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# Youth Sports & Public Health: Framing Risks of Mild Traumatic Brain Injury in American Football and Ice Hockey

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Children in North America, some as young as eleven or twelve, routinely don helmets and pads and are trained to move at high-speed for the purpose of engaging in repeated full-body collisions with each other. The evidence suggests that the forces generated by such impacts are sufficient to cause traumatic brain injury (TBI) among children.<sup>1</sup> Moreover, there is only limited evidence supporting the efficacy of interventions typically used to reduce the risks of such hazards. What kind of risk assessment enables such activities to be a relatively common feature of childhood in Canadian and American society?

In order to understand this state of affairs, we must examine the particular risk frame under which such hazards are commonly assumed. Risk assessments are embedded in the cultures in which they are situated and must be evaluated in their social contexts. In the United States and Canada, numerous popular activities, from soccer to cheerleading, have substantial risks of concussions. The two games we shall consider here, ice hockey in Canada and American football in the U.S., are sports which are best conceptualized as deep play games.<sup>2</sup> That is, each is inextricably linked to deeply-rooted sociocultural structures, and in some sense mirrors features peculiar to the cultures that invest so much in their play. The primary claim in this paper is that the framing of the risks of experiencing mild traumatic brain injury (mTBI)<sup>3</sup> in American football and in ice hockey in Canada has an enormous impact in defining the scope of the problem and the remedies that are prioritized. Beyond the political economy of sport, deeply-rooted social and cultural schemas in American and Canadian societies may affect the framing of risk.

The framing of risk is not a neutral, apolitical enterprise. In the analysis below, we contend that powerful institutional and political actors have advanced a particular framework for interpreting the risk of mTBI in American football and ice hockey.<sup>4</sup> This framework

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emphasizes that play is sufficiently safe, and that the risks of the game can be reduced to acceptable levels via laws, technological interventions, and rule changes. The risk frame also implies that the risks of brain injury that seem to be correlated with play are largely the responsibility of the people most directly connected to the individual player's participation (i.e., the trainers, coaches, and of course the players themselves).

The risk frame we describe applies to all age groups and levels of play. However, we focus here on the consequences of that risk frame for children and adolescents for several reasons. First, the majority of North Americans playing these games are children and adolescents, making sports-related mTBI an important population health concern affecting millions of young athletes. Second, the most affected population is also the most vulnerable, both physically and ethically. As to the former, children and adolescents have developing brains and weaker necks.<sup>5</sup> As to ethical vulner-

will continue to work with our players, coaches, and others to identify new and safer ways to play the game. We will build on our ongoing efforts to fund independent scientific research, develop better equipment, educate parents, players, and coaches on safe and fair play, advocate for safety in all sports, and enhance programs that support the health and well-being of NFL players and athletes at all levels.<sup>6</sup>

Additionally, the Letter highlights the "Heads Up Football" program, and the NFL-USA Football partnership that teaches "proper" tackling technique and mTBI education targeted at youth leagues. This demonstrates the NFL's influence on play among children and adolescents, and illustrates the intended application of the risk frame to these age groups. Indeed, much of the Letter focuses on efforts to protect these age groups, and to reduce the risks to an acceptable level.

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ability, children and at least some adolescents may be incapable of understanding and consenting to the particular risks that attend play. Moreover, the acceptable level of risk for adults playing contact sports may differ from that which would be deemed acceptable for children and adolescents. Accordingly, examining the acceptability of risk and the ways in which the risk frame shapes it requires some differential analysis between children and adolescents on the one hand and adults on the other.

We will first analyze three of the most common strategies in the United States and Canada deployed to address concussions in sports: return-to-play laws, helmets, and rule changes. Each of these three paradigms — better technology, rule changes, and health education linked to sport and mTBI — is in evidence in a recent "Letter to N.F.L. Fan," authored by National Football League (NFL) commissioner Roger Goodell:

Within the NFL, safety-related rules will always be clearly defined and strictly enforced, and we

Despite Goodell's message, we find little evidence that these strategies prevent concussive and subconcussive head impacts or significantly reduce the associated long-term risks. Rather, we submit that the popularity of these strategies can be attributed to their compatibility with prevailing understandings of safety risks in football and ice hockey. Such understandings shape the current risk frame, for which we examine the ethical, political and social implications. Finally, we will suggest how an alternative risk frame might reshape the discussion of the risks of mTBI associated with contact sports such as American football and ice hockey.

### **Concussion Laws and Return-to-Play Guidelines**

Return-to-play (RTP) guidelines, many of which have been incorporated into state laws, have been widely adopted in the hopes of improving player safety and managing youth mTBI. RTP guidelines typically require that athletes with symptoms of mTBI should

be withheld from play and examined by a physician, trainer, or other personnel with training in managing mTBI.<sup>7</sup> Players should then undergo neurological and cognitive assessment and be allowed to return to play only once symptoms have resolved. RTPs do not prevent mTBI, but instead guide their management after injury has occurred. Data on the long-term effects of these policies remain limited, and no evidence-based

parents, coaches, and school officials. It would also institute a “when in doubt, sit it out” policy requiring athletes suspected of sustaining a concussion to be removed from play for the rest of the day. Durbin’s press release announcing the introduction of this legislation notes that a multitude of major U.S. sports organizations, including the NFL and the NHL, have endorsed the bill.

**The evaluation and standardization of helmets helped reduce the rates of fatalities and catastrophic head injuries, but standards did not address the problem of mTBI. While helmets are effective in preventing other types of head injuries, such as skull fractures or intracranial hemorrhage, they are not designed to prevent mTBI. Indeed, Kevin Walter of the American Academy of Pediatrics’ Council on Sports Medicine and Fitness recently stated, “At this time, no protective equipment can prevent concussion.”**

RTPs have been validated in children.<sup>8</sup> Moreover, part of the difficulty in responding to and treating mTBI is the possibility that resolution of symptoms does *not* establish that it is safe to return to play.<sup>9</sup>

In 2009, Washington State’s Lystedt Law, named for a teenaged football player who had suffered catastrophic TBI during play, was the first RTP guideline to be legally mandated.<sup>10</sup> Since 2009, all 50 states and Washington, D.C., have passed similar legislation intended to reduce the impact of traumatic brain injuries in youth sports.<sup>11</sup> In addition to mandating removal from play and clearance before returning to play, such laws often also require education on mTBI detection for players, their parents, and coaches.<sup>12</sup> These laws therefore assume that the responsibility for detecting and managing mTBI will be primarily borne by the individuals most directly involved in playing the sport. As a post-injury tool, they represent a medicalized approach to managing mTBI after they have occurred. This may detract attention from reforms that might be more effective in mTBI prevention.<sup>13</sup> Furthermore, none of these laws explicitly require collection and analysis of data on youth sports head injuries, which would be essential for assessing the effectiveness of the legislation.<sup>14</sup>

Nonetheless, legislative action to prevent mTBI remains a popular strategy that has even reached the federal level. On September 25, 2013, Senator Dick Durbin (D-IL) introduced the Protecting Student Athletes From Concussions Act in the U.S. Senate.<sup>15</sup> Similar to state laws, this act would mandate information provision about the risks of mTBI to athletes,

### **Equipment/Technology: Helmets**

Protective equipment represents one of the most prominent strategies used to prevent head injuries in popular contact sports. In both ice hockey and American football, helmets have long been touted as an essential form of protection against injuries, including concussions. For decades, the salvation of football has been attributed to the introduction and refinement of protective gear. For instance, in 1950 a columnist for the *Chicago Tribune* asserted that the football of the early 20th century had been rendered far less dangerous “when the players were compelled to wear headgear, braced shoes, and pads. If such protective measures had not been adopted it is questionable whether football would have survived as one of our national sports.”<sup>16</sup> In ice hockey, by the 1960s, both Canadian and American amateur hockey associations required their youth players to wear helmets.<sup>17</sup>

Yet neither hockey nor football regulatory bodies imposed standards on helmet design, and the equipment in fact offered only limited protection. The deaths of two teenaged hockey players in 1968 from New Brunswick, who suffered fatal injuries despite having worn helmets, drew particular attention to the equipment’s inadequacy. Describing these cases, and noting that the helmets only protected the upper part of the skull, Dr. John Fekete argued that they did “not have enough rigidity to give adequate protection against any but the slightest blow,” emphasizing that “the so-called protective helmet of amateur hockey players gives only limited protection, even in minor accidents.”<sup>18</sup> Participants at a 1968 conference

addressing sports injuries advocated the universal use of helmets while noting the inability of existing headgear to adequately prevent injuries: “Every hockey player should wear a helmet. Most, perhaps all, helmets now available, are inadequate in view of the forces involved.”<sup>19</sup> Helmets were thus promoted as essential pieces of equipment even as their limitations were increasingly recognized.

In 1969, in response to an increasingly evident need for standardization, the National Operating Committee on Standards for Athletic Equipment (NOCSAE) was formed, with an initial focus on football helmets to reduce head injuries.<sup>20</sup> The American Society for Testing and Materials also formed Committee F-8 on Sports Equipment and Facilities that same year.<sup>21</sup> In 1973, NOCSAE implemented the first safety standards on football helmets.<sup>22</sup> While the original impetus for these American committees came from head and neck injuries in football, the ASTM soon formed a large subcommittee on ice hockey.<sup>23</sup> Meanwhile, in 1973, the Canadian Standards Association committee published its first preliminary hockey helmet standard, and in 1975 published the first national hockey helmet standard of its kind in the world (Z262.1).<sup>24</sup>

The evaluation and standardization of helmets helped reduce the rates of fatalities and catastrophic head injuries,<sup>25</sup> but standards did not address the problem of mTBI. While helmets are effective in preventing other types of head injuries, such as skull fractures or intracranial hemorrhage, they are not designed to prevent mTBI. Indeed, Kevin Walter of the American Academy of Pediatrics’ Council on Sports Medicine and Fitness recently stated, “At this time, no protective equipment can prevent concussion.”<sup>26</sup> Sander Reynolds, vice president for product development at Xenith, which manufactures football helmets, admitted to *New York Times* reporter Alan Schwarz that NOCSAE “exists for two reasons — to avoid skull fractures, and to avoid liability.”<sup>27</sup>

Moreover, in 2000, a biomechanical firm named Biokinetics reported to sports equipment manufacturer Riddell that helmets were not effective against mTBI. The senior engineer who authored the Biokinetics report noted recently that “[n]o helmet can prevent a concussion. Full stop.”<sup>28</sup> While this does not imply that helmets can have no role in reducing the risk of concussion, it does imply that their efficacy has been exaggerated to the point that some statements constitute deceptive claims. Indeed, allegations to this effect have proved the basis for litigation against helmet manufacturers. For instance, Riddell’s claims that players who wore its Revolution helmet were 31 percent less likely to suffer a concussion were singled out by experts and by members of Congress as dubious.<sup>29</sup>

Nonetheless, helmets continue to be portrayed and pursued as a key means of reducing mTBI. While acknowledging that the NOCSAE helmet standard is not an mTBI standard, NOCSAE asserts on its website that “[a] helmet certified to a NOCSAE standard provides a substantial level of protection for serious head injuries, including concussions.”<sup>30</sup> Furthermore, despite a lack of evidence, helmet manufacturers have promoted their products’ ability to prevent mTBI. Accordingly, manufacturers, sometimes with the help of prominent sports stars such as former NHL player Mark Messier, continue to work on new helmet designs with a focus on mTBI prevention, and to market helmets as offering such protection despite an absence of evidence supporting such claims.<sup>31</sup>

### Rule Changes

In addition to a focus on RTP guidelines and protective equipment, administrators of ice hockey and American football leagues have also sought to implement numerous rule changes to reduce injury rates. In ice hockey, body checking, a technique involving the use of one’s body to block an opposing player, has been identified as one of the sport’s most dangerous elements. One study of youth players aged 9 to 15 years found that body contact, including legal body checks, accounted for 86% of injuries during games, of which 23% were injuries to the head and neck.<sup>32</sup> According to a statement from the American Academy of Pediatrics (AAP), body checking and other collisions are particularly dangerous in youth hockey given the disparities in body size and strength that are common among children of the same age group. The AAP’s committee on sports medicine and fitness therefore recommended the prohibition of body checking for children aged 15 years and younger.<sup>33</sup>

While evidence specific to the impact of body checking on mTBI remains limited, studies suggest that rule changes eliminating body checking among youth players do effectively reduce mTBI.<sup>34</sup> At the professional level of play, however, rule changes regulating body checking to the head have not been associated with a reduction in mTBI rates.<sup>35</sup> Donaldson et al. suggest that improved enforcement of the rule as well as other changes, such as banning fighting and broadening the rule to include secondary or unintentional head contact, may be necessary to reduce mTBI rates in the NHL.<sup>36</sup> However, it is important to note that even evidence suggesting that rule changes can reduce the risk of experiencing mTBI does not imply that the risk is thereby reduced to a tolerable level. Moreover, there is an important distinction to be drawn here in the evidence regarding the impact of rule changes in hockey vs. that in American football. Namely, while

there is at least some evidence that the rule change on body checking in hockey might have a noteworthy impact in reducing relative risks of mTBI in hockey, in American football, there is limited evidence that rule changes can have a significant impact in reducing either the relative or absolute risk of mTBI.

Daneshvar et al. assert that rule changes during the 1970s substantially reduced the incidence of mTBI,<sup>37</sup> but neither cite evidence for this proposition nor explain precisely how the rule changes accomplished as such. In fact, although much of the epidemiologic literature regarding football-related mTBI discusses the notion of rule changes in passing, there is very little high-quality evidence via prospective studies establishing robust correlations between rule changes and significantly reduced risk.

thirty-fifty yards in an effort to locate and tackle the opposing player who has received and is in possession of the football. The “receiving team’s” players attempt to block the receiving team’s players, but the high speed often results in extremely high-impact collisions. After the NFL changed some of the rules for the kickoff, the NFL Players’ Association commissioned an unpublished study that found a 43 percent decline in mTBI experienced on kickoffs between 2010 and 2012.<sup>39</sup> This number was high enough to produce an overall decline in mTBI incidence during the same time period, if the total number of concussions indicated by the NFL’s injury surveillance system is presumed to be accurate.<sup>40</sup> Modifying or even prohibiting highly hazardous components of contact sports may therefore reduce the rate of mTBI.

**The idea that American football can be made safe, and that the risks faced by some of the most vulnerable groups in American society can be substantially diminished, is critical to shaping public discussion on the urgent question of whether the risks involved are acceptable in exchange for the expected benefits of football play. An alternative and arguably more plausible risk frame suggesting that significant risk inheres in play, and in many cases cannot be substantially reduced without entirely transforming the game, might produce a different decision calculus for families deciding whether to permit their children to play American football.**

Of course, absence of evidence is not evidence of absence. Yet, the paucity of data justifying the causal connection between rule changes and increased safety arguably renders more plausible the position advanced by a number of commentators: significant risks of football-induced mTBI inhere in play. Indeed, there is solid evidence that even subconcussive impacts, which are frequently experienced in practice, can produce the same kinds of forces as concussive impacts.<sup>38</sup> In a sense, this is a quintessential elephant in the living room, because it signifies that the risks of mTBI and long-term neuropathology may attend the act of practicing itself; rule changes to formal play may have no impact on subconcussive injuries in practice.

Obviously, it pushes the point too far to argue that no rule changes in American football could possibly reduce the risk. To the contrary, even in the absence of high-quality evidence, it is plausible to believe that rule changes to, for example, the specific type of play known as the “kickoff” may increase safety and reduce the risk of mTBI. During the kickoff, the “kicking team’s” players sprint at high speed for approximately

But even this point challenges the institutional actors’ preferred risk frame. For over a century, the kickoff has been widely recognized as an excessively dangerous play, even by the standards of violence deemed customary in American football. This matters given the basic epidemiologic point that health gains are much easier to show where the exposure or condition being evaluated is more severe. Rule changes related to an ultrahazardous play or tactics might produce significant evidence of benefit. In the 1970s, for example, rule changes prohibiting spearing and other uses of the head contributed to a decrease in the rates of cervical spine injuries.<sup>41</sup> However, this does not imply that other rule changes to less dangerous plays will result in similar benefits. And while some changes may reduce rates of catastrophic injuries such as quadriplegia, the extent to which rule changes can reduce the long-term risks of concussive and sub-concussive hits remains unknown.<sup>42</sup>

The point is not to suggest that rule changes are inadvisable. Rather, the central claim here is that the institutional actors’ emphasis on rule changes as a

pathway to player safety and mTBI risk reduction is a key plank in those actors' preferred risk frame. The idea that American football can be made safe, and that the risks faced by some of the most vulnerable groups in American society can be substantially diminished, is critical to shaping public discussion on the urgent question of whether the risks involved are acceptable in exchange for the expected benefits of football play. An alternative and arguably more plausible risk frame suggesting that significant risk inheres in play, and in many cases cannot be substantially reduced without entirely transforming the game, might produce a different decision calculus for families deciding whether to permit their children to play American football.<sup>43</sup> That is, eliminating contact from the game entirely would be likely to reduce the risk substantially. But within the context of American football as a full-contact game, limited evidence links rule changes to anything other than marginal reductions in mTBI risk. This underscores the importance of a frame that casts the fundamental question as whether the levels of risk that currently attend play are acceptable, and for whom.

### Prevailing Risk Frame and Technological Imperative

It is widely acknowledged that American football and ice hockey are inherently dangerous sports. Markowitz and Markowitz, for example, observe that despite the N.F.L.'s repeated rule changes over the last half-century, "football remains a sport that is intrinsically violent," and is one in which "athletes will undoubtedly continue to get hurt."<sup>44</sup> Yet American football and ice hockey remain highly popular among American and Canadian youth. This is not necessarily because parents believe that violent and dangerous sports with inherent risks of brain trauma are appropriate for children. Rather, the current reliance on helmets, rule changes and return-to-play guidelines as mTBI prevention strategies reflect the view that these risks, even if inherent, can be mitigated to an acceptable level.

According to this prevailing risk frame, the responsibility for minimizing the risk of football-induced mTBI belongs mostly to the teams, officials, coaches, and the players themselves. For example, USA Football devotes a section on its website to "Heads Up," which instructs that proper tackling technique — heads up — can increase player safety.<sup>45</sup> The Heads Up page prominently features a link to the website's "Concussion Awareness Program," thereby reinforcing the idea that changes in play can reduce the risk of mTBI among the population most vulnerable to their occurrence and their effects. Other youth leagues,

while acknowledging the occurrence of minor injuries, downplay or deny the existence of risks of major injuries. For instance, as of April 24, 2014, the website of Pop Warner Football asserts that "[i]n Pop Warner Football, there is 'an absence of catastrophic head and neck injuries and disruptive joint injuries found at higher levels.'"<sup>46</sup> If the proper techniques are instituted, supported, taught, and learned — so goes the narrative — player safety can be dramatically increased and risk of mTBI substantially ameliorated.

A similar analysis applies to the ubiquitous narrative suggesting that technological interventions, from helmets to neuropsychological testing to imaging devices, can resolve the significant problems posed by the football-mTBI connection. Yet here, the institutional actors' risk frame takes advantage of a deep-seated phenomenon: the technological imperative.

Although there are many ways of defining the technological imperative, for our purposes it refers to the general belief in the significance of technology to human progress in general,<sup>47</sup> and to American progress in particular. There is a widespread belief that salvation can be achieved through the proper application of technology.<sup>48</sup> While the technological imperative does not exclusively refer to the health sector, its influence on medicine and health care is particularly pronounced.<sup>49</sup> Perhaps unsurprisingly, there is uniform agreement that expenditures on novel medical technologies is by far the largest driver of hyperinflationary health care spending in the U.S. over the last half-century.<sup>50</sup>

Thus, it is not simply rule changes that can save American football; it is the proper application of technology. As NFL Commissioner Roger Goodell noted in his "Letter to N.F.L. Fan," "We work closely with the N.F.L. Players Association to ensure our players have access to the finest doctors and most cutting edge technology."<sup>51</sup> There are two key points we wish to highlight regarding the technological imperative. The first and most significant is that the emphasis on the role of technological interventions serves a particular risk frame. If technological interventions can substantially reduce the risk of brain injury, it follows that the game is either sufficiently safe (and has simply been played in ways that increase the risk) or can be made as such. Moreover, if the proper application of technology can make play substantially safer, the responsibility for safety rests with the individuals who have the capacity to implement and require the use of such technology, rather than with the institutional actors commodifying and selling play itself. (Admittedly, institutional actors might in theory be seen to have the responsibility of providing risk-reducing technology to stakeholders of child and youth hockey and American football respec-

tively, but there is little precedent by which the latter hold the former responsible for the provision of such. Youth football coaches, for example, do not generally expect the National Collegiate Athletic Association or the N.F.L. to provide pads, helmets, and uniforms for players).

The second important point regarding the influence of the technological imperative is the consequences of that particular risk frame. As noted from the outset, we are committed to the notion that ice hockey in Canada and American football are deep play. The risk frame that highlights the technological imperative mirrors American, and perhaps to a lesser extent, Canadian society, in the sense that health, risk, and illness are cast primarily as a function of access to “cutting-edge” technologies.

Certainly, there are examples of technical innovation that improve population health. However, we submit that the amount of resources and attention lavished on medical and point-of-care technologies is unjustified given the relatively small contribution such technologies exert on important metrics of population health.<sup>52</sup> For example, medical imaging associated with chronic low-back pain grew over 17% in the 2000s to almost \$8 billion, even though robust evidence suggests that it has no positive impact on patient outcomes.<sup>53</sup> As ice hockey and American football are deep play, it is unsurprising that the same dynamic is to a greater or lesser extent unfolding in each sphere. Much has been made in each sport, for example, of the role of helmets in ensuring player safety. Yet, as noted above, while helmets are effective in reducing skull fractures, there is virtually no evidence that helmets of any design are effective in reducing the risk of experiencing mTBI. Unlike many aspects of mTBI research, this particular epidemiologic point is not controversial. Consensus statements of the 2nd, 3rd, and 4th International Conference on Concussion in Sport (held in 2001, 2004, and 2012 respectively) have each expressly stated that “[t]here is no good clinical evidence that currently available protective equipment will prevent concussion, although mouthguards have a definite role in preventing dental and orofacial injury.”<sup>54</sup>

Similarly, much attention has been devoted to the neuropsychological testing that is now required in the N.F.L. and is increasingly common at other levels of play. However, such testing is beset with extensive conflicts of interest problems.<sup>55</sup> For example, in both the U.S. and in Australia, team physicians and psychologists are financially involved in the development and marketing of the dominant testing protocols used, which could well result in overconfidence regarding the capacity of such testing to reduce risk substantially.<sup>56</sup> Other difficulties also undermine the apparent confidence in the capacity of such testing

to reduce risk substantially. For example, some professional football players have admitted to intentionally attempting to achieve a low baseline score on the testing so as to facilitate their return-to-play,<sup>57</sup> and a joint position paper from the American Academy of Clinical Neuropsychology and the National Academy of Neuropsychology states that patient motivation and effort can “substantially influence neurocognitive test scores.”<sup>58</sup> In addition, Markowitz and Markowitz point out that the proprietary assessment exclusively used in the N.F.L. is “not able to determine whether an athlete is impaired or recovered based on overall test performance, making it ineffective as an objective indicator of neurological health....”<sup>59</sup> In a recent review, Randolph concludes that “the serious risks associated with sport-related concussion appear to be unlikely to be modified by baseline testing.”<sup>60</sup> Moreover, Randolph also notes that the relevant assessment is not particularly reliable, as it demonstrates significant false positive rates that are cumulative across multiple scores.<sup>61</sup>

In a recent commentary defending Randolph’s paper from criticism, the section editor of *Current Sports Medicine Reports* concludes that

[d]espite misleading media accounts and heavy marketing by companies that offer these tests, sports medicine practitioners should resist the seductive and simplistic appeal to use such products. To advocate for the addition of baseline neuropsychological testing for athletes at this time is scientifically unfounded and financially irresponsible and should be roundly condemned for confusing and raising false expectations in the athletes who are subjected to it....<sup>62</sup>

And, of course, even if neuropsychological testing were robustly linked with a substantial risk reduction and/or with better longitudinal health outcomes for participants, it is an intervention used for management of sport-induced mTBI. It will not prevent mTBI. Indeed, current policy responses to mTBI are generally driven by a focus on the application of technology to manage concussions, and tend to neglect preventive approaches. A 2012 analysis of state-level youth TBI laws found that none focused on primary prevention of TBI.<sup>63</sup> Furthermore, initial evaluation of these laws suggests that they are not effective in managing, let alone preventing, mTBI. A 2014 study in Washington State, the first state to pass a Lystedt law, found that over two-thirds of high school athletes who suffered mTBI reported playing with symptoms.<sup>64</sup> Given the vast health and economic benefits that broader preventive approaches can offer relative to the management of a medical problem, the extent

to which emphasis on mTBI management displaces primary prevention strategies is of great concern.<sup>65</sup>

There are additional examples of the technological imperative at work in discourse on mTBI and sport, including perhaps most notably the hope that neuroimaging techniques will prove a substantial boon in the diagnosis and management of sport-related mTBI. Such hope in the potential health impact of neuroimaging is not confined to professional sport, of course. Yet in the context of contact sports, the technological imperative sustains and fuels a particular risk frame preferred by institutional and generally empowered actors in Canadian ice hockey and American football. That risk frame emphasizes the limited and preventable risks associated with play, such that only the application of technology is needed to preserve the game and allow play at virtually any level. The technological imperative is arguably powerful enough to exert an effect even if a slightly different risk frame is operative. That is, even if the risk is deemed higher than the NHL and NFL might prefer, the perceived capacity of medical and health technology to solve all health-related ills might still be construed as sufficient to preserve play.

### **An Alternative Framing of the Risk and Fundamental Questions**

Generally wealthy and empowered actors responsible for the governance of play in ice hockey and American football in North America have molded and advanced their preferred risk frame, which posits that the games are generally safe enough and pose acceptable levels of risk. Such a framing of the risk focuses discourse on a particular set of inquiries and issues while deflecting attention from others. Rather than emphasizing the place of rule changes, of technological interventions such as helmets, neuropsychological testing, and medical imaging, and of concussion laws, we submit that other, arguably more fundamental questions are paramount and are more likely to take center stage upon application of the alternative risk frame described above. Currently, some of these questions are rarely posed, some are discussed peripherally, and some are asked and emphasized by researchers, but they are not always as visible in public discourse. Many of these questions admit of no easy answers, in part because mTBI science is still relatively young, and in part because even the best epidemiology cannot resolve fundamentally moral and political questions. Such questions include but are *not* limited to:

- Is it acceptable for children to risk mTBI in contact sports?

- At what point does the risk become so high that even fully informed parents ought to be precluded from exposing their children to such levels of risk?
- At what age can players consent to risks of head trauma and associated elevated risks of chronic degenerative neurological disease?

One of the most pressing and fundamental questions regarding mTBI and the risks of long-term neuropathology is whether children below a certain age should be permitted to bodycheck while playing ice hockey and/or play American tackle football at all. Despite the risks, this is not a simple question, for North American children and adolescents typically engage in a number of risky activities, from road cycling to skiing to — eventually — driving.

Yet these questions are frequently obscured by other debates. For example, stakeholders in American football are currently engaged in a debate over whether specific rule changes constitute so significant a change in play that the game itself has been utterly transformed. As U.S. Supreme Court Justice Antonin Scalia framed the issue in a 2009 dissenting opinion, “[T]here is some point at which the rules of a well-known game are changed to such a degree that no reasonable person would call it the same game.”<sup>66</sup> Active players frequently bemoan that safety-related changes dumb down the game, while spectators denounce the policing of collisions and tackles, the penalization of previously authorized plays, and the potential elimination of features of the game.<sup>67</sup> Given the complexity of the issue and the extent to which it touches on the identity of games that constitute deep play, whether rule changes fundamentally alter American football and ice hockey is obviously a high-stakes affair.

Yet when viewed from the prism of public health, we argue that the inquiry is far less significant, and in fact obscures other, more pressing questions. Where relatively piecemeal rule changes (i.e., those that do not transform the game itself, such as the elimination of full-contact) are unlikely to have a significant positive impact on player health, the contest over such changes largely seems beside the (public health) point. The risk frame we have described above posits that rule changes are so important because their adoption mitigates the risk in contact sports to an acceptable level. The alternative frame, also noted above, suggests that both ice hockey and American football are inherently violent and dangerous sports, and that there is little evidence that rule changes can substantially reduce the risk of mTBI and/or long-term neuropathology. If this latter framework were to dominate discourse on the risk of play among different levels and age groups, the signifi-

cance of the debate on rule changes and game identity as to player health and safety would diminish.

The countervailing possibility, that substantial risks of mTBI inhere in the respective games themselves as constituted and cannot be significantly reduced, disturbs the risk frame advanced by the relevant institutional actors. A risk frame which began from the premise that, even if the precise odds ratios remain to be calculated, (1) some significant level of risk attends play, and continued with the additional premise that (2) rule and technical changes are unlikely to reduce this risk substantially, would likely produce a *very* different public discourse among families and communities regarding the acceptability of the risk for children and adolescents.

Although better epidemiology is crucial to calibrating the level of risk and the efficacy of proposed interventions, fundamental questions implicated in mTBI discourse are irreducibly normative questions. The best science can only inform but never resolve these inquiries. An example of a fundamentally normative inquiry regarding mTBI and sport is the question of what constitutes an “acceptable” injury. Molcho and Pickett have proposed that those unintentional injuries which occur “during a necessary or health generating activity, and that do not have long-term implications could be viewed as acceptable.”<sup>68</sup> This definition, of course, raises further questions: to what extent is tackle football a necessary or health-generating activity? And how should our uncertainty about the long-term implications of repetitive head trauma inform our consideration of the acceptability of these sports, particularly for children?

Public health ethicists have only begun to develop robust frameworks to guide our thinking about these complex questions. Some commentators have proposed several key considerations that may be relevant to addressing the ethics of risky sports for children, including contextual concerns, the susceptibility of the practice to modification or abandonment, and unintended consequences of regulation.<sup>69</sup> While the development of such a comprehensive scheme is in progress, we cannot await its completion before grappling with difficult questions related to the acceptability of risk in contact sports among different age groups.

## Conclusion

The ways in which the risks of mTBI are framed in numerous activities, including American football and ice hockey, can either highlight or downplay the need to engage particular moral, social, and political questions. We prefer a risk frame which acknowledges that contact sports inherently carry significant

risks, even after the application of currently available interventions such as technologies, rule changes, and laws. Under our proposed risk frame, the fundamental questions are no longer, e.g., which technology is most effective, but are rather whether those risks that cannot be substantially reduced are acceptable, and for whom. Our goal in this paper was not to answer such questions, in no small part because the questions themselves are so complex and so freighted. If they are to be resolved at all, these questions must be addressed by robust processes of deliberation and public discussion involving parents, coaches, school administrators, fans, trainers, physicians, sporting goods manufacturers, and, of course, the players themselves. However, the likelihood and quality of such a conversation greatly depends on which risk frame we adopt.

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