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Concussions and youth football: using a public health law framework to head off a potential public health crisis

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ABSTRACT

Concussion from sport is increasingly recognized as a public health priority. In response, all states and the District of Columbia have enacted youth concussion legislation. This paper first examines key developments in concussion-related policy and legislation and then uses the findings from recent scientific studies to highlight the need to incorporate evolving scientific evidence into concussion legislation in order to better protect youth and adolescent athletes. Next, the paper discusses the framework of empirical health law research and why it should be applied in the case of concussion legislation. Finally, this paper argues that empirical health law research should be considered in any decision about whether legislation can help improve the health and safety of young players, a particularly vulnerable population whose unique needs have not yet been adequately addressed.

KEYWORDS: concussion, health policy, public health law, sport, youth

INTRODUCTION

Concussion is a form of mild traumatic brain injury (mTBI) that can be sustained through sufficient acceleration and deceleration of the head.\textsuperscript{1} A 2006 study found that between 1.6 and 3.8 million mTBI occur annually in the United States,\textsuperscript{2} although this

\textsuperscript{1} See Paul McCrory et al., Consensus Statement on Concussion in Sport: The 4th International Conference on Concussion in Sport, Zurich, November 2012, 48 J. ATHLET. TRAINING 554, 555 (2013).
\textsuperscript{2} Jean A. Langlois et al., The Epidemiology and Impact of Traumatic Brain Injury: A Brief Overview, 21 J. HEAD TRAUMA REHABIL. 375, 375 (2006).
is likely a conservative estimate as a significant number of concussions go unreported and undiagnosed. This injury incidence may be unsurprising, given the large number of individuals who participate in organized sports in the United States, many of which expose participants to the risk of concussion. Among youth, high school, and college sports, football presents one of the highest risks of concussion. Football is of particular public health importance as around 3 million youth athletes, 1.1 million high school athletes, and over 70,000 collegiate athletes play football in the United States annually.

Acutely, concussions can present with a variety of physical, psychological, and emotional symptoms. Concussions have also been associated with later-life depression and executive dysfunction. Even without a diagnosed concussion, repeated head impacts that cause subconcussive trauma have been found to alter the blood-brain barrier and lead to cognitive impairment. Relatively recently, concussions and subconcussive impacts have been associated with a neurodegenerative disease called chronic traumatic encephalopathy (CTE). Given both the frequency and the potential severity of its sequelae, concussions are increasingly seen as a public health priority.

Youth athletes are especially vulnerable to concussion. The severity and duration of acute concussion symptoms is thought to be greater in youths, compared to adolescents.

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11 Nicola Marchi et al., Consequences of Repeated Blood-Brain Barrier Disruption in Football Players, 8 PLOS ONE 1, 1 (2013).


13 Ann C. McKee et al., Chronic Traumatic Encephalopathy in Athletes: Progressive Tauopathy after Repetitive Head Injury, 68 J. NEUROPATHOL. EXP. NEUROL. 709, 709 (2009); Ann C. McKee et al., The Spectrum of Disease in Chronic Traumatic Encephalopathy, 136 BRAIN 43, 43 (2013); Robert A. Stern et al., Clinical Presentation of Chronic Traumatic Encephalopathy, 81 NEUROLOGY 1122, 1122 (2013).

or adults. Some have hypothesized that underdeveloped neck musculature may play a role in making these athletes more prone to concussion. In youth and adolescent athletes, sustaining a second impact prior to recovery from the initial concussion can lead to severe neurological consequences and even, sometimes, death.

This paper will examine key developments in concussion-related policy and legislation and will use the findings from recent scientific studies to highlight the need to incorporate evolving scientific evidence into mTBI legislation in order to better protect youth athletes. The framework of empirical health law (EHL) research should be considered in any decision about whether legislation can help improve the health and safety of young players, a particularly vulnerable population whose unique needs have not yet been adequately addressed.

**CONCUSSION LAWS AND POLICIES**

A variety of policy mechanisms have been employed in attempts to reduce the frequency and severity of concussions sustained through sport, especially in youth and adolescents. Many sports leagues have adopted rules that utilize primary and secondary concussion prevention measures. Primary prevention includes mechanisms that reduce the risk of incurring the injury, whereas secondary prevention involves early detection and treatment in order to minimize negative health impacts after the injury has occurred. Primary prevention mechanisms adopted by US sports leagues to limit concussions in football include limiting contact practices, eliminating high-risk formations such as the ‘wedge’ during football kickoffs and penalizing helmet-to-helmet contact or hitting a defenseless receiver. Many leagues also mandate that athletes receive education about concussions prior to play. As an example of secondary prevention, many sports leagues in the United States require athletes to be removed from play and

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15 Paul McCrory et al., Summary and Agreement Statement of the 2nd International Conference on Concussion in Sport, Prague 2004, BRIT. J. SPORTS MED. 196, 197 (2005). For the purposes of this paper, the term ‘adolescent’ will be used to describe high school aged athletes, and ‘youth’ will be used to describe pre-high school aged athletes.


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evaluated by a clinician if they are suspected of having a concussion.22 Despite the existence of these policies, the extent to which these policies have been uniformly enacted is understudied. Where examined, researchers have found that rules have not been uniformly followed,23 and even where implemented, efficacy has been inconsistent.24 Better enforcement of existing concussion-related policies has been highlighted as an area in need of improvement.25

State legislatures have also enacted protections specifically related to youth and adolescent mTBI. In 2009, Washington became the first state to put forth concussion-related legislation.26 The implementation of this law was spurred by the catastrophic injury of Zackery Lystedt, a middle-school football player who had an undiagnosed concussion and returned to play prematurely.27 Colloquially called the Lystedt Law, Washington’s law served as model legislation for the rest of the states.28 Currently, all states, and the District of Columbia, have adopted concussion legislation, with Mississippi the last to enact its law in 2014.29 Generally, the state laws contain the following provisions: (1) annual concussion education for athletes and their parents; (2) removal from play for any athlete suspected of having sustained a concussion; and (3) clearance by a medical professional before an athlete is allowed to return to play. Notably, all of these components represent secondary prevention efforts.

Prior scholarly work on concussion laws includes a state-by-state analysis of the provisions of these laws and examination of explicit limitations on liability for stakeholders in the athletic environment (eg schools, health care providers, and volunteers).30 Differences in implementation of these laws across states and resultant compliance with the statutes have also been investigated.31 A third project examined the effect of Washington’s law on the concussion knowledge of athletes, parents, and coaches in that state, finding that three years after passage, while coaches had relatively good concussion knowledge, parents’ and athletes’ understanding was less extensive.32 Yet, another study explored the education and acknowledgement provisions of each state’s law,....

References:
23 Christine M. Baugh et al., Concussion Management in United States College Sports: Compliance with the National Collegiate Athletic Association Concussion Policy and Areas for Improvement, 43 AM. J. SPORTS MED. 47, 47 (2015).
29 See Baugh et al., supra note 25, at 299.
30 See Harvey, supra note 28, at 1251,1252.
31 See Lowrey & Morain, supra note 25, at 290.
finding variation both in legislative requirements and differences in implementation by the states’ high school athletic associations. A recent report used insurance claims data to understand whether passage of a concussion-related law increased concussion-related healthcare. The authors concluded that concussion-related health care utilization has increased more in states that were early adopters of concussion laws compared to those that were later adopters, but explained that improved awareness of the health effects of concussion may have also played a role in the increase.

**Evolving Scientific Evidence**

Scientific evidence in the area of concussion continues to evolve. Several recent studies highlight this evolution, particularly as it relates to concussions at in youth and adolescents. Preliminary data from a small sample of former NFL players suggest that athletes who began playing football before age of 12 presented with greater neurological impairment later in life. A randomized control trial of 11–22 year olds who sustained a concussion found that five days of strict rest offered no added benefit over a shorter period of rest (one or two days). Yet, another study suggests that teaching certain tackling techniques may reduce injury rates in youth football. These are just a few recent examples in the long list of scientific information forthcoming on the risks of concussion and possible mechanisms to prevent such injuries.

In order to minimize the health consequences of concussions, prevention, and appropriately managing the injury are critical. Accomplishing this will require state laws and league policies that reflect research gleaned from the medical sciences. If appropriately implemented, evidence-based state concussion legislation and sports league concussion policies can provide important and wide-reaching primary and secondary prevention throughout the United States. The next section argues that concussion laws and policies should be considered under the framework of public health law research and that doing so will allow for the appropriate incorporation of evolving evidence.

**Empirical Data and Concussion Legislation**

Public health law has been traditionally defined as:

*the study of the legal powers and duties of the state to ensure the conditions for people to be healthy (eg to identify, prevent, and ameliorate risks to health and safety in the population), and the limitations on the power of the state to constrain the autonomy,*

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33 See Baugh et al., supra note 25, at 307, 308.
35 Id.
36 Julie M. Stamm et al., Age of First Exposure to Football and Later-Life Cognitive Impairment in Former NFL Players, 84 NEUROLOGY 1114, 1114 (2015). Christine Baugh, co-author of the present manuscript, was a co-author of this study.
37 Danny G. Thomas et al., Benefits of Strict Rest after Acute Concussion: A Randomized Controlled Trial, 135 PEDIATRICS 1, 1 (2015).
privacy, liberty, proprietary, or other legally protected interests of individuals for protection or promotion of community health.  

Concussion legislation that aims to reduce head injuries resulting from youth sports should be considered a prime example of public health laws. Ideally, such laws will incorporate two forms of empirical evidence. First, the laws should respond to scientific evidence about the public health issue the laws are trying to address. Evidence of the risks and dangers of the targeted injury or illness should be the basis for legislation aimed at curbing a particular health problem. Scientific evidence not only clarifies the health or safety problem at hand, but may also suggest the best mechanism for addressing the problem. This is especially true for laws that deal with complex medical risks, such as needle exchange laws, which are best understood through a scientific lens. Second, public health laws must be nimble enough to allow incorporation of empirical data concerning their efficacy. Indeed, if the goal of public health law is to protect health, this effort should be informed by empirical data concerning efficacy.

There are a variety of ways that empirical data about the laws can be reflectively mobilized to improve public health laws’ efficacy. Data from implementation studies can improve adoption and dissemination of laws, so that new laws can be written to most effectively counter a public health problem. Information about the prevalence and distribution of specific laws allow data to be gathered concerning their efficacy, which can enable policymakers to design legislation that better targets the underlying issue causing harm. Policymaking studies can gather data useful for identifying factors that influence the likelihood that public health laws will be adopted. Many of these are areas of public health law research, or what has more recently been called EHL research.

Not all areas of public health law are well suited to the introduction of empirical data. Recognizing this, Professor Michelle Mello has set forth a series of criteria that she argues allow EHL research to positively influence policy decisions. These factors include:

(1) ... variation in the health laws in question across jurisdictions and over time, which strengthens researchers’ ability to statistically estimate the effects of the laws;

(2) data on laws, their outcomes, and other factors that might confound analysis of the

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41 See Anthony D. Moulton et al., The Scientific Basis for Law as a Public Health Tool, 99 AM. J. PUB. HEALTH 17, 1–2 (2009).
44 Id.
46 Burris et al., supra note 45, at 183.
47 Id. at 179, 185.
48 Id. at 179, 182.
49 See Mello & Zeiler, supra note 45, at 691.
relationship between the laws and the outcomes are readily available; (3) the issue is convincingly framed as a public health issue and visible enough to attract skilled empirical researchers and funders of both primary studies and systematic reviews; (4) infrastructures exist within the academy to support the production and dissemination of empirical research; (5) interest groups act as facilitators rather than barriers to basing policy decisions on the best available evidence; and (6) policymakers understand and have confidence in the methods used to produce relevant empirical findings.

The presence or absence of these criteria can often indicate whether a field will be well suited to incorporate empirical data to positively affect the development of policy. We now explore these criteria in the context of concussion-related legislation in the United States.

**Variation in concussion laws across jurisdictions and time.** Concussion laws in the United States are generally seen as having been built based on a similar template. However, existing scholarship suggests that despite the similarity in motivation, there is sufficient variation in implementation of these laws to permit the measurement of differential effects. Additionally, despite the relatively short time horizon during which all states implemented concussion laws (between 2009 and 2014), existing data suggest measurable differences among early adopter and late adopter states. Furthermore, since enactment, some states have revised or are in the process of revising their concussion laws, providing further variation. Thus, despite first appearances, existing evidence suggests sufficient variability across jurisdictions to allow for empirical measurement.

**Data on the law, outcomes, and possible confounders are readily available.** In 2014 alone, nearly 500 peer-reviewed publications were produced containing the word ‘concussion’ in their abstract or title.

This range of publications includes EHL research, as well as basic and applied scientific research, all of which contributes to the body of knowledge required to appropriately and empirically analyse existing concussion laws. Although not all aspects of concussion science are fully developed nor have all achieved scientific consensus, the knowledge around this topic is increasing rapidly, and the field is sufficiently developed to support empirical research. This boom in peer-reviewed research on the topic also indicates that infrastructures exist to produce and disseminate empirical research, Mello’s fourth criterion.

**Issue is a public health issue visible enough to attract researchers and funders.** As understanding of the acute and possible long-term health effects of concussions grows, this injury is increasingly recognized as a public health issue. As the field has developed,
increasing numbers of researchers and funders are participating in and supporting scientific and policy research related to concussion. As noted above, there is a boom in research related to concussion as noted by the sheer number of peer-reviewed publications. Additionally, some major sports leagues in the United States have put forth millions of dollars in grants to fund research related to understanding and preventing concussion.\footnote{See eg Ninesigma, GE NFL Head Health Challenge, Apr. 30, 2015, https://www.ninesigma.com/ge-nfl-head-health-challenge (accessed May 15, 2015); NCAA, DOD, launch Mind Matters Challenge, NCAA.COM (accessed Nov. 6, 2014); http://www.ncaa.org/about/resources/media-center/news/ncaa-dod-launch-mind-matters-challenge (accessed May 15, 2015).}

Interest groups act as facilitators rather than barriers.\footnote{See Mello & Zeiler, supra note 45, at 692.} There are several major stakeholders in this arena, most notably the sports leagues. Although the leagues have been criticized for their handling of concussion-related issues,\footnote{See Jake New, Combating Concussions, INSIDEHIGHERED, Oct. 2, 2014, https://www.insidehighered.com/news/2014/10/02/u-michigans-response-athletes-concussion-renews-regulation-debate (accessed May 15, 2015); Patrick Hruby, The Case Against the NFL, THEPOSTGAME, Feb. 29, 2012, http://www.thepostgame.com/blog/hruby-tuesday/201202/case-against-nfl (accessed May 15, 2015).} there have also been indications that they may be willing to facilitate the incorporation of empirical evidence into policy in this arena. For example, the NFL actively promoted Washington State’s Lystedt law and tried to leverage its influence to encourage other states to adopt similar laws.\footnote{See NFL Commissioner Roger Goodell urges governors to adopt youth concussion law, NFL.COM, May 23, 2010, http://nflcommunications.com/2010/05/23/nfl-commissioner-roger-goodell-urges-governors-to-adopt-youth-concussion-law (accessed May 15, 2015).} While some have criticized the NFL’s youth football program ‘Heads Up Football’,\footnote{See Steve Fainaru and Mark Fainaru-Wada, Questions about Heads Up Tackling, ESPN.COM, Jan. 13, 2014, http://espn.go.com/espn/otl/story/_/id/10276129/popular-nfl-backed-heads-tackling-method-questioned-former-players (accessed May 15, 2015).} others have suggested that it may produce measurable reduction in injury to youth football players.\footnote{See Alic, supra note 38.} Some scholars have criticized the sports leagues as purposefully manufacturing doubt relating to the seriousness of brain trauma sustained through sport, leading to a slowed reaction to what has been called the ‘concussion crisis’.\footnote{See Kathleen E. Bachynski & Daniel S. Goldberg, Youth Sports & Public Health: Framing Risks of Mild Traumatic Brain Injury in American Football and Ice Hockey, 42 J.L. MED. & ETHICS 323, 323 (2014); Emily Harrison, The First Concussion Crisis: Head Injury and Evidence in Early American Football, 104 AM. J. PUB. HEALTH 822, 822 (2013).} Whether or not sports leagues, as the major interest groups in this area, will serve as facilitators rather than barriers to improving policy remains to be seen. However, their previous actions indicate that, at minimum, we should not rule out this possibility.

Policymakers understand and are confident in empirical methods.\footnote{See Mello & Zeiler, supra note 45, at 692.} Although the extent to which policymakers understand and are confident in the empirical methods used in concussion research is not fully understood, there is a reason to believe that they are taking the existing empirical evidence seriously. One reason is the reconsideration of existing health laws and the incorporation of more primary prevention measures which recent scientific evidence indicated was warranted.\footnote{See Lowrey, supra note 54, at 61.} Although the case of concussion legislation may not fulfill each of Mello’s outlined criteria perfectly, there is a sufficiently strong case for each criterion that they will likely
Concussions and youth football benefit from consideration under the EHLR framework. Furthermore, a forthcoming paper by Harvey et al. highlights that concussion laws have evolved in a manner quite similar to other public health law interventions, going through a multistep process involving engagement, enactment, research, and reform.69 Particularly in the final two stages, empirical evidence plays a tremendous role in refining laws, enabling legislation to more effectively address the targeted health problem.

POSSIBLE CHALLENGES TO INCORPORATING EVIDENCE INTO CONCUSSION POLICY

One difficulty of incorporating scientific evidence into policy is determining when the evidence is sufficiently valid or agreed upon. This balancing act between incorporating cutting-edge scientific findings, and ensuring that policy will be based on replicable, empirical evidence, rather than statistical outliers, is non-trivial. Incorporation of inappropriate evidence can have negative consequences. For example, if policymakers rely on data that is too preliminary, there is a danger that laws will need to be constantly revised to reflect emerging information that casts doubt on, or further clarifies, past studies. Constant revision can hamper the ability of law to make a lasting positive impact, and could even have a negative health impact, should the premature scientific evidence be wholly refuted. Although laws are inherently reactive, any legislation that takes into account emerging data from scientific studies must ensure that the empirical evidence being incorporated is sufficiently agreed upon. One possible approach for policymakers to consider is relying on expert consensus statements. Luckily, in the context of TBI legislation, there are several relevant expert consensus statements on concussion science.70

It is important to remember that identifying concussion legislation as an issue that is ripe for improvement under the framework of EHL, and actually initiating such an improvement, are two different endeavors. Indeed, there is a widespread view that ‘rigorous research may be relevant to policy in theory but too often is neither salient nor useful to policymakers and advocates in practice’.71 Scholars have highlighted a concern amongst policymakers that researchers generally follow their own interests and are poor judges of how policy agendas develop in the legislative sphere.72 This can make it difficult for policymakers to effectively draw on the expertise of researchers, even when designing legislation that addresses scientific and medical concerns. These concerns only increase the need for policymakers to directly engage with concussion research, so that those designing the policy responses are as well versed as possible in the relevant scientific research studies. It is essential for legislatures to work with, and be aware of the work of, researchers in the field, as data alone cannot provide protection for those who are at most risk.73 Furthermore, legislatures have the experience and expertise needed to design effective legislation, as well as the ability to push for greater study of this

70 See eg Steven S. Broglio et al., National Athletic Trainers’ Association Position Statement: Management of Sport Concussion, 49 J. ATHL. TRAINING 245 (2014); McCrory et al., supra note 1, at 555.
71 Burris et al., supra note 45, at 196.
73 See Moulton et al., supra note 41, at 1.
Concussions and youth football is an evolving issue, so that more evidence can be collected. Beyond their expertise, legislators are elected officials trusted with the important responsibility of drafting law, in this case law that protects the public’s health.

CONCLUSION
There are numerous examples of past public health laws that have succeeded or failed in their goals depending on the willingness of those who drafted the legislation to be guided by up to date scientific evidence. Medical malpractice reform laws provide an example of a field in which lawmakers ignored evidence-based data, and the enacted legislation did little to ameliorate the problems in the field. Scholars have written about the shortcomings of current medical malpractice legislation and regulatory schemes, highlighting that ignoring empirical data when designing legislation can hamper law’s ability to achieve its goals. In contrast, seatbelt laws, mandatory helmet laws, and graduated licensing motor safety laws were enacted based on the results of large-scale scientific research studies, and their salutary effect on public health is unquestioned. Concussion legislation can follow the leads of the latter fields, using scientific evidence to design laws that effectively protect the health and safety of those players most at risk.

The application of scientific evidence is the best way to improve the efficacy and substance of laws designed to improve the health and safety of young athletes. However, scientific evidence is constantly evolving and is not created in a vacuum; rather, it is a body of knowledge generated by fallible humans situated in a particular social, political, and historical context. In this way, it is equally important that policy be based on scientific evidence that has been substantially replicated and validated. In the context of concussion-related legislation, expert consensus statement may provide one way of ensuring that the evidence on which the laws are built is sufficiently valid. However, given the rapidly evolving nature of concussion research and the possible health detriments that can result from concussion, further study of the impact of head impacts on youth athletes is essential. By utilizing the EHL framework and incorporating scientific evidence, we can design concussion legislation that utilizes the most recent advances in knowledge and empirical evidence about the efficacy of existing legislation to protect the health of young athletes.

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79 Steven Shapin, Never Pure: Historical Studies of Science as if It Was Produced by People with Bodies, Situated in Time, Space, Culture, and Society, and Struggling for Credibility and Authority 48 (2010).