia. *J Psycholinguist Res* 1997;26:413-24.
 50. Benz B, Ritz A, Kiesow S. Influence of age-related factors on long-term outcome after traumatic brain injury (TBI) in children: a review of recent literature and some preliminary findings. *Restor Neurol Neurosci* 1999;14(2-3):135-41.
 51. Leon-Carrion J, Ramos FJ. Blows to the head during development can predispose to violent criminal behaviour: rehabilitation of consequences of head injury is a measure for crime prevention. *Brain Inj* 2003;17:207-16.
 52. Biasca N, Wirth S, Tegner Y. The avoidability of head and neck injuries in ice hockey: an historical review. *Br J Sports Med* 2002;36:410-27.
 53. Hockey Development Centre for Ontario. Injury Data Collection Program 2000-2001. Available: www.hdco.on.ca/injurydate00-02.htm (accessed 2003 June 18).
 54. Hill AB. The environment and disease: Association or causation? *Proc R Soc Med* 1965;58:295-300.
 55. Weed P, Brooks D, Blaranu C. Group of three oppose body-checking. Three perspectives on bodychecking in minor hockey. *Hockey Talk* 2003 Feb 27. Available: www.hockeytalk.com/archives/features/grp3Checking.asp (accessed 2003 June 18).
 56. Roberts WO. Hitting in amateur ice hockey: not worth the risk. *Phys Sportsmed* 1999;27(12):1-5.
 57. Genuardi FJ, King WD. Inappropriate discharge instructions for youth athletes hospitalized for concussion. *Pediatrics* 1995;95:216-8.
 58. Kelly JP, Nichols JS, Filley CM, Lillehei KO, Rubinstein D, Kleinschmidt-DeMasters BK. Concussion in sports. Guidelines for the prevention of catastrophic outcome. *JAMA* 1991;266:2867-9.
 59. Saunders RL, Harbaugh RE. The second impact in catastrophic contact-sports head trauma. *JAMA* 1984;252:538-9.
 60. Collins MW, Lovell MR, Mckeag DB. Current issues in managing sports-related concussion. *JAMA* 1999;282:2283-5.
 61. Cantu RC. Cerebral concussion in sport. Management and prevention. *Sports Med* 1992;14(1):64-74.
 62. Kelly JP. Concussion in sports and recreation. *Semin Neurol* 2000;20(2):165-71.
 63. Kalchman L. Making NHL a very long shot [press release GN 001]. Ottawa: Canadian Hockey Association; 2003 Jan 25. Available: www.canadianhockey.ca/e/news/2003/gn001.html (accessed 2003 June 18).
 64. Canadian Broadcasting Corporation. Little known facts about Canadian hockey. Toronto: The Corporation; 2003. Available: www.cbc.ca/sports/hockey/hdic2003/canadian_hockey.html (accessed 2003 June 18).
 65. Erlanger D, Kaushik T, Cantu R, Barth JT, Broshek DK, Freeman JR, et al. Symptom-based assessment of the severity of a concussion. *J Neurosurg* 2003;98:477-84.
 66. Cantu RC. Reflections on head injuries in sport and the concussion controversy. *Clin J Sports Med* 1997;7:83-4.
 67. Cantu RC. Return to play guidelines after a head injury. *Clin Sports Med* 1998;17(1):45-60.
 68. Trudel P, Dionne JP, Bernard D. [A qualitative study of the violence in hockey: perceptions of trainers and players] [French]. *Can J Sport Sci* 1992;17:320-32.
 69. McCaw ST, Walker JD. Winning the Stanley Cup final series is related to incurring fewer penalties for violent behavior. *Tex Med* 1999;95(4):66-9.

70. Brust JD, Roberts W, Leonard B. Gladiators on ice. *Med J Allina* 1995; 5(1):26-30.
71. Medical Research Council of Canada, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada. *Tri-Council policy statement: ethical conduct for research involving humans*. 1998. Available: www.nserc.ca/programs/ethics/english/policy.htm (updated 2000 Nov 21; accessed 2003 June 18).
72. Edmonton Sport Council. Fair Play. 2002. Available: www.edmontonsport.com/fairplay.html (accessed 2003 June 18).
73. Cusimano MD, Cook DJ, Tator C, Mansfield E, Ulrich D. The effectiveness of an injury prevention educational intervention in teaching young hockey players about concussion. *Can J Neurol Sci* 2002;29(2):S23-4.
74. Hedlund J. Risky business: safety regulations, risks compensation, and individual behavior. *Inj Prev* 2000;6(2):82-90.
75. Parkkari J, Kujala UM, Kannus P. Is it possible to prevent sports injuries? Review of controlled clinical trials and recommendations for future work. *Sports Med* 2001;31(14):985-95.
76. Horrow R. Violence in sports: Aggressive or excessive? CBS SportsLine.com; 2002 May 29. Available: www.cbs.sportsline.com/b/page/pressbox/0,1328,5381768,00.html (accessed 2003 June 18).
77. Reid SR, Losek JD. Factors associated with significant injuries in youth ice hockey players. *Pediatr Emerg Care* 1999;15:310-3.
78. Charbonneau L. Unsportsmanlike conduct. A seminar series tries to answer the age-old question: Is violence part of the game? *University Affairs* 2001 June 18. Available: www.universityaffairs.ca/pdf/past_articles/2001/june_july/june_18.pdf (2003 June 18).
79. Brown WJ, Basil MD, Bocarnea MC. The influence of famous athletes on health beliefs and practices: Mark McGwire, child abuse prevention, and Androstenedione. *J Health Commun* 2003;8(1):41-57.
80. Tator CH, Carson JD, Edmonds VE. Spinal injuries in ice hockey. *Clin Sports Med* 1998;17(1):183-94.
81. Murray TM, Livingston LA. Hockey helmets, face masks, and injurious behavior. *Pediatrics* 1995;95:419-21.
82. Tator CH, Edmonds VE, Lapczak L, Tator IB. Spinal injuries in ice hockey players, 1966-1987. *Can J Surg* 1991;34(1):63-9.
83. Shannon HS, Szatmari P. Seat-belt legislation and risk homeostasis: further analysis of the British data. *Accid Anal Prev* 1994;26:803-5.

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Dr Eric Wooltorton,
boursier de 2001

« Ce stage postdoctoral ouvre des possibilités extraordinaires. Il m'a permis d'améliorer à la fois mon interprétation des écrits scientifiques et ma capacité à formuler par écrit cette perspective. De plus, en raison de l'immense envergure de l'exposition aux écrits, il a rehaussé mon appréciation de la médecine en général. Je ne saurais recommander ce stage assez vivement. »

Dr James Maskalyk,
boursier de 2002

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