

# Reducing Traumatic Brain Injuries in Youth Sports: Youth Sports Traumatic Brain Injury State Laws, January 2009–December 2012

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Since the beginning of 2011, 35 US states and Washington, DC, passed legislation designed to reduce the overall impact of traumatic brain injuries (TBIs) among young athletes—bringing the total number of states that have done so since 2009 to 44 (45 including Washington, DC). Given the pace of lawmaking in this area (hereinafter “youth sports TBI laws”), it is an optimal time to compare the content of these laws with current scientific consensus regarding symptoms, impact, and treatment of youth TBIs.

There is consensus about basic TBI epidemiology, at least with respect to short-term causes and consequences. A TBI is an injury caused by a blow to the head or rapid acceleration–deceleration forces, and such an injury may lead to decreased levels of consciousness, amnesia, neurologic or neuropsychological abnormalities, or other consequences including death.<sup>1</sup> Symptoms and effects of TBIs are wide ranging, from mild headaches to memory loss and significant neurologic deficits.<sup>2</sup> There is no agreed-upon TBI diagnostic metric, and there are no uniform national TBI reporting protocols.<sup>3</sup> In athletics, individuals who suffer a TBI and resume play too soon may be at greater risk of re-injury. This re-injury could result in second-impact syndrome, which may have serious health consequences, although there is still much to learn about scope of the phenomenon and its consequences.<sup>4</sup>

Although TBIs can result from many activities, sports activities cause an estimated 20% of all TBIs among youths and young adults.<sup>5</sup> Children and young teenagers are at the greatest risk of TBIs,<sup>6</sup> and TBIs in these populations take longer to heal in part because youths’ brains are still growing and developing.<sup>7</sup> Sports activities account for an estimated 300 000 TBIs per year.<sup>8</sup> There is an upward trend in emergency room visits for TBIs across all demographics, although whether this is a result of increased awareness of TBIs or an

**Objectives.** I sought to describe current state-wide youth sports traumatic brain injury (TBI) laws and their relationship to prevailing scientific understandings of youth sports TBIs, and to facilitate further research by creating an open-source data set of current laws.

**Methods.** I used Westlaw and LexisNexis databases to create a 50-state data set of youth sports TBI laws enacted between January 2009 and December 2012. I collected and coded the text and citations of each law and developed a protocol and codebook to facilitate future research.

**Results.** Forty-four states and Washington, DC, passed youth sports TBI laws between 2009 and 2012. No state’s youth sports TBI law focuses on primary prevention. Instead, such laws focus on (1) increasing coaches’ and parents’ ability to identify and respond to TBIs and (2) reducing the immediate risk of multiple TBIs.

**Conclusions.** Existing youth sports TBI laws were not designed to reduce initial TBIs. Evaluation is required to assess their effectiveness in reducing the risk and consequences of multiple TBIs. Continued research and evaluation of existing laws will be needed to develop a more comprehensive youth TBI-reduction solution. (*Am J Public Health.* 2013;103:1249–1254. doi:10.2105/AJPH.2012.301107)

overall rise in injury rates is not certain.<sup>9</sup> No state comprehensively tracks TBI data (by state, by age, by sport),<sup>10,11</sup> and, therefore, estimates about the scope of the problem vary widely. Finally, because (as of yet) there have been no longitudinal cohort studies that evaluate long-term health outcomes by following athletes with and without TBIs over a multi-decade span, it is impossible to precisely determine the causal relationship, if any, between youth-sports injuries and subsequent early onset dementia that has been observed in former professional athletes.<sup>12</sup>

Despite uncertainty about the best approach to TBI reduction, many sport-specific strategies have been proposed to reduce TBIs in sports. These include changes in equipment, sports rules, or the times and locations in which sports are played.<sup>13</sup> Both the National Football League<sup>14</sup> and the National Hockey League have changed rules with the explicit intent of reducing TBIs.<sup>15</sup> At the collegiate level, the National Collegiate Athletic Association has partnered with the Centers for Disease Control

and Prevention (CDC) to promote TBI prevention and best practices.<sup>16</sup> In youth sports, similar efforts are underway to establish clear guidelines and recommendations for various sports.<sup>17</sup> Most recently, Pop Warner (an umbrella organization for youth football, cheer, and dance programs in 42 states) created new standards to limit contact during football practice and heighten TBI awareness among its participants.<sup>18</sup> Despite these efforts by professional, collegiate, and youth sports organizations, during recent years, state-wide legislation has become an increasingly common approach to achieving a reduction in instances of TBIs in youth populations.

The proliferation of youth sports TBI laws within the past few years had its genesis in a single galvanizing event. In 2006, Zackery Lystedt, a 13-year-old middle-school student, suffered a severe head injury during a football game after returning to play following a concussion that was not properly diagnosed.<sup>19</sup> Public attention to his injury and vigorous support for his recovery led in April 2009 to

the passage of Washington State's Zackery Lystedt Law, the first law that attempted to set general guidelines and standards involving the identification and reduction of TBIs in youth sports.<sup>20</sup> The Lystedt law was organized around 3 core elements: (1) annual education of athletes and parents, (2) the mandatory removal from play of athletes suspected of having TBIs, and (3) clearance by a designated health professional before an athlete with a TBI returned to play.

In this article, I comprehensively describe the state of youth sports TBI laws now that all but a few states have enacted such laws. I describe the specific features of youth sports TBI laws, postulate their consequences in implementation, and provide guidance, so that those interested in the ostensible goals of such laws can begin to determine whether these laws will significantly reduce youth TBIs. To facilitate future empirical evaluation of these laws, I conducted and evaluated legal research in accord with scientific principles of transparency and reproducibility,<sup>21</sup> and the data for this article is embodied in an open-source protocol, code book, and data set available on the Internet (<http://lawatlas.org/welcome>).

## METHODS

Research for this article followed the legal research methods described by Ibrahim et al.<sup>21</sup> I conducted a comprehensive survey of youth sports TBI laws enacted between 2009 and 2012. I used LexisNexis and Westlaw to search for current laws (in all 50 states and Washington, DC) that attempted to reduce the risk of TBIs in youth sports. The search terms included "concussions state law," "concussions and youth sports," "concussion guidelines," "traumatic brain injury and school sports," and "student sports concussion." To verify the search results, I made comparisons between the data that were collected and publicly available tables of state TBI laws compiled by third-party organizations. Because the research focused on identifying laws explicitly addressing youth sports TBIs after passage of the Lystedt Law, I excluded broader youth public health laws as well as laws that indirectly addressed head injuries outside the context of organized youth sports, such as seat-belt laws or bicycle helmet laws. I did not attempt to gather or analyze other competing TBI-reduction mechanisms that may have been

directly implemented by local governments, school districts, sport governing bodies, sport accrediting bodies, private youth leagues, and others.

After I collected the full text of each state's youth sports TBI law, I completed an initial review to determine and define a list of variables for which each law would be coded. Three law students coded the laws, and periodically revised the initial list of variables as more laws were enacted during 2011 and 2012. The final list of variables included dichotomous, continuous, or categorical variables, including types of sports covered, age of target population, public or private school distinctions, liability waivers, mandatory reporting, scope of athlete's removal after a suspected TBI, requirements for athlete post-TBI clearance, and mandatory education for athletes, parents, and coaches. To ensure intercoder reliability, each student coded all laws separately. Rates of divergence were minimal, and I resolved any divergence through adjudication. After the law students completed the coding, I reviewed and revised the codebook and protocol to ensure continuity and include instructions on how to collect youth sports TBI laws, how to code such laws, how to recode or create new variables, and how to conduct reliability tests when necessary. The full data set, codebook, and protocol are available at the Public Health Law Research Policy Surveillance Web Portal.<sup>22</sup>

## RESULTS

Between 2009 and 2012, 44 states (and Washington, DC) enacted 1 or more youth sports TBI laws. Six states have no youth sports TBI laws, although, at the time of this writing, the pace of legislative developments suggests that this number may change throughout 2013. The pace of legislative development has quickened since the initial 2009 legislation. Thirty-five states and Washington, DC, enacted such laws between January 1, 2011, and December 31, 2012. There are no states that have banned traditional youth sports with high TBI risks or that have set out legal regimens attempting to govern sports play by legislation or regulatory oversight.

### Scope of the Laws

Youth sports TBI laws vary little in their substance. The most common elements of such laws include a minimum 24-hour mandatory

removal from play of young athletes suspected of having a TBI, requiring assessment from a health professional before an athlete's return to play, coach training in TBIs management, yearly information sheets for parents, and exculpatory clauses waiving liability for certain parties. Key features across all such laws include a focus on secondary, not primary prevention—and a general adherence to the Lystedt framework.

The Lystedt framework features 3 prongs of secondary-level intervention: a young athlete's removal after an initial TBI, evaluation of such athlete by a designated health professional, and distribution of concussion information to key constituents. In Table 1, state laws are compared by reference to their most common elements and those of the Lystedt framework. As the results indicate, states that have passed youth sports TBI laws have conformed to a similar model with minimal policy experimentation. Each component of the Lystedt framework is further described in the next paragraphs.

*Removal from play.* Forty-one states and Washington, DC, have youth sports TBI laws that require coaches and teams to remove young athletes from play if they are suspected of having suffered a TBI, and all of those states but Wisconsin and Ohio require removal for a minimum of 24 hours. The states that have such a minimum time-length removal requirement do not substantively vary in their approach, which is based on the Lystedt framework. Accordingly, only Delaware mandates a removal time beyond 24 hours, although the accompanying health evaluation and clearance provisions in other states may effectively create a longer minimum removal provision by default.

*Evaluation and clearance to play.* Forty states and Washington, DC, have youth sports TBI laws that require a young athlete to be cleared by a third party before returning to play. All but 1 of the "removal from play" provisions are coupled with this mandatory evaluative or clearance component. Clearance must be provided by an individual who meets 1 of potentially several different "health professional" categories. These laws assign clearance responsibility by explicit descriptions of permitted health professional roles or titles, such as certified athletic trainer, health professional certified with experience in concussion management, physician, physician trained in concussion management, nurse, or neuropsychologist.

TABLE 1—Key Features of Statewide Youth Sports Traumatic Brain Injury Laws: January 2009–December 2012

State	Athlete's Removal From Play Required Following Actual or Suspected TBI		RTP Clearance Provisions		TBI Awareness Requirements			Liability			
	Must Be From an Individual Trained in TBI Management	Must Be Provided in Writing	Training for Coaches Required	Yearly Education to Parents and Athletes Required	Limits Potential Liability	Limits Liability for Schools	Limits Liability for Health Care Providers	Limits Liability for Volunteers	Requires Review and/or Updating of the Policy		
AK	X	X		X	X	X		X			
AL	X	X	X	X	X						
AR			X								
AZ	X	X		X	X	X		X			
CA	X	X		X							
CO	X	X	X								
CT	X	X	X							X	
DC	X	X		X							
DE	X	X	X								
FL	X	X	X								
HI	X	X	X								
IA	X	X		X							
ID <sup>a</sup>											
IL <sup>a</sup>											
IN	X	X		X	X	X		X			
KS	X	X		X	X			X			
KY	X	X	X		X					X	
LA	X	X	X		X	X		X			
MA	X	X	X		X	X		X			
MD	X	X		X							
ME	X	X	X		X			X			
MI	X	X	X								
MN	X	X	X		X	X					
MO	X	X	X		X					X	
NC	X	X		X							
ND	X	X	X		X						
NE	X	X		X							
NH	X	X	X		X						
NJ	X	X	X		X	X		X		X	
NM	X	X	X		X						
NV	X	X	X		X						
NY	X	X	X		X						
OH	X	X	X		X	X		X		X	
OK	X	X	X		X			X			
OR	X	X	X		X						
PA	X	X	X		X	X					
RI	X	X	X		X						

Continued



regarding the fit between these state-level legislative mandates and current public health knowledge and practice.

Most state laws establish a minimum 24-hour period of athlete removal, but there is still no scientific agreement about the optimal removal time frame for any individual who suffers a sports-related TBI. An influential study of National Collegiate Athletic Association athletes found that recovery can come as early as 24 hours and that, by 7 days later, 91% of athletes suffering TBIs had recovered.<sup>25</sup> However, it is not clear that a 24-hour minimum standard derived from observation of *college* athletes is an appropriate standard for *youth* athletes. Furthermore, in states that permit the return-to-play decision to be made by a nonphysician, the risk of premature return may be increased, although there has been no evaluation of such concerns.

State laws diverge regarding who is qualified to provide medical clearance and which metrics are appropriate for making the return-to-play decision. For example, some suggest that athletic trainers could have a conflict of interest when returning the player to the active roster would benefit the team, but whether this influences clearance decisions in practice is unknown and empirical evidence may suggest otherwise.<sup>26</sup> With respect to methods of evaluation, there is no professional consensus regarding the best standard diagnostic procedure or metric for TBIs, or the professional qualifications required to make the decision that an athlete is able to return to play. Furthermore, should such an agreed best TBI diagnostic metric or clinical best practice emerge, legislation may need to be changed to adopt it and include the appropriate professional qualifications for those who provide clearance by using such techniques. Finally, since 19 jurisdictions with such laws do not require that clearance be provided by an individual with TBI-specific training, it is unclear how those who lack TBI-specific training can be expected to provide an authoritative evaluation of when TBI symptoms have decreased enough to allow a youth athlete's safe reentry into sports activity.

Another key area of uncertainty across youth sports TBI laws involves the common educational components for parents and athletes and the less frequently required education for coaches. Although the CDC has created broad guidance, the fidelity of state and local

informational materials to CDC guidance is currently unknown. Instead, with respect to the parents' and athletes' educational components of these laws, most states have delegated this information content and distribution to a state agency or local school board. South Dakota, for example, specifies that the state's high-school athletic conference and its Department of Education "shall develop guidelines to inform and educate member schools, coaches, athletes, and the parents or guardians of athletes, of the nature and risk of concussion."<sup>27(p1)</sup> With respect to coaches, there is further divergence in the appropriate educational components and how such components should be best utilized by coaches to increase their ability to identify and prevent TBIs.

The "education" components of these laws thus present a number of important issues for implementers and researchers. First, the efficacy of education and consent in helping parents prevent, identify, and respond to TBIs in this context is unknown. Second, the content of the required education is not clearly specified in most laws—thus allowing for wide variance in implementation and standardization of such materials. Third, there is divergence between the education requirements among key stakeholders (e.g., parents vs coaches), which may produce inconsistent responses to potential TBI events. Fourth, as some training materials already exist, the value proposition for each state to create standards from scratch remains uncertain. Finally, some coaches may already receive substantial training through membership athletic associations and other nongovernment entities, but the laws do not contemplate the integration of such education into a more uniform education approach among stakeholders such as coaches, parents, athletes, and schools.

Youth sports TBI laws also differ in their approach to liability waivers. At present, there is no basis in evidence for assessing whether liability waivers positively or negatively influence the identification and management of TBIs. Two thirds of states with youth sports TBI laws do not provide liability waivers, thus leaving those that do divided regarding the various individuals and organizations that are immunized and the circumstances under which immunity attaches. This may raise legal questions; contests may involve athletes from different states or take place outside of one state's jurisdiction under a different set of liability rules.

### Uniformity and Avoidance

Finally, it is important to note that youth sports TBI laws have generally taken a 1-size-fits-all approach. There may be many reasons for this,<sup>28</sup> but, nonetheless, the laws do not incorporate scientific consensus that youth concussions vary on the basis of age, the type of sport, and whether the athlete is male or female.<sup>29</sup> In the future, there may be value in addressing organized sports risks in a more specific manner. For example, because a significant proportion of TBIs suffered by female youth student-athletes occur in soccer and cheerleading, more narrowly or finely tailored laws might direct state officials to involve soccer or cheerleading sport-specific associations in the development of TBI identification and treatment guidelines. Or, because most male youth student-athlete TBIs occur in soccer and football, such laws could address sport-specific TBI reduction techniques particular to those sports.

Youth sports TBI laws also avoid a variety of other areas of uncertainty. For example, no youth sports TBI laws attempt to directly regulate the content of sports activity—for example, banning certain types of maneuvers or prohibiting certain types of contact. No youth sports TBI laws explicitly require data collection and analysis of all youth sports TBI events—whether at the aggregate, school district, or individual level. And, although morbidity and mortality are commonly associated with all types of TBIs in children,<sup>30</sup> reforms in youth sports TBI laws do not directly address the study of morbidity and mortality with respect to youth TBIs developed outside of athletics and compare interventions for those TBIs with ones that might be appropriate in youth sports.

Therefore, youth sports TBI laws enacted to date are only part of a comprehensive youth sports TBI-prevention framework. Other interventions could include changing sports rules and culture, utilizing advanced equipment technology to absorb impact, changing player or coach incentives to ignore TBIs to win contests,<sup>31</sup> and identifying the best education programming. Each of these efforts is individually challenging, as is coordinating these changes at local, state, and national levels. The legislative response to TBIs has been rapid, but it remains a work in progress.

### Conclusions

Since 2009, 44 states and Washington, DC, have enacted youth sports TBI laws aimed at increasing awareness or preventing repeat injury

or both. The laws reflect a uniform, but not scientifically proven, consensus about the minimum time a young athlete should refrain from reentering youth sports activities, and the laws also exhibit divergence regarding what type of health professional is best qualified to make the decision that an athlete is able to return. These laws also rely on parent and coach education for TBI reduction, but the content and delivery of such education is not generally specified in the laws, is delegated to varied state agencies to implement, and has not been uniformly validated for efficacy. Despite the rapid pace of legislation, and the widespread adoption of the Lystedt approach, we are at the very beginning of the process of developing legal and nonlegal interventions to reducing TBIs in youth sports.

Going forward, interested parties must ask whether any such laws will substantially reduce TBIs in youth sports. Ideally, a range of primary and secondary prevention interventions, legal and nonlegal, would be applied in an evidence-informed and coordinated way. But there remain many questions about preventing TBIs that will have to be answered. There are economic and cultural barriers to any substantial changes in popular sports rules or techniques of play. And, legal focus on secondary or tertiary prevention may take some attention away from the harder changes entailed in preventing TBIs in the first place. If so, one may be concerned that the passage of laws described herein reduces the impetus for other, possibly more effective, interventions. This study contributes to the debate by defining the key components of state-level youth sports TBI laws and contributes to the evaluation of such laws by creating a comprehensive data set of recently enacted state provisions. As we move forward, rigorous evaluation of legal and nonlegal interventions, and comparison of the effectiveness of the various legal approaches, will help guide us toward even more effective measures. ■

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