1 ***Will New Legislation Aimed at Preventing Concussions in Youth Succeed?***

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ABSTRACT

The importance of preventing sports-related traumatic head and brain injuries such as concussion is underscored by their clinical severity and prevalence. Legislation to prevent injury has been successful in many settings, including cycling. Recently, legislation designed to reduce rates of sports-related concussion has been introduced in North America. The Zackery Lystedt Law (ZLL) was drafted and enacted by Washington State in 2009, and Bill 39, legislation with a similar intent, was introduced in Ontario, Canada, in 2012. In this study, we compare the ZLL and Bill 39 and contrast them with legislation to prevent cycling head injuries. We found important similarities and differences between the ZLL and Bill 39 and helmet laws for cyclists. Both the ZLL and Bill 39 have a strong bias in favour of education, but no means of enforcement. In contrast to cycling legislation, the ZLL and Bill 39 are revenue-neutral for the participant. Although our findings suggest that the ZLL and Bill 39 are promising means of preventing sports-related concussions, their effectiveness needs to be empirically evaluated.

INTRODUCTION

It is important that the health benefits of sport participation to youth [1-3] are not offset by the risk of sport-related injuries, such as concussion. Unfortunately, more than half of the traumatic brain injuries sustained by youth are caused by participation in sports [4 5]. These injuries can have lasting cognitive effects (including impaired attention and memory) in addition to behavioural consequences, such as mood disorders [6-9]. Since the developing bodies of youth are prone to the long-term consequences of injury [10], it is especially important to minimize the risk of concussion in all sports youth play.

Recently, several jurisdictions have introduced initiatives aimed at preventing concussions among youth playing sports in North America. Legislation has been used to prevent injury in other, similar settings; helmet laws for cyclists reduced risk of cycling-related head and brain injury by up to 88% [11]. Exploring the parallels between these two prevention efforts permits the opportunity to evaluate the strengths and weaknesses of the new sport injury prevention initiatives relative to former, successful helmet laws for cyclists. Doing so can benefit the new initiatives by avoiding prior errors and learning from prior successes.

The first legislation to prevent concussion was introduced in the United States of America in 2009, when Washington State drafted and enacted the Engrossed House Bill 1824, otherwise known as the Zackery Lystedt Law (ZLL) [12]. In 2012, the Government of Ontario, Canada, introduced Bill 39, the Education Amendment Act (Concussions), to protect young athletes from sports-related concussions by promoting awareness about

concussions and implementing protocols to manage them [13]. It is important to note that Bill 39 is still in the lawmaking process.

In this paper, we describe, compare, and contrast the core principles of the ZLL and Bill 39. We then examine how the principles of the ZLL and Bill 39 differ from those of helmet laws for cyclists. Finally, we discuss the potential impact of the ZLL and Bill 39 and explore the role of education in injury prevention initiatives.

UNDERSTANDING THE LEGISLATION

The Zackery Lystedt Law

The ZLL arose out of an incident involving 13-year-old football player Zackery Lystedt who suffered permanent neurological damage because of brain trauma sustained during a middle school football game. Despite showing clear signs of pain, discomfort, and confusion in the first half of the game, Zackery was permitted by his coaches to return to play for the second half without receiving any medical attention. Towards the end of the game, Zackery collapsed and required immediate decompressive brain surgery. He then lapsed into a prolonged coma from which he emerged with severe cognitive and behavioural deficits that profoundly affected his daily living [14].

Youth participating in school district athletics and other athletic activities played in or on school facilities fall under the jurisdiction of the ZLL [12 15 16]. This law also affects young athletes involved with sports run by private or non-profit organizations that use publically owned sports facilities. In Washington State, private and non-profit

sports groups that use public facilities must carry private insurance. Since the ZLL has been passed, these groups can be insured only if they comply with the guidelines for managing concussion stipulated in the ZLL [15 16].

According to the ZLL, coaches and trainers are primarily responsible for managing onsite concussions. As such, they will receive information on how to identify and manage these injuries; the Centres for Disease Control and Prevention (CDC) and other institutions have made such information freely available on their website [17 18]. Further, the ZLL requires that school districts within Washington State work with the Washington Interscholastic Activities Association to develop concussion information and management resources, not only for coaches and trainers, but also for young athletes and their parents or guardians. One such resource is an online concussion training video that has been produced with support from the Harborview Medical Centre and Seattle Children's Hospital; it describes the dangers of concussion and the concussion identification and management protocols of the ZLL [19]. The ZLL also states that coaches and trainers must immediately remove players with suspected concussions from the game or practice and permit their return only after a medical professional has cleared them for return to play. To ensure that parents and young athletes are aware of the risks and severity of sports-related concussion, the ZLL mandates that both parties sign a concussion-education sheet at the start of each athletic season [12]. Some cities in Washington State now do not allow youth to participate in city-specific sport programs until both parent and athlete sign a formal concussion education sheet [20].

As of March 2013, 47 states, plus the District of Columbia, have adopted legislation with core principles that mirror those of the ZLL [16]. In early 2011, federal legislation (Bill H.R. 469, *Protecting Student-Athletes from Concussions Act of 2011*) with similar intent and design to that of the ZLL was introduced in the House of Representatives. Bill H.R. 469 was referred to the Subcommittee on Early Childhood, Elementary, and Secondary Education on January 25th, 2011, and it has since died in committee [21]. Despite the lack of federal pressure to adopt nationwide ZLL-like legislation, the expansion of the ZLL into multiple jurisdictions has been quick, likely because of support from influential sporting bodies such as the National Football League (NFL), National Collegiate Athletics Association (NCAA), and American College of Sports Medicine (ACSM) [16 22 23]. It is possible that the rapid state-to-state spread of ZLL-like legislation in addition to the homogeneity of this legislation across jurisdictions eliminated the need for an overarching federal law.

Bill 39

The recently introduced Government of Ontario Bill 39, the first of its kind in Canada and based upon the premises of the ZLL, aims to reduce concussions among youth participating in sports at school (namely, in intramural and interschool athletics, and in those sports played as part of the physical education curriculum) through distribution of information. If passed, Bill 39 will provide resources that communicate the clinical severity of concussions and strategies for their prevention, identification, and management to many concerned parties, including student athletes, parents and guardians, teachers, coaches, school board members, and volunteers involved with

school-related athletics. The means by which these resources will be produced and distributed is not yet certain, though it is likely an advisory board (established by the Ontario Minister of Education, designed to advocate on issues of prevention, identification, and management of concussions) will be involved in this task [13]. The Bill mandates that those with a suspected concussion be removed from play immediately; specific medical guidelines for addressing return-to-play are to be determined, though returning to athletes will likely require a doctor's certificate [24].

Bill 39 attempts to ensure that young athletes do not resume athletic activity too soon after an injury. To prevent further complications after a concussion that may be induced by cognitive demand, the Bill mandates that the return of injured young athletes to the classroom not be rushed. However, guidelines for returning to the classroom are not stipulated in the current draft of the legislation [13]. Overall, this Bill is an important and potentially effective legislative response to the youth sport-related concussion healthcare problem.

Comparison of the ZLL and Bill 39

Varying levels of public support for the ZLL and Bill 39 may result in differences in their impact. Cohen and Swift [25] describe a spectrum of prevention, namely a framework for developing a successful, multi-faceted method of preventing injury, that comprises six action levels: (1) strengthening individual knowledge and skills, (2) promoting community education, (3) educating providers, (4) fostering coalitions and networks, (5) changing organizational practices, and (6) influencing policy and legislation. This spectrum, given its comprehensive nature, provides a structure under

which multiple parties – including athletes and parents, health practitioners, and lawmakers – can work together to further an injury prevention strategy [23]. For example, educating the community about concussions will result in more educated athletes and parents, who can then more strongly advocate for better health services and changes in organizational practices. By working in this way, complex problems can be addressed efficiently, as multiple parties can bring unique perspectives to the table that may help advance prevention efforts. It is of interest to note that this spectrum has been widely used, most notably by the World Health Organization and National Highway Traffic Safety Administration of America have used it for strategy development [23].

A prevention initiative that incorporates many or all of the above mentioned action levels will be comprehensive and likely effective [25]. Both the ZLL and Bill 39 meet criteria 1–3 of the spectrum of prevention, as they are designed to educate individuals and communities. Further, these initiatives, by their very existence, meet criteria 5 and 6 of the spectrum; both the ZLL and Bill 39 have had an impact on public policy and have evoked changes in current practice within organizations such as sporting bodies. However, to date, only the ZLL has met criterion 4. Unlike Bill 39, which is not yet extensively supported by external health and sporting organizations, the ZLL is supported by a coalition of institutions, such as the CDC, NFL, NCAA, and ACSM [16 17 22 23]. Support from a coalition increases the capacity of a prevention initiative because these partnerships often further a common goal through a concerted effort. Therefore, based on this injury prevention framework, the ZLL may be more successful than Bill 39 because of the degree of external support it has received. However, it is also important

to note that Bill 39 is newer than the ZLL. As such, Bill 39 has had a relatively short amount of time to garner external support, though it has been well received by the public and medical professionals [26].

Limitations of the ZLL and Bill 39

Both the ZLL and Bill 39 are aimed at preventing the occurrence of a second injury soon after the first, or the so-called second-impact syndrome, a potentially devastating neurological condition [27-30]. Given that the cognitive impairment associated with multiple concussions can be cumulative and prolonged [31 32], these initiatives, by aiming to prevent second injuries, could have beneficial effects to prevent multiple, independent concussions. Although preventing second impact syndrome is laudable, introducing specific initiatives beyond education to prevent the athlete's initial concussion could have strengthened both the ZLL and Bill 39. Research has shown that changes in rules, their enforcement, properly worn equipment, and appropriate positive and negative reinforcement can be effective primary means of prevention [33 34].

Although proper management of concussion is critical to the health of the concussed athlete, neither the ZLL nor Bill 39 provides for funding to educate physicians, teachers, or coaches about managing this injury. Specific standards for this sort of education are just being developed, but have not widely translated to community physicians and those on the front lines [35]. Proper levels of funding are important to the sustainability of the legislative effort, but neither the ZLL nor Bill 39 has ensured this outcome by imposing fines or instituting other means of raising funds. As well, both the

ZLL and Bill 39 seem to be youth-centric and ignore adult participants in sports. Experience with bicycle helmet legislation indicates that legislation covering the whole population has a better chance of success; helmet legislation that applied to the entire population was associated with greater compliance than similar, youth-specific legislation [36]. Therefore, a more comprehensive legislation may be associated with greater adherence.

Moreover, neither the ZLL nor Bill 39 include methods of enforcement. This is problematic because seatbelt legislation studies suggest that legislation with primary enforcement is most effective in achieving its goals [37]. However, it is important to note that to preserve their fiscal neutrality, it is likely that the ZLL and Bill 39 could not incur enforcement-associated expenses.

COMPARING THE ZLL AND BILL 39 TO CYCLING LEGISLATION

Legislation designed to reduce cycling-related head injuries has been introduced on a global scale, and widely in Canada, the United States, Australia, New Zealand, and the United Kingdom [38]. Such legislation varies across geographic regions, yet it nearly always mandates that helmets that meet approved safety standards be worn while cycling. Those who fail to comply with the legislation can be fined or charged, although the monetary value of the penalty varies by jurisdiction.

A Cochrane review by Thompson et al. [11] found that helmets reduce the risk of head and brain injury among cyclists of all ages. Another more recent Cochrane review found that helmet legislation for cyclists significantly reduced head injuries and that,

despite what opponents to this legislation have argued, the helmet legislation was not a deterrent to cycling itself [39]. LeBlanc et al. [40] also found that cycling legislation not only increased rates of helmet use, but also halved rates of head injury 2-years post-intervention. In contrast to cycling legislation, which was based on much research about the effectiveness of helmet use before the enactment of the laws, to our knowledge, no studies demonstrating the effectiveness of the approaches taken in ZLL and Bill 39 exist.

An important distinction between cycling legislation and Bill 39 or the ZLL is the implementation of consequences for violating the legislation. Violation of the cycling legislation can incur a fine, whereas violation of Bill 39 or the ZLL will not. As financial disincentives are effective in reducing drinking-and-driving related fatalities [41 42], applying such incentives to the ZLL and Bill 39 may also benefit these initiatives.

Experience with cycling helmet laws indicates that educational programs can promote helmet use and decrease head injury incidence [43]. As both the ZLL and Bill 39 are education-based prevention initiatives, these initiatives include an ingredient that is key to effective prevention, and therefore have the potential to succeed. Successful prevention requires not only environmental changes, but also change at the person-level [44]. As education is an important driver of personal change, and the ZLL and Bill 39 – like the aforementioned helmet laws – use education to promote awareness and reduce injuries, the ZLL and Bill 39 show promise as prevention initiatives.

An advantage of Bill 39 and the ZLL over cycling legislation is that they are revenue-neutral for the athlete. The CDC have released freely available posters about concussion that can be posted in locker rooms and free educational fact sheets about

concussion for players, parents, and coaches [17]. In contrast, cycling legislation requires cyclists to purchase helmets (a personal expense) and law enforcement to actively monitor this law (a governmental expense). The revenue neutrality of the ZLL may facilitate the implementation and acceptance of Bill 39 and the ZLL.

COMMENT ON EDUCATION

It has been shown that a lack of knowledge on the dangers of sport-related injury may serve as an impediment to their timely management and treatment. McCrea et al. [45] found that highschool football players frequently did not report concussions because these players thought that their injuries were not severe enough to warrant medical attention, and they lacked the awareness necessary to detect a probable concussion, or feared that having a concussion would result in their removal from competition. A lack of awareness about concussion may hinder appropriate management of these injuries. However, a core component of the ZLL and Bill 39 is raising awareness about concussion. Educating all parties involved with youth sports about the dangers of concussion may permit appropriate and timely management of these injuries because concussions may be self-reported sooner and with greater frequency.

Hemenway [46] outlines three beliefs commonly thought to impede initiatives to prevent injury: (1) the optimistic belief that injury is not a possibility or that “nothing bad will happen to me,” (2) a fatalistic belief that “accidents happen” and nothing could have been done to prevent the injury-causing event, and (3) the moralistic belief that an

injury is somehow deserved. Hemenway [46] argues that it is important to deal with and counter these beliefs so that injury-prevention initiatives can succeed. We believe that both the ZLL and Bill 39 counter these beliefs by educating all parties involved with youth sports about the prevalence and implications of concussion and the ways these injuries can be managed. Such education will allow youth to realize that: the possibility of concussion is legitimate; there are means (e.g., safer and less reckless play) that may prevent injury; and that any player can sustain a concussion, irrespective of how much he or she 'deserves' it. These three realizations, secondary to being educated, can counter the impediments to successful injury prevention outlined by Hemenway [46].

Criteria for successful injury prevention have also been proposed. Chipman [47] stated that a preventative measure is most likely to succeed when it is population-based, requires passive rather than active participation, and can be accomplished with a single action rather than many repeated actions. Both the ZLL and Bill 39 are population-based, but they are far from passive: schools or other organizations must institute educational and management programs to comply with the legislation. The ZLL and Bill 39 meet some of these criteria for success, but evidence-based support for their ultimate value will be dependent on further research.

Future Directions

Independent research that evaluates the effectiveness of the ZLL and Bill 39 by measuring changes in the occurrence of sport-related concussion in the target population is required before the benefits of these two prevention initiatives can be assumed. Moreover, as recent research suggests that concussion awareness is high in

boys' football, but much lower in boys' ice hockey and boys' and girls' soccer [48], future empirical research on the ZLL and Bill 39 should examine whether the impact of these initiatives vary across sports. Determining which parts of each piece of legislation are most responsible for change will also be useful to other jurisdictions considering similar legislation action to curb the incidence and burden associated with sport-related concussion.

There are, however, difficulties in conducting such empirical research. For example, new concussion diagnostic tools may have resulted in an increase in the number of reported concussions in recent years; formerly, some of these concussions may have remained undiagnosed. Therefore, better awareness and diagnosis may actually lead paradoxically increased rates of concussion early in the evaluation of these initiatives.

KEY MESSAGE

The ZLL and Bill 39 show promise in reducing sports-related concussion among youth. Future research will be required to show that these initiatives prevent concussion in youth sports across different jurisdictions.

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COMPETING INTERESTS

The authors have no competing interests to declare.

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REFERENCE LIST

1. Pate R, Trost SL, S, Dowda M. Sports participation and health-related benefits among US youth. *Archives of Pediatrics & Adolescent Medicine* 2000;**154**(9):904-11
2. Steptoe A, Butler N. Sports participation and emotional wellbeing in adolescents. *Lancet* 1996;**347**(9018):1789-92
3. Tammelin T, Nayha S, Hills AP, Jarvelin MR. Adolescent participation in sports and adult physical activity. *Am J Prev Med* 2003;**24**(1):22-8 doi: S0749379702005755 [pii][published Online First: Epub Date] |.
4. Nonfatal traumatic brain injuries related to sports and recreation activities among persons aged <=19 years--United States, 2001-2009. *MMWR Morb Mortal Wkly Rep*; **60**(39):1337-42 doi: mm6039a1 [pii][published Online First: Epub Date] |.
5. Ilie G, Boak A, Adlaf EM, Asbridge M, Cusimano MD. Prevalence and correlates of traumatic brain injuries among adolescents. *JAMA* 2013;**309**(24):2550-2 doi: 1700489 [pii] 10.1001/jama.2013.6750[published Online First: Epub Date] |.
6. Lovell MR, Collins MW, Iverson GL, et al. Recovery from mild concussion in high school athletes. *J Neurosurg* 2003;**98**(2):296-301 doi: 10.3171/jns.2003.98.2.0296[published Online First: Epub Date] |.
7. Lord-Maes J, Obrzut JE. Neuropsychological consequences of traumatic brain injury in children and adolescents. *J Learn Disabil* 1996;**29**(6):609-17
8. Halstead M, Walter KD. Sport-related concussion in children and adolescents. *Pediatrics* 2010;**126**(3):597-615
9. Grady MF. Concussion in the adolescent athlete. *Curr Probl Pediatr Adolesc Health Care* 2010;**40**(7):154-69 doi: S1538-5442(10)00090-8 [pii] 10.1016/j.cppeds.2010.06.002[published Online First: Epub Date] |.
10. Adirim TA, Cheng TL. Overview of injuries in the young athlete. *Sports Med* 2003;**33**(1):75-81 doi: 330106 [pii][published Online First: Epub Date] |.

- 331 11. Thompson DC, Rivara FP, Thompson R. Helmets for preventing head and facial
332 injuries in bicyclists. *Nurs Times* 2001;**97**(43):41
- 333 12. House Bill Report EHB 1824. In: Legislature WS, ed. Washington State, 2009.
- 334 13. Bill 39: An Act to amend the Education Act with respect to concussions. In: Ontario
335 LAo, ed. Ontario, 2012.
- 336 14. Adler RH, Herring SA. Changing the culture of concussion: education meets
337 legislation. *PM R*;3(10 Suppl 2):S468-70 doi: S1934-1482(11)00527-2 [pii]
338 10.1016/j.pmrj.2011.08.006[published Online First: Epub Date]|.
- 339 15. Concussion management for schools. Secondary Concussion management for
340 schools 2009.
341 [www.doh.wa.gov/CommunityandEnvironment/Schools/EnvironmentalHealth/Co](http://www.doh.wa.gov/CommunityandEnvironment/Schools/EnvironmentalHealth/ConcussionManagement.aspx)
342 [ncussionManagement.aspx](http://www.doh.wa.gov/CommunityandEnvironment/Schools/EnvironmentalHealth/ConcussionManagement.aspx).
- 343 16. Youth Concussions FAQ. Secondary Youth Concussions FAQ 2012.
344 www.nflevolution.com/article/Youth-Concussions-FAQ?ref=936.
- 345 17. Heads up: Concussion in high school sports. Secondary Heads up: Concussion in high
346 school sports 2012. www.cdc.gov/concussion/headsup/high_school.html.
- 347 18. Think First. Secondary Think First 2013. www.thinkfirst.ca/programs/index.aspx.
- 348 19. Coaching Resources. Secondary Coaching Resources 2012.
- 349 20. Concussion Information Sheet. Secondary Concussion Information Sheet 2012.
- 350 21. Protecting student athletes from concussions Act of 2011. Secondary Protecting
351 student athletes from concussions Act of 2011 2011. [thomas.loc.gov/cgi-](http://thomas.loc.gov/cgi-bin/bdquery/z?d112:h.r.469)
352 [bin/bdquery/z?d112:h.r.469](http://thomas.loc.gov/cgi-bin/bdquery/z?d112:h.r.469)..
- 353 22. ACSM calls for national policy adoption for concussion in youth sports. Secondary
354 ACSM calls for national policy adoption for concussion in youth sports 2011.
355 [www.acsm.org/about-acsm/media-room/acsm-in-the-news/2011/09/01/acsm-](http://www.acsm.org/about-acsm/media-room/acsm-in-the-news/2011/09/01/acsm-calls-for-national-policy-adoption-for-concussion-in-youth-sports)
356 [calls-for-national-policy-adoption-for-concussion-in-youth-sports](http://www.acsm.org/about-acsm/media-room/acsm-in-the-news/2011/09/01/acsm-calls-for-national-policy-adoption-for-concussion-in-youth-sports).
- 357 23. NFL and NCAA push for youth sports concussion legislation. Secondary NFL and
358 NCAA push for youth sports concussion legislation 2011.
- 359 24. Tymochenko N. Bill 39, Concussions - Is it Everything It's Cracked Up to Be?
360 Secondary Bill 39, Concussions - Is it Everything It's Cracked Up to Be? 2012.
- 361 25. Cohen L, Swift S. The spectrum of prevention: developing a comprehensive approach
362 to injury prevention. *Inj Prev* 1999;**5**(3):203-7
- 363 26. Education Mo. Protecting Student Athletes: McGuinty Government Launches New
364 Concussion Strategy. Secondary Protecting Student Athletes: McGuinty
365 Government Launches New Concussion Strategy 2012.
- 366 27. Bowen AP. Second impact syndrome: a rare, catastrophic, preventable complication
367 of concussion in young athletes. *J Emerg Nurs* 2003;**29**(3):287-9 doi:
368 S0099176703001077 [pii][published Online First: Epub Date]|.
- 369 28. Cantu RC. Second-impact syndrome. *Clin Sports Med* 1998;**17**(1):37-44
- 370 29. Cobb S, Battin B. Second-impact syndrome. *J Sch Nurs* 2004;**20**(5):262-7
- 371 30. Wetjen NM, Pichelmann MA, Atkinson JL. Second impact syndrome: concussion and
372 second injury brain complications. *J Am Coll Surg*;211(4):553-7 doi: S1072-
373 7515(10)00397-2 [pii]
374 10.1016/j.jamcollsurg.2010.05.020[published Online First: Epub Date]|.

31. Iverson GL, Gaetz M, Lovell MR, Collins MW. Cumulative effects of concussion in amateur athletes. *Brain Inj* 2004;**18**(5):433-43 doi: 10.1080/02699050310001617352 JX9C1V3TUVRYW46 [pii][published Online First: Epub Date] |.
32. Moser RS, Schatz P, Jordan BD. Prolonged effects of concussion in high school athletes. *Neurosurgery* 2005;**57**(2):300-6; discussion 00-6 doi: 00006123-200508000-00017 [pii][published Online First: Epub Date] |.
33. Cusimano MD, Nassiri F, Chang Y. The effectiveness of interventions to reduce neurological injuries in rugby union: a systematic review. *Neurosurgery* 2010;**67**(5):1404-18; discussion 18 doi: 10.1227/NEU.0b013e3181f209f1[published Online First: Epub Date] |.
34. Cusimano MD, Nastis S, Zuccaro L. Effectiveness of interventions to reduce aggression and injuries among ice hockey players: a systematic review. *CMAJ* 2013;**185**(1):E57-69 doi: cmaj.112017 [pii] 10.1503/cmaj.112017[published Online First: Epub Date] |.
35. ONF funds guidelines for management of concussion/mTBI symptoms in children and youth. Secondary ONF funds guidelines for management of concussion/mTBI symptoms in children and youth 2013. www.concussionsontario.org/onf-funds-pediatric-guidelines/.
36. Dennis J, Potter B, Ramsay T, Zarychanski R. The effects of provincial bicycle helmet legislation on helmet use and bicycle ridership in Canada. *Inj Prev* 2010;**16**(4):219-24 doi: ip.2009.025353 [pii] 10.1136/ip.2009.025353[published Online First: Epub Date] |.
37. Rivara FP, Thompson DC, Cummings P. Effectiveness of primary and secondary enforced seat belt laws. *Am J Prev Med* 1999;**16**(1 Suppl):30-9 doi: S0749379798001068 [pii][published Online First: Epub Date] |.
38. Cunrow WJ. Bicycle helmets: A scientific evaluation. In: Smet AD, ed. *Transportation accident analysis and prevention*. New York: Nova Science Publishers, 2008:141-77.
39. Macpherson A, Spinks A. Bicycle helmet legislation for the uptake of helmet use and prevention of head injuries. *Cochrane Database Syst Rev* 2008(3):CD005401 doi: 10.1002/14651858.CD005401.pub3[published Online First: Epub Date] |.
40. Leblanc JC, Beattie TL, Culligan C. Effect of legislation on the use of bicycle helmets. *CMAJ* 2002;**166**(5):592-5
41. Ruhm CJ. Alcohol policies and highway vehicle fatalities. *J Health Econ* 1996;**15**(4):435-54 doi: S0167-6296(96)00490-0 [pii][published Online First: Epub Date] |.
42. Evans WN, Neville D, Graham JD. General deterrence of drunk driving: evaluation of recent American policies. *Risk Anal* 1991;**11**(2):279-89
43. Rivara FP, Thompson DC, Patterson MQ, Thompson RS. Prevention of bicycle-related injuries: helmets, education, and legislation. *Annu Rev Public Health* 1998;**19**:293-318 doi: 10.1146/annurev.publhealth.19.1.293[published Online First: Epub Date] |.

- 418 44. Haddon W, Jr. Advances in the epidemiology of injuries as a basis for public policy.
419 Public Health Rep 1980;**95**(5):411-21
- 420 45. McCrea M, Hammeke T, Olsen G, Leo P, Guskiewicz K. Unreported concussion in high
421 school football players: implications for prevention. Clin J Sport Med
422 2004;**14**(1):13-7
- 423 46. Hemenway D. Three common beliefs that are impediments to injury prevention. Inj
424 Prev 2012 doi: injuryprev-2012-040507 [pii]
425 10.1136/injuryprev-2012-040507[published Online First: Epub Date]].
- 426 47. Chipman ML. Hats off (or not?) to helmet legislation. CMAJ 2002;**166**(5):602
- 427 48. Esquivel A, Haque S, Keating P, Marsh S, Lemos S. Concussion Management,
428 Educatio, and Return-to-Play Policies in High Schools: A Survery of Athletic
429 Directors, Athletic Trainers, and Coaches. Sports Health: A Multidisciplinary
430 Approach 2013;**5**(3):258-62
- 431
- 432