

# The Failure of Youth Sports Concussion Laws and the Limits of Legislating Health Education

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Abstract:

Legislatures have increasingly turned to education-based strategies to address significant public health challenges, despite unclear efficacy of statutory mandated education. In this Article, we examine the recent and rapid adoption of youth sports concussion laws as a lens to explore the limits of education-based legislative intervention models. In less than 10 years, all 50 states adopted a youth sports concussion statute—and each law mandates concussion education for coaches and/or student-athletes. This expansive, expensive intervention was designed to reduce concussion incidence and improve concussion care. But based on a review of 54 peer-reviewed studies, we argue that concussion education has not, and likely will not, produce the desired public health outcomes. The data largely demonstrate that, at most, concussion education can produce short-term changes in knowledge, but that these gains are unlikely to translate into measurable behavior changes that reduce the incidence and risk of concussion in sport. The Article uses public health perspectives to explore the reasons why top-down education interventions from legislatures may fail to have their

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intended effect. Given these limitations, the Article argues for a new type of concussion education intervention that better aligns with incentives to win, focuses on primary prevention, and promotes culture change in concussion reporting.

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## INTRODUCTION

Sports-related concussion (SRC) is a high-profile public health challenge.<sup>1</sup> Concussion stories are frequently headline news on ESPN<sup>2</sup> and sports concussions are a growing concern for athletes, parents, and legislators.<sup>3</sup>

Given this interest in brain health for youth athletes, the law has responded. In 2008, no state had a youth sports concussion law. Today, all 50 states have passed such legislation.<sup>4</sup> This rapid adoption of concussion laws is indicative of the priority states have placed on addressing the risk, impact, and prevention of sports concussion.

In crafting these concussion laws, states deliberately avoided creating new civil liability, and often chose not to mandate rule changes.<sup>5</sup> Rather, the central tenet of current concussion legislation is an information-based model of concussion education. While states vary in their language and degree of intervention, each state law requires that youth sports coaches complete concussion training, and/or that concussion information be provided to athletes and parents.<sup>6</sup>

The success of these laws rests on the assumption that more and better education will result in fewer concussions and better care for concussions that do occur.<sup>7</sup> These goals are aligned with the public health principles of primary, secondary, and tertiary prevention, which recommend preventative strategies for before, during, and after an injury is sustained.<sup>8</sup> The aim is to prevent injury

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1. Douglas J. Wiebe et al., *Concussion Research: A Public Health Priority*, 17 INJ. PREVENTION 69 (2011).

2. Kevin Seifert, *NFL Concussions Continue to Rise*, ESPN (Jan. 26, 2018), [http://www.espn.com/nfl/story/\\_/id/22226487/nfl-concussions-rise-highest-level-league-began-sharing-data](http://www.espn.com/nfl/story/_/id/22226487/nfl-concussions-rise-highest-level-league-began-sharing-data).

3. Linda Flanagan, *How Students' Brains Are in Danger on the Field*, THE ATLANTIC (Aug. 14, 2017), <https://www.theatlantic.com/education/archive/2017/08/how-students-brains-are-in-danger-on-the-field/536604/>.

4. Sungwon Kim et al., *Legislative Efforts to Reduce Concussions in Youth Sports: An Analysis of State Concussion Statutes*, 27 J. LEGAL ASPECTS SPORT 162, 166 (2017); Hosea H. Harvey, *Reducing Traumatic Brain Injuries in Youth Sports: Youth Sports Traumatic Brain Injury State Laws, January 2009–December 2012*, 103 AM. J. PUBLIC HEALTH 1249, 1249 (2013).

5. Francis X. Shen, *Are Youth Sports Concussion Statutes Working?*, 56 DUQ. L. REV. 7, 10-13 (2018).

6. Kelly L. Potteiger et al., *An Examination of Concussion Legislation in the United States*, INTERNET J. ALLIED HEALTH SCI. & PRAC., Apr. 2018, at 1, 8 (2018).

7. Kerri McGowan Lowrey, *State Laws Addressing Youth Sports-Related Traumatic Brain Injury and the Future of Concussion Law and Policy*, 10 J. BUS. & TECH. L. 61, 61-64 (2015).

8. Charles H. Tator, *Concussions and Their Consequences: Current Diagnosis, Management*

before it occurs in the first place; improve early detection of an injury once it occurs; and improve management and reduce negative long-term outcomes after the injury is sustained, respectively.<sup>9</sup>

In this Article, we assess whether this assumption holds in practice through a comprehensive review of the known evidence on the relationship between concussion education interventions and outcomes.<sup>10</sup> We examine 54 studies and conclude that current concussion education programs may improve concussion knowledge in the short-term, but that without additional interventions, concussion education is unlikely to change athlete attitudes towards concussion or their behaviors during play. We further argue that to improve effectiveness, both the surrounding incentive structures and the culture of contact sports need to be fundamentally revisited.

Our findings speak directly to the on-going and high-profile debates over youth SRC, but they also have implications for public health law more generally. Federal and state governments are increasingly turning to public health education to change individual behavior.<sup>11</sup> These include campaigns to reduce smoking, increase seatbelt use, reduce texting while driving, and improve the utilization of vaccines.<sup>12</sup> Yet there is significant variation in the effectiveness of information-based public health campaigns.<sup>13</sup>

The limited effectiveness of youth sports concussion laws suggests three general lessons for legislatively mandated public health education regimes. First, reactionary rather than proactive policy development may be too focused on a single issue while missing the more foundational problems. In the context of youth SRC, the laws focus primarily on return to play after a concussion is sustained and fail to address the primary prevention of concussion. Second, additional education is unlikely to be effective when the underlying incentive structure remains designed to discourage concussion prevention and reporting. Third, top-down education initiatives may fail when a “one-size-fits-all” approach is applied. In youth SRC policy, concussion education has often failed to consider unique cultural aspects of specific sports, athlete groups, age, and gender.

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*and Prevention*, 185 CAN. MED. ASS’N J. 975, 977 Box 3 (2012).

9. *Id.*

10. See discussion *infra* Part IV.

11. Lawrence O. Gostin, *Health Promotion: Education, Persuasion, and Free Expression*, in PUBLIC HEALTH LAW AND ETHICS: A READER 335, 337-38 (Lawrence O. Gostin ed., 2002).

12. PUBLIC HEALTH COMMUNICATION: EVIDENCE FOR BEHAVIOR CHANGE (Robert C. Hornik ed., 2002).

13. Robert C. Hornik, *Public Health Communication: Making Sense of Contradictory Evidence*, in PUBLIC HEALTH COMMUNICATION: EVIDENCE FOR BEHAVIOR CHANGE 1 (Robert C. Hornik ed., 2002).

In developing a solution, we apply these lessons and suggest a path forward that aligns sport-specific and individualized incentives with concussion educational interventions; addresses primary prevention; and makes greater use of trained medical professionals.

The Article proceeds as follows. In Part I, we discuss the legislatively mandated concussion education requirements. In Part II, we present a comprehensive review of the scientific literature on the effects of concussion education on concussion reporting and incidence in youth sports. In Part III, we discuss the legal and policy implications of these findings and argue that education programs as currently designed are not likely to significantly improve concussion prevention and care. In Part IV, we discuss several potential solutions that are more likely to produce better youth sports concussion outcomes. Part V concludes.

## I. LEGISLATING CONCUSSION EDUCATION

With over 44 million youth participating in organized sports annually,<sup>14</sup> youth SRC is a significant public health concern. The Centers for Disease Control and Prevention (CDC) estimates that between 1.6 and 2.8 million SRCs occur each year in the United States, accounting for nearly 30% of total youth concussions.<sup>15</sup>

Concussion is a traumatic brain injury induced by biomechanical forces, typically resulting in short-lasting neurological impairment.<sup>16</sup> The word concussion is derived from the Latin word *concussus*, which means to shake violently.<sup>17</sup> Concussion, at present, is primarily diagnosed based on symptoms, which presents the clinician with significant diagnostic challenges.<sup>18</sup>

Improper management of concussion can result in prolonged symptoms, long-term neurological impairment, or even death.<sup>19</sup> Given the incidence of

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14. NAT'L COUNCIL OF YOUTH SPORTS, NCYS REPORT ON TRENDS AND PARTICIPATION IN ORGANIZED YOUTH SPORTS 7 (2008) available at <https://www.ncys.org/pdfs/2008/2008-ncys-market-research-report.pdf>.

15. Jameson D. Voss et al., *Update on the Epidemiology of Concussion/Mild Traumatic Brain Injury*, 19 CURRENT PAIN & HEADACHE REP. 32, 36 (2015).

16. Paul McCrory et al., *Consensus Statement on Concussion in Sport—The 5th International Conference on Concussion in Sport Held in Berlin, October 2016*, 51 BRIT. J. SPORTS MED. 838, 839 (2017).

17. Carly Rasmussen, Sydney Diekmann, Christine Egan, Tyler Johnson & Francis X. Shen, *How Dangerous are Youth Sports for the Brain? A Review of the Evidence*, 7 BERKELEY J. ENT. & SPORTS L. 67, 81 (2018).

18. Paul McCrory et al., *What is the Definition of Sports-Related Concussion: A Systematic Review*, 51 BRIT. J. SPORTS MED. 877, 877-87 (2017).

19. *Id.*

concussion in youth sports, and the severe consequences of improper management, youth sports concussion legislation aims to promote timely identification and management of concussion.

This Part describes how the 50 states have operationalized concussion education via statutory mandates. Section A describes how concussion education fits into a public health risk prevention model and Section B summarizes the current concussion legislation. Appendix Table A1 presents the precise statutory language from each state's concussion education provision.<sup>20</sup>

### *A. Concussion as a Public Health Risk*

Youth SRC laws are a public health legislative intervention.<sup>21</sup> Such interventions, like much public policy, are typically precipitated by a “focusing event.”<sup>22</sup> This may be a tragic incident that is heavily covered or sensationalized by the media.<sup>23</sup> Media coverage and citizen demand may often lead to new government regulation.<sup>24</sup> After an initial state takes the lead, policy diffusion occurs and additional states enact similar policies.<sup>25</sup>

This framework of focusing events and policy diffusion readily applies to the concussion legislation context. The recent surge in sports concussion laws can largely be attributed to high profile concussive injuries in youth sport populations, particularly the case of 13-year-old football player Zachary Lystedt. Lystedt experienced debilitating neurological symptoms after being prematurely returned to play during a football game.<sup>26</sup> In response, the state of Washington developed legislation based on a three-tenet system for concussion management

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22. See SYDNEY DIEKMANN, ET AL, APPENDIX A1. ANNOTATED SUMMARY TABLE OF STATE CONCUSSION STATUTE EDUCATIONAL MANDATES (2020), [http://www.fxshen.com/DiekmannEganRasmussenShen\\_2020\\_ConcussionEducationAppendixTableA2\\_FINAL.pdf](http://www.fxshen.com/DiekmannEganRasmussenShen_2020_ConcussionEducationAppendixTableA2_FINAL.pdf) [hereinafter DIEKMANN, ET AL, APPENDIX A1].

21. Hosea H. Harvey et al., *The Four Stages Of Youth Sports TBI Policymaking: Engagement, Enactment, Research, And Reform*, 43 J.L. MED & ETHICS 87, 87 (2015) (comparing concussion laws to legislative interventions triggered by other public health crises, including HIV/AIDS prevention and seatbelt use in automobiles).

22. Thomas A. Birkland, *Agenda Setting in Public Policy: Theory, Politics, and Methods*, in HANDBOOK OF PUBLIC POLICY ANALYSIS 63, 73-74 (Frank Fischer, Gerald J. Miller & Mara S. Sidney eds., 2007); John W. Kingdon, *AGENDAS, ALTERNATIVES, AND PUBLIC POLICIES* (1984).

23. M.R. Oakley, *Agenda Setting and State Policy Diffusion: The Effects of Media Attention, State Court Decisions, and Policy Learning on Fetal Killing Policy*, 90 SOC. SCI. Q. 164, 167 (2009).

24. *Id.*

25. Charles R. Shipan & Craig Volden, *The Mechanisms of Policy Diffusion*, 52 AM. J. POL. SCI. 840, 841-44 (2008); Charles R. Shipan & Craig Volden, *Policy Diffusion: Seven Lessons for Scholars and Practitioners*, 72 PUB. ADMIN. REV. 788, 788-93 (2012).

26. Lowrey, *supra* note 7, at 63.



that was subsequently adopted by nearly all states.<sup>27</sup>

Public health interventions generally operate at one (or more) of three levels.<sup>28</sup> “Primary prevention” interventions, such as implementing rule changes to reduce contact or reducing the number of contact practices in a season, aim to prevent an injury from being sustained in the first place.<sup>29</sup> “Secondary prevention” interventions, such as educating coaches about the signs and symptoms of concussion to allow for quicker recognition, aim to detect the injury earlier.<sup>30</sup> “Tertiary prevention” interventions, such as ensuring that a concussed athlete sees a healthcare professional after an injury, aim to reduce the severity of an injury after it has occurred.<sup>31</sup>

With several exceptions, state laws address the secondary and tertiary effects of concussion, but often do not target primary prevention.<sup>32</sup> Central to those prevention efforts is concussion education for coaches, referees, parents, and athletes.

### *B. Legislative Response*

In October of 2006, middle school football player Zachary Lystedt suffered a head injury while playing in a football game.<sup>33</sup> Despite exhibiting symptoms of concussion, including memory problems and headache, he was returned to play by his coaches following the injury. He collapsed at the end of the game.<sup>34</sup> After undergoing life-saving brain surgery to relieve intracranial pressure, Lystedt experienced debilitating neurological disability.<sup>35</sup> In response to this tragedy, the state of Washington implemented the Lystedt law, which was designed to remove concussed athletes from play and prevent return to play until after recovery has occurred.<sup>36</sup>

Beginning in 2009 with the passage of the Lystedt law, individual states passed youth sports concussion legislation to increase awareness of sport-related concussion and promote proper management and return to play.<sup>37</sup> By 2014, all 50

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27. *Id.*

28. Charles H. Tator, *Sport Concussion Education and Prevention*, 6 J. CLINICAL SPORT PSYCHOL. 293, 297 (2012).

29. *Id.*

30. *Id.*

31. *Id.*

32. Harvey et al., *supra* note 20, at 88; Lowrey, *supra* note 7, at 67.

33. Richard H. Adler & Stanley A. Herring, *Changing the Culture of Concussion: Education Meets Legislation*, 3 PM&R S468, S468 (2011).

34. *Id.* at 468.

35. *Id.*

36. *Id.* at 469-70.

37. Lowrey, *supra* note 7, at 63.

states had passed sports concussion legislation.<sup>38</sup> There is variation in the laws,<sup>39</sup> but in general, the existing state laws “are organized around three central provisions: education of athletes, parents, and coaches; immediate removal of play of concussed athletes; and medical clearance before returning to play.”<sup>40</sup>

For example, in Minnesota, schools and youth sports organizations are required to make information accessible to all participating coaches, officials, and youth athletes and their parents or guardians about the nature and risks of concussions, including the effects and risks of continuing to play after receiving a concussion, and the protocols and content, consistent with current medical knowledge from the Centers for Disease Control and Prevention.<sup>41</sup>

All coaches and officials are required “to receive initial online training and online training at least once every three calendar years . . . consistent with the . . . Concussion in Youth Sports online training program available on the Centers for Disease Control and Prevention Web site.”<sup>42</sup>

Following the “first wave” of concussion legislation, states are revisiting the issue to determine what policies work, what policies do not, and what additional reforms are needed.<sup>43</sup> Since initial passage, 22 states have amended their laws.<sup>44</sup> The “amendments generally fall into three types: (1) expanding coverage of the law (e.g., to include younger grades or recreational sports leagues), (2) tightening or clarifying existing requirements,” and (3) attempting to improve primary and secondary prevention of concussion.<sup>45</sup>

Even with these amendments, many scholars argue that the statutes are in need of further scrutiny.<sup>46</sup> Our focus here is specifically on whether the education

38. *Id.* (although states have continued to modify their laws, the education provision remains in all 50 states).

39. Kim et al., *supra* note 4, at 163-64.

40. Kerri McGowan Lowrey & Stephanie R. Morain, *State Experiences Implementing Youth Sports Concussion Laws: Challenges, Successes, and Lessons for Evaluating Impact*, 42 J.L. MED. & ETHICS 290, 291 (2014).

41. MINN. STAT. §121A.37 (2017).

42. *Id.*

43. Kerri McGowan Lowrey, *Revising the Game Plan: Primary Prevention, Early Detection, and the Future of Concussion Laws*, THE NETWORK FOR PUBLIC HEALTH LAW (Jul. 21, 2014, 2:57 PM) (“Now that many of these laws have been in effect for a few years, legislatures are revisiting them and making changes according to developments in the field.”).

44. Lowrey, *State Laws*, *supra* note 7, at 66.

45. *Id.* at 66 (footnotes omitted).

46. Hosea H. Harvey, *Refereeing the Public Health*, 14 YALE J. HEALTH POL’Y, L., & ETHICS 66, 87 (2014) (“The focus of legislative efforts on a more narrowly defined problem, following passage of the Lystedt Law was shaped, in part, by the NFL’s early and visible involvement. Given this proactive effort by an interested and influential private for-profit interest group, it is not surprising that subsequent TBI legislation in many states exhibited remarkable uniformity based on the NFL’s suggestions.”); Douglas E. Abrams, *Concussion Safety in Children’s Sports: A Central*

provision in these laws is working. As summarized in Appendix Table A1, the education provisions vary along several dimensions.<sup>47</sup> Although every state mandates education, the content of that education varies.<sup>48</sup> Nine states either mandate that information must be consistent with agency guidelines or designate specific agencies to assist with the development of such information.<sup>49</sup> Other states pass on the duty of designing a program to a third party such as a state department of health,<sup>50</sup> sport governing body,<sup>51</sup> or interscholastic activities association.<sup>52</sup>

There is also significant variation in the audience for concussion education (see Table 1). Most states require parents (48 states), athletes (47 states), and coaches (45 states) to receive information about sports concussion. However, only 10 states require that referees or officials be educated,<sup>53</sup> and only 9 states require that specific healthcare providers be educated. Even fewer states require education for medical professionals like athletic trainers (6 states) and nurses (5

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*Role for the “Power of the Permit”,* 10 J. BUS. & TECH. L. 1, 5 (2015) (arguing that “[i]n states where concussion legislation does not reach private youth sports organizations that use public facilities, local government should approve private use only by organizations that agree to adhere to the three statewide core mandates.”); Taylor Adams, *The Repercussions of Concussions in Youth Football Leagues: An Analysis of Texas’s Concussion Law and Why Reform Is Necessary*, 18 SCHOLAR: ST. MARY’S L. REV. & SOC. JUST. 285, 343 (2016); Chris Lau, *Leaders and Laggards: Tackling State Legislative Responses to the Youth Sports Concussion Epidemic*, 85 FORDHAM L. REV. 2879, 2886 (2017).

47. See DIEKMANN ET AL, APPENDIX A1, *supra* note 22.

48. Iowa, Minnesota, Oklahoma, and Pennsylvania identify which educational program should be used to educate constituents about concussion. Iowa and Minnesota specify the CDC as their educational resource, while Oklahoma and Pennsylvania utilize either the CDC or the NFHS training courses.

49. Idaho, Illinois, Louisiana, Maryland, Massachusetts, New Hampshire, Rhode Island, South Carolina, and Tennessee all fall within this category.

50. *E.g.*, LA. REV. STAT. ANN. § 40:1089.5 (2016) (“ . . . The office of public health within the Louisiana Department of Health shall promulgate and make available to all public and private middle schools, junior high schools, and high schools, private clubs, public recreation facilities, and each athletic league which sponsors youth athletic activities information which informs of the nature and risk of concussion and head injury, including the risks associated with continuing to play after a concussion or head injury.”).

51. *E.g.*, ALA. CODE § 22-11E-2 (2018) (“Each local school system and governing body of each sport or recreational organization shall develop guidelines and other pertinent information and forms to inform and educate youth athletes and their parents or guardians in their program of the nature and risk of concussion and brain injury”).

52. *E.g.*, FLA. STAT. ANN. § 1006.20 (2017) (“The FHSAA shall adopt guidelines to educate athletic coaches, officials, administrators, and student athletes and their parents of the nature and risk of concussion and head injury.”).

53. *E.g.*, MONT. CODE ANN. § 20-7-1303 (2017) (“Each coach and official participating in organized youth athletic activities shall complete the training program at least once each year.”).

states).<sup>54</sup>

Notably, the lack of provisions concerning youth sports leaves a sizeable gap in concussion education. The majority of youth participating in sports are participating in non-school sanctioned activities.<sup>55</sup> Yet there is little to no education provided for these volunteer parents, who typically run practices and games without the benefit of athletic trainers nearby.<sup>56</sup>

Given the central role that concussion education plays in these statutes, we need to carefully consider the empirical question: what do we know about the effectiveness of concussion education? We answer this question in the next Part.

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54. *E.g.*, N.Y. EDUC. LAW § 305(42) (McKinney 2017) (“requiring a course of instruction relating to recognizing the symptoms of mild traumatic brain injuries and monitoring and seeking proper medical treatment for pupils who suffer mild traumatic brain injuries. Such course of instruction shall be required to be completed on a biennial basis by all school coaches, physical education teachers, nurses and athletic trainers.”).

55. Rasmussen et al., *supra* note 17, at 80 Fig. 2.

56. *Id.* at 97-99.

**TABLE 1: ANALYZING CONCUSSION EDUCATION PROVISIONS IN STATE LEGISLATION**

✓ = Legislation requires this group to receive concussion information  
 ✗ = Legislation does NOT require this group to receive concussion information

State	<i>School-sponsored sports</i>			<i>Youth (non-school) sports</i>				<i>Medical Professionals</i>		
	Parents	Athletes	Coach	Parents	Athletes	Coach	Referees	Athletic trainers	Nurses	Physicians
AL	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗
AK	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
AZ	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
AR	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗
CA	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
CO	✗	✗	✓	✗	✗	✓	✗	✗	✗	✗
CT	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
DE	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
DC	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
FL	✓	✓	✓	✗	✗	✗	✓	✗	✗	✗
GA	✓	✓	✗	✓	✓	✗	✗	✗	✗	✗
HI	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗
ID	✓	✓	✓	✗	✗	✗	✓	✓	✗	✗
IL	✓	✓	✓	✗	✗	✗	✓	✓	✓	✓
IN	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
IA	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
KS	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
KY	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
LA	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗
ME	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
MD	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
MA	✓	✓	✓	✗	✗	✗	✗	✗	✓	✓
MI	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗

MN	✓	✓	✓	✓	✓	✓	✓	x	x	x
MS	✓	x	x	x	x	x	x	x	x	x
MO	✓	✓	✓	x	x	x	x	x	x	x
MT	✓	✓	✓	✓	✓	✓	✓	x	x	x
NE	✓	✓	✓	✓	✓	✓	x	x	x	x
NV	✓	✓	x	x	x	x	x	x	x	x
NH	✓	✓	✓	x	x	x	x	x	x	x
NJ	✓	✓	✓	x	x	x	x	✓	x	✓
NM	✓	✓	✓	✓	✓	✓	x	x	x	x
NY	✓	✓	✓	x	x	x	x	✓	✓	x
NC	✓	✓	✓	x	x	x	x	x	✓	x
ND	✓	✓	x	x	x	x	x	x	x	x
OH	✓	✓	✓	x	x	x	✓	x	x	x
OK	✓	✓	✓	✓	✓	✓	✓	x	x	x
OR	x	x	✓	x	x	x	x	x	x	x
PA	✓	✓	✓	x	x	x	x	x	x	x
RI	✓	✓	✓	x	x	x	x	x	✓	x
SC	✓	✓	✓	x	x	x	x	x	x	x
SD	✓	✓	✓	x	x	x	x	x	x	x
TN	✓	✓	✓	✓	✓	✓	x	x	x	x
TX	✓	✓	✓	x	x	x	x	✓	x	✓
UT	✓	✓	✓	✓	✓	✓	x	x	x	x
VT	✓	✓	✓	x	x	x	✓	x	x	x
VA	✓	✓	✓	x	x	x	x	x	x	x
WA	✓	✓	✓	x	x	x	x	x	x	x
WV	✓	✓	✓	x	x	x	x	x	x	x
WI	✓	✓	✓	✓	✓	✓	x	x	x	x
WY	✓	✓	✓	x	x	x	x	✓	x	x

Table 1 presents a state-by-state comparison of which stakeholder groups are legislatively mandated to receive concussion information. Coaches, athletes, and parents in school-sanctioned sports are most commonly targeted, while youth (non-school) populations generally are not. Data for this table was collected through September 1, 2018. For citations and text of state statutes, see Appendix Table A1.

## II. THE EFFECTIVENESS OF CONCUSSION EDUCATION: A COMPREHENSIVE REVIEW

The success of SRC legislation reviewed in Part I rests upon the assumption that legislatively-mandated concussion education will improve health outcomes. In this Part, we present a comprehensive examination of the published research literature to evaluate what is known about the effects of concussion education and training interventions.

We arrive at three central conclusions. First, there is mixed evidence connecting concussion education to a reduction in concussion incidence. Second, there is little evidence suggesting that concussion education will produce lasting changes in relevant behaviors, such as athlete reporting of suspected concussions. Third, there is limited evidence suggesting that concussion education will change concussion attitudes, but much evidence that concussion education can improve short-term knowledge about concussion. Taken together, the research literature suggests that—as currently implemented—legislatively-mandated concussion education is failing to achieve its desired public health goals.

Section A describes in detail the methods we used to search the research literature and identify studies for inclusion in our review. Section B summarizes research on the links between education interventions and actual incidence of concussion. Section C examines the relationship between education and other relevant concussion behavior, such as how long athletes were held out before returning to play. Section D reviews the effect of concussion education on concussion attitudes and concussion knowledge. Appendix Table A2 provides a detailed summary of each of the 54 studies reviewed.<sup>57</sup>

### *A. Identifying Relevant Studies on the Effect of*

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57. See SYDNEY DIEKMANN, ET AL, APPENDIX A2. ANNOTATED SUMMARY TABLE OF RESEARCH STUDIES ON CONCUSSION EDUCATION INTERVENTIONS (2020), [http://www.fxshen.com/DiekmannEganRasmussenShen\\_2020\\_ConcussionEducationAppendixTableA2\\_FINAL.pdf](http://www.fxshen.com/DiekmannEganRasmussenShen_2020_ConcussionEducationAppendixTableA2_FINAL.pdf).

*Concussion Education*

To identify relevant studies for inclusion in the review, we focused on research that answered either of two questions: (1) What is the relationship between concussion education interventions and the incidence of SRCs?; and (2) what are the demonstrated relationships between sports concussion education and outcomes such as concussion knowledge, concussion attitudes, and concussion-related behaviors?

Our search included publications through June 30, 2018. Our inclusion criteria for the review were as follows: (1) article was a peer-reviewed original research article; (2) article was available in English; (3) research was specific to SRC, at any age level and however it was defined in the article; and (4) study involved concussion education and/or a concussion training intervention.

To search for articles, we utilized the online databases Ovid Medline, EMBASE, PsycINFO, SPORT Discus, CINAHL, Web of Science, PubMed, and Cochrane Library. The specific search strategy used was: (concuss\* OR “brain injur\*”) AND (sport\* OR coach\* OR athlete\* OR “student-athlete\*”) AND (educat\* OR train\*), in addition to other related keywords or subject headings specific to each database. This search strategy was used to address the inclusion criteria and was based on strategies used by previous reviews on a similar topic.<sup>58</sup>

Titles, abstracts, and full texts of relevant articles were reviewed to determine if the article met the inclusion criteria.<sup>59</sup> The references of relevant articles and review articles were also examined to determine additional articles not identified by the search strategy. In total, fifty-four articles were identified that met the inclusion criteria.<sup>60</sup>

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58. Jeffrey G. Caron et al., *An Examination of Concussion Education Programmes: A Scoping Review Methodology*, 21 *INJ. PREVENTION* 301, 302 (2015); Michael R. Fraas & Jessica Burchiel, *A Systematic Review of Education Programmes to Prevent Concussion in Rugby Union*, 16 *EUR. J. SPORT SCI.* 1212, 1213 (2016); Martin Mrazik et al., *A Qualitative Review of Sports Concussion Education: Prime Time for Evidence-Based Knowledge Translation*, 49 *BRIT. J. SPORTS MED.* 1547, 1548 (2015); Christine F. Provvienza & Karen M. Johnston, *Knowledge Transfer Principles as Applied to Sport Concussion Education*, 43 *BRIT. J. SPORTS MED.* 68, 68 (2009); Sam Gleadhill et al., *Engagement by Education for Action: Recommendations for Educational Interventions to Prevent Concussion in Sport*, 3 *J. FITNESS RES.* 8, 12 (2014).

59. The search strategy produced 3,814 unique results.

60. Studies were excluded if they involved an intervention not specific to concussion prevention or if they studied a population not in a sports setting. See, e.g., Edward A. Neuwelt et al., *Oregon Head and Spinal Cord Injury Prevention Program and Evaluation*, 24 *NEUROSURGERY* 453 (1989); Alice E. Avolio et al., *Evaluation of a Program to Prevent Head and Spinal Cord Injuries: A Comparison Between Middle School and High School*, 31 *NEUROSURGERY* 557 (1992); Sara P. Chrisman et al., *Physician Concussion Knowledge and the Effect of Mailing the CDC’s “Heads Up” Toolkit*, 50 *CLINICAL PEDIATRICS* 1031 (2011); Karen A. McLaughlin et al., *Web-Based Training in Family Advocacy*, 28 *J. HEAD TRAUMA REHABILITATION* 341 (2013); Geoffrey L.



Studies varied in the quality of their research design and data. For instance, randomized controlled trials (RCTs)<sup>61</sup> are often considered to be the “gold standard” of experimental design because they allow for causal inferences to be made.<sup>62</sup> However, well-designed observational studies, such as those that include a case-control design, can also produce meaningful and comparable results.<sup>63</sup> Thus, for the purposes of this review, we include both RCT and non-RCT studies.<sup>64</sup>

Most of the studies we review employed one of two research designs. Within-subject studies evaluated subject knowledge/behavior before and after the concussion education intervention. Between-subject studies compared subject knowledge/behavior between the concussion education treatment and control groups. With regard to the particular educational intervention, a large variety of concussion education modalities have been deployed.<sup>65</sup>

Concussion education is often provided through an online training course. For example, the CDC *Heads Up* Initiative consists of a series of free, 30–45-minute educational videos targeted towards different groups, including coaches, athletes, parents, officials, and healthcare providers.<sup>66</sup> These trainings consist of several modules designed to educate groups about the nature and risks of concussion, recognizing concussion symptoms, implementing safe return-to-play and return-to-school policies, and preventative efforts. These online education modules typically include a pre- and post-training knowledge assessment and provide a certificate of training completion.

However, there are many other modalities of concussion education on the market. Concussion education programs currently being used include:

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Heyer et al., *High School Principals' Resources, Knowledge, and Practices Regarding the Returning Student with Concussion*, 166 J. PEDIATRICS 594 (2015); David Salisbury et al., *Concussion Knowledge Among Rehabilitation Staff*, 30 BAYLOR U. MED. CTR. PROC. 33 (2017).

61. Randomized controlled trials are experiments in which participants are randomly assigned to either experimental or control groups, and conditional differences between these groups are (ideally) limited to the dependent variable (in this case, the educational intervention).

62. John Concato et al., *Randomized, Controlled Trials, Observational Studies, and the Hierarchy of Research Designs*, 342 NEW ENG. J. MED. 1887, 1892 (2000).

63. *Id.* at 1890.

64. In our discussion section we recognize the limitations of some study designs.

65. See, e.g., Ellen K. Payne et al., *Investigation of the Concussion Goggle™ Education Program with Secondary School Athletic Team: A Pilot Study*, J. SPORTS MED. & ALLIED HEALTH SCI.: OFFICIAL J. OHIO ATHLETIC TRAINERS ASS'N 1, 3 (2017). This group created “concussion goggles” which replicate symptoms of concussion when worn. The Concussion Goggles™ were used as part of a larger 60-minute presentation based on concussion education materials provided by the CDC *Heads Up* program. However, a study of high school student-athletes found no improvement in concussion knowledge following the presentation.

66. *HEADS UP to Youth Sports*, CENTERS FOR DISEASE CONTROL AND PREVENTION, <https://www.cdc.gov/headsup/youthsports/index.html> (last updated Mar. 5, 2019).

- Government-developed educational materials, such as those provided by the CDC *Heads Up* Initiative<sup>67</sup>
- Organization- or institution-developed educational programs<sup>68</sup>
- Sport governing-body education programs, such as those utilized by USA Football<sup>69</sup>
- Online education modules<sup>70</sup>
- Videos<sup>71</sup>
- In-person lectures or presentations<sup>72</sup>
- Handouts and informational sheets
- Video games with concussion education content<sup>73</sup>

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67. See, e.g., Jane Mitchko et al., *CDC's Approach to Educating Coaches About Sports-Related Concussion*, 38 AM. J. HEALTH EDUC. 99 (2007); Jessica Sarmiento et al., *Evaluation of the Centers for Disease Control and Prevention's Concussion Initiative for High School Coaches: 'Heads Up: Concussion in High School Sports'*, 80 J. SCHOOL HEALTH 112, 113-14 (2010); Tracey Covassin et al., *Educating Coaches About Concussion in Sports: Evaluation of the CDC's "Heads Up: Concussion in Youth Sports" Initiative*, 82 J. SCHOOL HEALTH 233, 234 (2012).

68. See, e.g., Alexander F. Bagley et al., *Effectiveness of the SLICE Program for Youth Concussion Education*, 22 CLINICAL J. SPORT MED. 385, 386 (2012); Gillian Hotz et al., *The Challenges of Providing Concussion Education to High School Football Players*, 2 CURRENT RES: CONCUSSION 103, 104 (2015); Erin M. Parker et al., *Reach and Knowledge Change Among Coaches and Other Participants of the Online Course: "Concussion in Sports: What You Need to Know"*, 30 J. HEAD TRAUMA REHABILITATION 198, 199 (2015).

69. See, e.g., Zachary Y. Kerr et al., *Comprehensive Coach Education Reduces Head Impact Exposure in American Youth Football*, 3 ORTHOPAEDIC J. SPORTS MED, Oct. 15, 2015 at 1, 3-4.

70. See, e.g., Ann E. Glang et al., *The Effectiveness of a Web-Based Resource in Improving Post-Concussion Management in High Schools*, 56 J. ADOLESCENT HEALTH 91, 93 (2015); Quincy Conley & Willi Savenye, *Brainbook: An Impact Study of a Statewide Concussion Awareness Training for High School Athletes*, 56 PERFORMANCE IMPROVEMENT, 28, 29 (2017).

71. See, e.g., D. J. Cook et al., *Evaluation of the Thinkfirst Canada, Smart Hockey, Brain and Spinal Cord Injury Prevention Video*, 9 INJ. PREVENTION 361, 362 (2003); Michael D. Cusimano et al., *Effectiveness of an Educational Video on Concussion Knowledge in Minor League Hockey Players: A Cluster Randomised Controlled Trial*, 48 BRIT. J. SPORTS MED. 141, 142 (2014); Ann Glang et al., *Online Training in Sports Concussion for Youth Sports Coaches*, 5 INT'L J. SPORTS SCI. & COACHING 1, 2 (2010); Tamerah N. Hunt, *Video Educational Intervention Improves Reporting of Concussion and Symptom Recognition*, 10 ATHLETIC TRAINING EDUC. J. 65, 66 (2015).

72. See, e.g., Matthew E. Eagles et al., *The Impact of a Concussion-U Educational Program on Knowledge of and Attitudes About Concussion*, 43 CAN. J. NEUROLOGICAL SCI. 659, 660 (2016); Emily Kroshus et al., *NCAA Concussion Education in Ice Hockey: An Ineffective Mandate*, 48 BRIT. J. SPORTS MED. 135, 137-38 (2014); Brad G. Kurowski, et al., *Impact of Preseason Concussion Education on Knowledge, Attitudes, and Behaviors of High School Athletes*, 79 J. TRAUMA & ACUTE CARE SURGERY S21, S23 (2015); Nancy J. Manasse-Cohick & Kathy L. Shapley, *Concussion Education for High School Football Players: A Pilot Study*, 35 COMM. DISORDERS Q. 182, 183 (2014).

73. See, e.g., Jill Daugherty et al., *A Description and Evaluation of the Concussion Education Application HEADS UP Rocket Blades*, 20 HEALTH PROMOTION PRAC. 22, 26-28 (2018) (thirteen children played the gaming application called HEADS UP Rocket Blades while their parents

The great variety of education programs speaks to the urgency with which policymakers have attempted to address the challenge of sports related concussion. However, whether or not these interventions actually work is the question we now tackle.

*B. Effects of Concussion Education on Concussion Incidence in Sports*

Of the fifty-four articles included for review, five studies evaluated the effect of concussion education on concussion incidence. The results are mixed and suggest that the success of concussion education is contingent on additional factors beyond the educational components. While two studies (with smaller sample sizes) indicate that concussion education may reduce incidence,<sup>74</sup> results from larger case-control study designs<sup>75</sup> and a RCT suggest that educational interventions have no effect on concussion incidence.<sup>76</sup> While some of these studies feature larger sample sizes and/or a controlled experimental setting, the overall lack of thorough empirical investigation presents a significant gap in our understanding of the relationship between concussion education and its related outcomes. Given the importance of reducing concussion incidence as a first step in bottlenecking the downstream issues of improper concussion management that education attempts to address, additional study of this topic is warranted.

A study published in 2015 examined the relationship between exposure to the education program *Brain 101: The Concussion Playbook* and concussion incidence in high school athletes from high schools in Oregon.<sup>77</sup> The study encompassed twenty-five high schools: thirteen high schools were randomly assigned to receive the *Brain 101* treatment. In these thirteen schools, student-athletes and their parents viewed the *Brain 101* website materials, and athletic directors and principals in these high schools were asked to implement

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watched them play the game; a parent survey indicated that the application was a good learning tool and that the application presented concussion information in an easily understood way and a similar survey of children indicated that most correctly identified all of the learning objectives outlined by the application creators); David Goodman et al., *Video Gaming Promotes Concussion Knowledge Acquisition in Youth Hockey Players*, 29 J. ADOLESCENCE 351, 352-53, 355 (2006) (130 youth hockey players completed the computer game *Symptom Shock*, which involves matching concussion symptoms; those who played the game identified significantly more symptoms in a faster time span).

74. Simon Gianotti & Patria A. Hume, *Concussion Sideline Management Intervention for Rugby Union Leads to Reduced Concussion Claims*, 22 NEUROREHABILITATION 181, 183 (2007); Kerr et al., *supra* note 69, at 3-4.

75. Kerr et al., *supra* note 69, at 1-2; Kurowski et al., *supra* note 72, at S22-24.

76. Glang et al., *supra* note 70, at 94.

77. *Id.* at 92-93.

prevention policies recommended by *Brain 101*.<sup>78</sup> By contrast, twelve different high schools were randomly assigned to the control group, which viewed teen driving safety materials or teen job safety materials (unrelated to concussion) from the CDC.<sup>79</sup>

Athletic trainers at all twenty-five schools recorded the number of concussions that occurred in the fall sports season. Comparing the treatment and control groups, statistical analysis did not indicate a significant difference in the concussion incidence rate. This suggests that targeted education programs such as *Brain 101* do not reduce concussion incidence.<sup>80</sup>

Additional studies have examined whether concussion education, as compared to no education, would reduce concussion incidence. In 2015 in Ohio, researchers randomly assigned student-athletes in one high school to receive a concussion education lecture from the researcher at the beginning of their sport season.<sup>81</sup> Student-athletes in a different high school did not receive any form of concussion education.<sup>82</sup> At the end of the sport season, student-athletes from both schools self-reported the concussive symptoms they experienced during the season.<sup>83</sup> The percentage of student-athletes that self-reported concussion symptoms and the percentage of student-athletes that received a concussion diagnosis from a healthcare professional were not significantly different between the intervention and control groups.<sup>84</sup>

Another 2015 study examined the effectiveness of USA Football's *Heads Up Football* program and found little evidence of education effectiveness. *Heads Up Football* provides concussion education to youth football coaches.<sup>85</sup> Youth football leagues can choose whether to participate in the *Heads Up Football* program: in this study, the researchers compared outcomes from those leagues that utilized *Heads Up*, against leagues that did not use *Heads Up*.<sup>86</sup>

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78. *Id.* at 92-93 (these policies include starting a concussion management team, developing a concussion management policy, and offering support and accommodation for student athletes as they return to academics).

79. *Id.*

80. *Id.* at 94.

81. Brad G. Kurowski et al., *Impact of Preseason Concussion Education on Knowledge, Attitudes, and Behaviors of High School Athletes*, 79 J. TRAUMA & ACUTE CARE SURGERY S21, S22-23 (2015). Kurowski et al., *supra* note 71.

82. *Id.*

83. *Id.* at S23-24.

84. *Id.* at S24.

85. Kerr et al., *supra* note 69.

86. *Id.* at 2. Because some leagues became affiliated with Pop Warner football, a youth football organization that restricts player-to-player contact during practice and could thus affect concussion incidence, researchers further divided teams into those participating in both USA Football's *Heads Up Football* program and Pop Warner Football; those participating in only *Heads*

Athletic trainers attended the practices and games of all 100 teams participating in the study during one season to document concussion incidence.<sup>87</sup> There were no significant differences in concussion injury rates during games or practices between the teams that only used the *Heads Up Football* program, as compared with those that did not.<sup>88</sup>

However, teams that used *Heads Up*—and that were affiliated with Pop Warner Football (whose rules restrict contact)—produced significantly lower concussion rates than the teams that solely participated in the *Heads Up Football* program.<sup>89</sup> These results suggest that *Heads Up* may help reduce concussion incidence, but that it is more likely that institutional rule changes aimed to reduce player-to-player contact are the drivers of lower concussion incidence.<sup>90</sup>

There are, to be sure, mixed findings. A different study of *Heads Up Football* found positive benefits of coach education.<sup>91</sup> Comparing eight teams that did not participate in *Heads Up* with seven teams that did, the study found that there were six concussions reported in athletes playing in the group that did not participate in *Heads Up Football*.<sup>92</sup> There were no reported concussions in the group using *Heads Up*.<sup>93</sup> While suggestive of the positive effects of *Heads Up*, the small sample size limits the generalizability of these results.

Internationally, a concussion education program in New Zealand that distributed Sideline Concussion Check cards to coaches was found to be effective at preventing concussions.<sup>94</sup> There was a 10.7% decrease in the number of concussions incurred in rugby from before the implementation of the cards to after.<sup>95</sup> Additionally, other sports that implemented the Sideline Concussion Check cards saw decreases in the number of concussions following the cards' distribution while sports without the cards saw increases in the number of

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*Up Football*; and those not participating in either program. *Id.* at 2-3.

87. *Id.* at 3.

88. *Id.* at 4.

89. *Id.* at 4-5.

90. *Id.* at 7 (“We speculate that the HUF + PW group may have been more effective due to the PW practice contact restriction guidelines that specifically limited how much player-to-player contact time could occur.”)

91. Zachary Y. Kerr et al., *Comprehensive Coach Education Reduces Head Impact Exposure in American Youth Football*, 3(10) ORTHOPAEDIC J. SPORTS MED, Oct. 15, 2015, at 2.

92. *Id.* at 3.

93. *Id.*

94. Simon Gianotti & Patria A. Hume, *Concussion Sideline Management Intervention for Rugby Union Leads to Reduced Concussion Claims*, 22 NEUROREHABILITATION 181, 183, 185 (2007) (Sideline Concussion Check cards provide information to coaches about how to manage a suspected concussion, including advice to seek medical help and return-to-play guidelines).

95. *Id.* at 185.

concussions across the same time period.<sup>96</sup> Thus, the Sideline Concussion Check cards may be an effective intervention.<sup>97</sup>

Taken together, these results show that the success of education interventions on concussion incidence is likely contingent on the implementation of additional interventions such as changing contact rules and sideline protocols.

*C. Effects of Concussion Education on Coach and Athlete Behavior*

In addition to reducing concussion incidence, concussion education is intended to change coach and athlete behavior.<sup>98</sup> For instance, with better concussion education, coaches might spot more concussion symptoms or modify their practice regimens,<sup>99</sup> and players might be more likely to report concussion symptoms.<sup>100</sup> As with the studies of concussion incidence, the evidence is mixed regarding the relationship between concussion education and resulting changes in behavior.

Of the fifty-four studies included for review, four studies concluded that concussion education resulted in a positive change in athlete and/or coach behavior. These studies found that concussion education programs may encourage athletes and coaches to engage in safer gameplay,<sup>101</sup> improve athlete

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96. *Id.*

97. *Id.* at 186-88.

98. Emily Kroshus, et al., *Concussion Reporting Intention: A Valuable Metric for Predicting Reporting Behavior and Evaluating Concussion Education*, 25 *CLINICAL J. SPORTS MED.* 243, 243 (2015).

99. Sarmiento et al., *supra* note 67, *Evaluation of the Centers for Disease Control and Prevention's Concussion Initiative for High School Coaches: "Heads Up: Concussion in High School Sports"*, 80 *J. SCHOOL HEALTH* 112, 115-16 ("More than one third of survey respondents (38%) reported making changes in how they prevented or managed concussions after using the tool kit.").

100. Charles H. Tator, *Sport Concussion Education and Prevention*, 6 *J. CLINICAL SPORT PSYCHOL.* 293, 296 (2012) ("It is possible that mandatory education will lead to a reduction in the incidence of concussions and improved compliance with reporting and management, thus preventing brain deterioration in both the short and long term.").

101. Simon M. Gianotti et al., *Evaluation of RugbySmart: A Rugby Union Community Injury Prevention Programme*, 12 *J. SCI. & MED. SPORT* 371, 374. Researchers found that educating coaches was associated with a significant increase in the percentage of players who self-reported the use of safer tackle and gameplay techniques after the program's implementation. Zachary Y. Kerr et al., *Comprehensive Coach Education Reduces Head Impact Exposure in American Youth Football*, 3(10) *ORTHOPAEDIC J. SPORTS MED.*, Oct. 15, 2015, at 2-3. USA Football's *Heads Up Football* program educates coaches on safe tackling techniques, strategies to reduce player contact, and concussion awareness. Researchers placed accelerometers in athlete helmets to measure impact intensity during practices and games. They found that players on teams participating in the *Heads Up Football* program experienced significantly fewer moderate- and high-level head impacts in

reporting of concussion symptoms,<sup>102</sup> and make safer decisions regarding removal from play after a suspected concussion.<sup>103</sup>

It must be recognized, however, that the studies leave many questions unanswered. For instance, cultural differences, for instance between rugby culture in New Zealand and American football culture in the United States may mediate the effect of concussion education.<sup>104</sup> A culture of high-stakes competition may limit the effects of concussion education on decision-making and behavior.<sup>105</sup>

To be sure, some studies regarding specific interventions come to conclusions that are less clear-cut, and the mixed results of these interventions are well illustrated by two different studies that evaluated the same intervention: ThinkFirst Canada's *Smart Hockey* video.<sup>106</sup> During the middle of the season, youth hockey players were randomly assigned to view either the concussion video or a control video. The athletes exposed to the concussion video showed significant improvements in concussion knowledge both immediately following the video and three months later.<sup>107</sup> This study was unique in that penalties were recorded by a researcher throughout the entire season.<sup>108</sup> Concussion education produced significantly fewer cross-checking and checking-from-behind penalties.<sup>109</sup> Since these types of penalties present a high risk of injury,<sup>110</sup> their

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practice, as measured by the accelerometer, than players on teams not participating in the *Heads Up Football* program. However, no difference in number of head impacts was seen during games.

102. Theresa L. Miyashita, et al., *The Impact of an Educational Intervention on College Athletes' Knowledge of Concussions*, 23 *CLINICAL J. SPORT MED.* 349, 350-51 (2013). In a study of fifty college soccer and basketball players, six athletes reported receiving a concussion during the season, and 50% of those athletes stated that the concussion education presentation impacted their timely reporting of their concussion and how they managed their concussion.

103. Brad G. Kurowski et al., *Impact of Preseason Concussion Education on Knowledge, Attitudes, and Behaviors of High School Athletes*, 79 *J. TRAUMA & ACUTE CARE SURGERY* S21, S24 (2015). In a study of high school athletes in Ohio, among athletes who reported having concussion symptoms during the season, significantly fewer athletes who received the presentation reported returning to play compared to athletes who did not receive the presentation. However, among athletes who were diagnosed with a concussion by a medical professional, there was no difference in the number of athletes reporting they returned to play while still having symptoms between those who had received the presentation and those who had not. Furthermore, the presentation did not affect concussion reporting or diagnosis.

104. See discussion *infra* Part III, discussing a New Zealand study in which rugby players self-reported using safer play techniques after the implementation of RugbySmart.

105. See Kerr et al., *American Youth Football*, *supra* note 102, at 4-5.

106. D. J. Cook et al., *supra* note 71, at 361-62.

107. *Id.* at 363.

108. *Id.* at 362 (showing the video mid-season allowed for longitudinal comparison in penalties pre- and post-intervention).

109. *Id.* at 363.

110. *Id.* at 363-64.

decline suggests that the *Smart Hockey* video may be effective in reducing risky concussion-promoting behaviors.

While these results are promising, a RCT study of the *Smart Hockey* video came to different conclusions.<sup>111</sup> Utilizing a similar design, ten- and fourteen-year-old youth hockey players were randomly assigned to view the video or to discuss injuries in hockey with the researcher.<sup>112</sup> There was no change in concussion attitudes or self-reported concussion-related behaviors for either group across time points.<sup>113</sup>

Finally, of the fifty-four studies included for review, six studies found no effects of concussion education on stakeholder behavior. These studies demonstrate that concussion education has no effect on identification of concussion symptoms<sup>114</sup> and athlete reporting of concussion symptoms.<sup>115</sup> There is also evidence that concussion education has little effect on concussion management and return to play. A study of 1,004 parents and 4,804 athletes from 25 Oregon high schools found that the *Brain 101* program did not affect return-to-play outcomes.<sup>116</sup> Among athletes who had received a concussion, there were no differences between the *Brain 101* schools and the control school in the average time for the athlete to return to play, the average time for the athlete to return to school, whether the athlete saw a healthcare professional, or whether the athlete received special accommodations at school.<sup>117</sup> Thus, the *Brain 101* program may result in knowledge gains but fails to change how concussion is

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111. Cusimano et al., *supra* note 71.

112. *Id.* at 142-43.

113. *Id.* at 145 (concussion knowledge increased immediately, then returned to baseline within two months; however, fourteen-year-olds retained their knowledge after two months while the younger cohort did not).

114. Janie Courmoyer & Brady L. Tripp, *Concussion Knowledge in High School Football Players*, 49 J. ATHLETIC TRAINING 654, 656 (2014) (finding that concussion education for high school athletes was not associated with greater concussion symptom identification or improved recognition of long-term consequences of concussion; Frederick P. Rivara et al., *The Effect of Coach Education on Reporting of Concussions Among High School Athletes After Passage of a Concussion Law*, 42 AM. J. SPORTS MED. 1197, 1200, (2014) (finding that coach education did not affect whether or not coaches identify concussion symptoms in their athletes, although some educational modalities were more effective in improving awareness of symptoms than others).

115. Daniel M. Torres et al., *Sports-Related Concussion: Anonymous Survey of a Collegiate Cohort*, 3 NEUROLOGY: CLINICAL PRAC. 279, 282-83 (2013). A study of 262 collegiate athletes found that while 71% of athletes reported being formally educated about concussion, their intent to report symptoms remained low: 43% of athletes with a history of concussion reported that they had intentionally hidden concussion symptoms to remain in play, and 22% of athletes also reported that they were unlikely to disclose concussion symptoms to their coach or athletic trainer in the future.

116. Glang et al., *Web-Based Resource*, *supra* note 70, at 92-94.

117. *Id.* at 94.



managed by school staff, including coaches.<sup>118</sup> Other studies have come to similar conclusions that concussion education did not result in better concussion management behaviors, such as removal from play after a suspected concussion<sup>119</sup> and receiving follow-up medical care.<sup>120</sup>

*D. Effects of Concussion Education on Coach and Athlete Attitudes and Knowledge*

The majority of the studies in our review examined only self-reported attitudes toward and knowledge about SRC. This is understandable given the practical constraints of measuring behavioral outcomes. It is easier to solicit a response on a survey (e.g. “Do you think you would be more likely to report a concussion?”) than it is to track concussion reporting over a full season. Given this methodological limitation, and our primary interest in behavioral rather than attitudinal change, we must proceed cautiously in assessing the literature on these attitudinal outcomes. Similarly, when evaluating studies of concussion knowledge, it is important to remember that we do not know (from the studies reviewed below) whether improved short-term knowledge of concussion leads to improved concussion care in the sports setting.

*1. Effect on Coach Attitudes and Knowledge*

Of the fifty-four articles included for review, nine studies evaluated the effect of concussion education on coaches’ knowledge and attitudes.<sup>121</sup> The results of these coaches’ studies are generally mixed. On one hand, concussion education programs may be helpful in promoting greater knowledge of concussion symptoms, in addition to increasing expressed intention to take appropriate action in managing concussion. On the other hand, it is unclear whether coach education will result in better concussion recognition or management protocols.

One study, which evaluated the efficacy of the *ACTive: Athletic Concussion*

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118. *Id.* at 94-95.

119. Tracy McDonald et al., *Underreporting of Concussions and Concussion-like Symptoms in Female High School Athletes*, 23 J. TRAUMA NURSING 241, 243-44 (2016).

120. McDonald et al., *supra* note 117, at 243-44; Miriam Carroll-Alfano, *Mandated High-School Concussion Education and Collegiate Athletes’ Understanding of Concussion*, 52 J. ATHLETIC TRAINING 689, 691-93 (2017).

121. In addition, one study has evaluated the effect of a concussion education intervention on sports medicine physicians. See Sara P. Chrisman, Melissa A. Schiff & Frederick P. Rivara, *Physician Concussion Knowledge and the Effect of Mailing the CDC’s “Heads Up” Toolkit*, 50 CLINICAL PEDIATRICS 1031 (2011) (finding that physicians provided with concussion education were significantly less likely to recommend that a concussed athlete return to play the next day).

*Training* using a RCT study design, found that coaches in the *ACTive* group had greater improvement in general concussion knowledge, knowledge of concussion symptoms and misconceptions, confidence in taking the appropriate action when faced with a suspected concussion, and the intention to take the appropriate action compared to coaches who did not do the *ACTive* training.<sup>122</sup> While these results suggest that the *ACTive* training program was effective in improving knowledge about concussions in youth coaches, it remains unclear if this change in short-term knowledge produced lasting changes in concussion prevention and care.<sup>123</sup>

The most commonly studied concussion education program for coaches is the CDC *Heads Up* intervention, which was made available in September 2015 by the CDC following extensive internal development.<sup>124</sup> The final product was a series of educational toolkits and programs tailored to different target audiences, including high school coaches, youth coaches, and health care professionals.<sup>125</sup> Several studies have evaluated the effectiveness of the toolkit by surveying coaches about how they use the program. Studies that assessed the kit prior to its release found that while coaches found the kit easy to use<sup>126</sup> and learned something from the program,<sup>127</sup> most coaches reported only using it for educational purposes, and significantly fewer coaches reported that the program changed their concussion protocols.<sup>128</sup> While the results of these self-report survey studies are encouraging, because they are self-reported without objective verification of subsequent behavioral change, we do not know the actual impact of the CDC *Heads Up* materials.

Other studies have found that concussion education improves coach concussion knowledge<sup>129</sup> and the ability to recognize concussion symptoms and

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122. Glang et al., *supra* note 70, at 4-6.

123. *Id.* at 7-8.

124. The preliminary CDC *Heads Up* toolkit included multimedia educational materials for coaches, athletes, and parents. During the development of the toolkit, focus groups indicated its potential usefulness, citing an increased awareness and knowledge of concussion and the intent to implement the toolkit's recommendations. See Mitchko et al., *supra* note 67, at 105.

125. Sarmiento et al., *supra* note 67, at 113-14. In the self-report survey, 34% of coaches reported that they learned something from the toolkit, 125. 38% reported that they changed their concussion protocols and practices, 125. and 68% reported that they educated others about concussions after reviewing the toolkit. *Id.*

126. Richard J. Sawyer et al., *High School Coaches' Assessments, Intentions to Use, and Use of a Concussion Prevention Toolkit: Centers for Disease Control and Prevention's Heads Up: Concussion in High School Sports*, 11 HEALTH PROMOTION PRAC. 34, 38-41 (2010).

127. Covassin et al., *supra* note 67, at 234. Researchers found that 50% of the surveyed youth coaches self-reported that they learned something new from the toolkit, and 72% of coaches expressed desire to educate others about concussions. *Id.* at 233.

128. *Id.*

129. The percentage of correct answers was higher on the post-test than the pre-test among the

understand concussion management, although variation exists across gender, sport type, and concussion history.<sup>130</sup>

## 2. Effect on Athlete Attitudes and Knowledge

Another twenty-eight studies evaluated the effect of concussion education programs on *athlete* knowledge and attitudes. As with coaches' education, the results of athlete education are mixed. Some evidence suggests that athlete education programs can produce short-term knowledge gains. However, these gains are age- and modality-dependent, long-term retention of information is unlikely, and changes in concussion reporting behaviors and attitudes are much harder to generate.

There is much evidence to support the claim that concussion education can, in the short term, improve athlete knowledge about how to identify and care for a sports concussion.<sup>131</sup>

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133,764 participants who took the NFHS/CDC course for the first time during the data collection period. However, no formal statistical analyses were performed to determine if the observed effects were significant. Erin M. Parker et al., *Reach and Knowledge Change Among Coaches and Other Participants of the Online Course: "Concussion in Sports: What You Need to Know"*, 30 J. HEAD TRAUMA REHABILITATION 198, 201-02 (2015).

130. See Tamara C. Valovich McLeod, Christian Schwartz & R. Curtis Bay, *Sport-Related Concussion Misunderstandings Among Youth Coaches*, 17 CLINICAL J. SPORT MED. 140 (2007); Emily Kroshus, Christine M. Baugh & Daniel H. Daneshvar, *Content, Delivery, and Effectiveness of Concussion Education for US College Coaches*, 26 CLINICAL J. SPORT MED. 391, 394 (2016); Erin M. O'Donoghue, James A. Onate, Bonnie Van Lunen & Connie L. Peterson, *Assessment of High School Coaches' Knowledge of Sport-Related Concussions*, 1 ATHLETIC TRAINING & SPORTS HEALTH CARE 120, 129 (2009).

131. See Jae O. Koh, *Effect of Snowboard-Related Concussion Safety Education for Recognizing Possible Concussions*, 51 J. SPORTS MED. & PHYSICAL FITNESS 625, 628 (2011) (showing that concussion knowledge among 208 college students enrolled in a snowboarding course significantly increased immediately following a 30-minute concussion education presentation); Miyashita et al., *supra* note 103 (showing that after fifty NCAA athletes were given a 20-minute concussion education presentation, concussion knowledge significantly increased and the gain was maintained until the end of the season); Kurowski et al, *supra* note 72, at S22 (showing how 234 high school athletes who received a 20-minute presentation before their sports season began showed gains in concussion knowledge, attitudes, and intentions to report concussion symptoms, while a group of 262 control high school athletes did not; however, these gains regressed to baseline by the end of the season); Manasse-Cohick & Shapley, *supra* note 72, at 183 (showing how after receiving a concussion education presentation containing information CDC Heads Up initiative, 160 high school football players showed significantly improved concussion knowledge but displayed no changes in attitudes towards concussion); Jeffrey G. Caron et al., *Development, Implementation and Assessment of a Concussion Education Programme for High School Student-Athletes*, 36 J. SPORTS SCI. 48, 51-52 (2017) (showing how after a series of four different interactive oral concussion presentations administered weekly, 35 male high school athletes demonstrated significantly increased concussion knowledge which was maintained for two months; however, there were no significant change in attitudes towards concussion); Hunt, *supra*

Still, evidence remains mixed, even among studies that evaluate the same education program. For instance, two studies of the Sports Legacy Institute Community Educators (SLICE) concussion education program<sup>132</sup> found that students' concussion knowledge generally improved shortly after participation in the program,<sup>133</sup> but another study of a modified version of the same program found no improvement in knowledge.<sup>134</sup>

Short term gains have been found in evaluations of *Brain 101*,<sup>135</sup> the Barrow *Brainbook* online concussion education course;<sup>136</sup> the *Head Safety in Youth*

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note 71, at 67, 70 (comparing 68 high school athletes who were randomly assigned to either watch a concussion education video or watch a video on nutrition; both groups exhibited significant improvement in concussion symptom identification but there was a greater increase for athletes who watched the concussion education video); Paul S. Echlin et al., *The Sport Concussion Education Project. A Brief Report on an Educational Initiative: From Concept to Curriculum*, 121 J. NEUROSURGERY 1331, 1331-36 (2014); Nancy R. Chinn & Paul Porter, *Concussion Reporting Behaviours of Community College Student-Athletes and Limits of Transferring Concussion Knowledge During the Stress of Competition*, BMJ OPEN SPORT & EXERCISE MED., at 1, 3-5 (2016) (showing prior concussion education in community college student-athletes was associated with greater concussion knowledge, and more concussion education sessions associated with higher knowledge); L. Sullivan, L. Pursell & M. Molcho, *Evaluation of a theory-based concussion education program for secondary school student-athletes in Ireland*, HEALTH EDUC. RES. (2018) (athletes who received the education intervention has significantly higher concussion knowledge post-intervention and compared to controls); Jessica Wallace, Tracey Covassin & Erica Beidler, *Concussion Bingo: Taking an active learning approach to concussion education with vulnerable populations*, HEALTH EDUC. J. (2018) (showing that athletes exhibited significantly higher concussion knowledge after a "Concussion Bingo" educational activity compared to pre-intervention).

132. The SLICE program is 40-60 minutes long and includes information about the signs and symptoms, long-term risks, and strategies for managing concussions. The modified SLICE program is a 30-minute PowerPoint presentation including similar content. See Bagley et al., *supra* note 68; Hotz et al., *supra* note 68, at 104. The 15-minute UConcussion educational video is another derivative of the SLICE program. See Gillian Hotz, *Concussion: Video Education Program for High School Football Players*, 20 SPORT J. (2018).

133. Bagley et al., *supra* note 68, at 387 (showing that concussion knowledge among 599 students increased following the SLICE program, with a significantly higher quiz pass rate and higher mean quiz score); Hotz, *supra* note 68 (showing that concussion knowledge among 152 high school football player significantly improved after being shown the UConcussion educational video).

134. Hotz et al., *supra* note 68, at 105 (showing that 559 football players who underwent the modified SLICE program did not have higher concussion knowledge than a control group of 483 football players).

135. Glang et al., *supra* note 70, at 91-97 (showing that student-athletes randomly assigned to view the *Brain 101* concussion education material had larger gains in concussion knowledge, knowledge application and behavioral intention from pre- to post-test than student-athletes viewing CDC safety material; however, concussion management did not significantly differ).

136. Conley & Savenye, *supra* note 70, at 29 (11 students who reported completing the 50-minute online Barrow *Brainbook* concussion education course showed greater knowledge at a 6-month follow up than 12 students who had not taken the course).

*Sports* concussion education program;<sup>137</sup> and the *Concussion-U* presentation.<sup>138</sup> However, not all education programs guarantee knowledge gains,<sup>139</sup> and some evidence suggests that certain educational modalities are more effective than others.<sup>140</sup>

While concussion *knowledge* seems to generally improve, *attitudes* about concussion (e.g. the likelihood to report a concussion) are less malleable.<sup>141</sup> Studies in this field have indicated that concussion education is not associated with better concussion knowledge and attitudes,<sup>142</sup> concussion prevention

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137. Ross-Jordan S. Elliott et al., *Pediatric Sport-Related Concussion Education: Effectiveness and Long-Term Retention of the Head Safety in Youth Sports (HSYS) Program for Youth Athletes Aged 11-16*, COGENT EDUC. Dec. 2, 2015 at 1, 3-5 (showing that 858 middle school students, most of whom participated in sports, exhibited significantly improved concussion knowledge following completion of the Head Safety in Youth Sports concussion education program).

138. Eagles et al., *supra* note 72, at 660 (showing that 43 youth hockey players who watched the 30-minute Concussion-U presentation demonstrated significantly increased concussion knowledge from pre-intervention baseline knowledge, which was maintained between four and six months later; concussion attitudes initially increased but dissipated between four and six months later).

139. Paul S. Echlin et al., *A Prospective Study of Concussion Education in 2 Junior Ice Hockey Teams: Implications for Sports Concussion Education*, 29 NEUROSURGICAL FOCUS E6, E7 (2010) (showing that 2 male junior hockey teams randomly assigned to watch the ThinkFirst educational DVD (n = 16), participate in an interactive concussion education computer module (n = 20), or to receive no concussion education (n = 22) did not significantly differ in concussion knowledge); Chris Bosshardt et al., *Does Concussion Education Have an Impact in Behaviours Amongst School-Age Rugby Players?*, 51 BRIT. J SPORTS MED. A15 (2017) (120 male high school rugby players did not demonstrate significantly higher concussion knowledge 2-3 months following a concussion education presentation, but did demonstrate significant improvement in the number of correct behavioral responses to a concussion scenario).

140. Tara Kobitowich & Martin Mrazik, *Concussion Education: A Randomised Trial with Undergraduate Students*, 51 BRIT. J. SPORTS MED. A62 (2017) (showing that when 162 undergraduates were randomly assigned to an Internet education group, presentation education group or control group, all three had significantly higher knowledge scores post-intervention and the presentation group had significantly higher post-intervention scores than the control and Internet group).

141. Manasse-Cohick & Shapely, *supra* note 72, at 184; Brit L Anderson et al., *High School Football Players' Knowledge and Attitudes About Concussions*, 26 CLINICAL J. SPORT MED. 206, 208 (2016) (prior concussion education was not associated with greater concussion knowledge or improved concussion attitudes for high school football players); Carol et al., *supra* note 132 (prior concussion education was not associated with significant changes in attitudes towards concussion in high school student athletes).

142. Emily Kroshus et al., *Pilot Randomized Evaluation of Publicly Available Concussion Education Materials: Evidence of Possible Negative Effect*, 42 HEALTH EDUC. & BEHAV. 153, 156-57 (2015). Junior league hockey players were randomly assigned to watch the *Concussions in Ice Hockey* video, watch the *Head Games* documentary, or to watch nothing. All players received the CDC's *Heads Up Concussion in High School Sport: A Fact Sheet for Athletes* handout; Brad Kurowski et al., *Factors that Influence Concussion Knowledge and Self-Reported Attitudes in High*

behaviors,<sup>143</sup> reporting self-efficacy,<sup>144</sup> and behavioral intention to report concussions.<sup>145</sup> Indeed, perhaps counterintuitively, athletes who watched *Head Games* actually exhibited increased *underreporting* of concussion symptoms to their coaches one month after viewing the video.<sup>146</sup> Finally, a study of 160 collegiate athletes suggests that favorable perceptions of concussion education may not be enough to promote better reporting.<sup>147</sup>

To be sure, some studies have found attitude change. In a focus group pretesting the CDC's *Heads Up* video, high school athletes self-reported that they were more likely to have a head injury examined and would be more likely to consider whether or not they had a concussion after a head injury.<sup>148</sup> In another study, high school athletes with concussion education had a greater intention to tell their coach about a potential concussion than athletes who had not received concussion education.<sup>149</sup> Another study of Irish student athletes found that some attitudes significantly changed following the intervention, such as perception of control over their concussion reporting behaviors, the need to immediately disclose concussion symptoms, and the athlete's intention to report, but that other attitudes did not, such as the athlete's perceived outcome of reporting a concussion or the athlete's subjective reporting norms.<sup>150</sup> However, only reporting intentions in athletes who completed the intervention significantly differed from control athletes with no exposure to the education program, which questions the effectiveness of the program.<sup>151</sup>

Overall, the pattern of findings in our review is clear: although there are

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*School Athletes*, 77 J. TRAUMA & ACUTE CARE SURGERY S12, S14 (2014).

143. Conley & Savenye, *supra* note 70, at 31.

144. Kroshus et al., *Pilot Randomized Evaluation*, *supra* note 143, at 155.

145. Kurowski et al., *supra* note 143; Kroshus et al., *Pilot Randomized Evaluation*, *supra* note 143, at 155.

146. Kroshus et al., *Pilot Randomized Evaluation*, *supra* note 143, at 153.

147. Liam Higginson et al., *The Evaluation of the Effectiveness of NCAA Concussion Education Legislation: 640 Board #55 May 28, 2, 2:00 PM – 3:00PM*, MED. & SCI. SPORTS & EXERCISE 162, Volume 46 Supplement 1, 2014, at 162. Researchers found that of fifty-four college athletes who sustained a concussion as a National Collegiate Athletic Association athlete, there was no significant difference in the perceived effectiveness of concussion education between those that reported their concussion and those who did not report their concussion.

148. Mitchko et al., *supra* note 67, at 101 (focus groups with twenty high school student athletes indicated that athletes were more likely to report they would see a healthcare professional following a head injury after viewing an educational video).

149. Harry Bramley et al., *High School Soccer Players with Concussion Education are More Likely to Notify Their Coach of a Suspected Concussion*, 51 CLINICAL PEDIATRICS 332, 334 (2012) (concussion education and athlete intention to report a potential concussion to a coach were significantly associated in a survey of sixty high school soccer players).

150. Sullivan, Pursell, and Molcho, *supra* note 132.

151. *Id.* at 499.

some education interventions that improve short-term knowledge, and even some that seem to promote longer-lasting behavioral change, the bottom line is that most interventions are not likely to achieve the public health goals of reduced concussion incidence, more robust concussion reporting, and improved concussion management. In the next Part, we discuss why concussion education is failing to achieve these goals.

### III. DISCUSSION: WHY HAS CONCUSSION EDUCATION POLICY FAILED

Legislatures have mandated concussion education, and nearly 30 different types of concussion education interventions have now been studied. Although there are notable exceptions, the general findings of the studies reviewed in Part II are clear: the implementation of top-down concussion education interventions seem unlikely, on their own, to reduce concussion incidence, produce improvements in long-term knowledge, and change attitudes about concussion reporting. Clearly, legislatively-mandated education programs as they are currently designed and implemented are underperforming.

But why does concussion education fail? We believe there are four primary reasons, discussed below in order of likely importance. These are not mutually exclusive explanations, and they work in tandem to dampen the effectiveness of current concussion education programs.

#### *A. Concussion Education Does Not Focus on Primary Prevention*

Current state legislation is largely aimed at secondary, and not primary, prevention of concussion. Secondary prevention measures only help “mitigate the downstream effects of concussion,” as opposed to preventing concussions from occurring in the first place.<sup>152</sup> These laws do not address the enabling factors for concussion, such as rules about contact, equipment safety, and so forth.<sup>153</sup> For instance, the education programs could have offered sport-specific recommendations for reducing head contact. Instead, education programs often focus on identification of symptoms *after* head contact, and how to manage

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152. Lowrey, *State Laws*, *supra* note 7, at 67.

153. When interpreting concussion incidence research following an educational intervention, it is also important to note that an increase in incidence may reflect an increase in concussion diagnoses due to increased awareness or documentation, not necessarily due to an increased number of concussions. See Viviana Bompadre et al., *Washington State’s Lystedt Law in Concussion Documentation in Seattle Public High Schools*, 49 J. Athletic Training 486, 491 (2014) (attributing the 2.26% increase in concussion documentation following the implementation of the Lystedt law to increased awareness or diligence among coaches, athletes, and parents to report concussion).

injury *after* a concussion is sustained.

Scholarly reviews have found that other facets of concussion management, such as return-to-play guidelines, actually do little to reduce incidence.<sup>154</sup> As suggested previously, perhaps this is to be expected. Return-to-play guidelines are a desirable intervention because they are an “easy, visible response to the problem of concussion that has virtually no impact on the way sports are played.”<sup>155</sup> However, the emphasis of return-to-play guidelines as an all-encompassing solution “neglect[s] genuine reforms that would prevent concussions,” which would require physically changing the way in which the sport is played.<sup>156</sup> We think a similar argument can be made for concussion education interventions.

*B. Incentives to Improve Concussion Care are Not Aligned with Incentives to Win*

Coaches and athletes can learn new lessons. Every off-season, for instance, coaches look to improve their game strategy. Athletes watch film and learn new drills to improve their skills. If new information is aligned with improving on-field performance, coaches and athletes are likely to change their behavior.

We believe that the most fundamental challenge facing concussion education is its perceived or real misalignment with the team’s incentive to win and the individual athlete’s incentive to contribute as much as possible to winning. Although athletes in youth sports report that the primary reason they play is to have fun,<sup>157</sup> winning remains paramount. The competitive drive to win is a valuable skill to develop, but it can run counter to concussion reporting and concussion care.

An athlete’s decision to self-report a suspected concussion depends on many factors, only one of which is knowledge about the signs and symptoms of concussion.<sup>158</sup> Multiple studies have confirmed that athletes are wary of self-reporting concussions, even when they think they may have one.<sup>159</sup> These

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154. L. Syd M. Johnson, *Return to Play Guidelines Cannot Solve the Football-Related Concussion Problem*, 82 J. SCHOOL HEALTH 180, 182-83 (2012).

155. *Id.* at 183.

156. *Id.* at 180.

157. Vern Seefeldt et al., CARNEGIE COUNCIL FOR ADOLESCENT DEVELOPMENT, OVERVIEW OF YOUTH SPORTS PROGRAMS IN THE UNITED STATES 53 (1992).

158. Johna K. Register-Mihalik et al., *Using Theory to Understand High School Aged Athletes’ Intentions to Report Sport-Related Concussion: Implications for Concussion Education Initiatives*, 27 BRAIN INJ. 878, 878-80 (2013).

159. See Paul Sean Echlin, *Concussion Education, Identification, and Treatment Within a Prospective Study of Physician-Observed Junior Ice Hockey Concussions: Social Context of This Scientific Intervention*, 29 NEUROSURGICAL FOCUS 2 (2010); Emily Kroshus et al., *Concussion*



athletes do not want to let their teammates down, and do not want to be perceived of as weak.<sup>160</sup> Indeed, some athletes in focus groups have stated that even though they learned about concussions through the presentations, they were not more likely to report them.<sup>161</sup>

Over 20 articles in this review concluded that concussion education produced short-term improvements in knowledge, but only three articles concluded that the educational intervention produced observed changes in athlete behavior. This disparity between knowledge and behavior may occur because education programs often fail to account for the culture of sport itself. Sports culture has typically “rewarded athletes who . . . feign toughness for the benefit of the team.”<sup>162</sup> Moreover, coaches may be hesitant to remove a player out of concern that it could detrimentally affect the team’s success.<sup>163</sup>

Athletes who sustain a concussion may ignore symptoms, oppose medical evaluation, or underreport symptoms when being evaluated. This may be part of a “cultural resistance” to disclosing injury, perhaps to appease the pressure placed on them by their coaches or parents or peers.<sup>164</sup> A study of 1,532 high school football players found that 54% of the 229 athletes who sustained a concussion during the current season did not report their symptoms; when asked why the concussion was not reported, 41% reported that they did not want to leave the game, and 22% reported that they did not want to let their teammates down.<sup>165</sup>

Furthermore, the intent to report a concussion heavily relies on the athlete’s perception of the team atmosphere.<sup>166</sup> A study that assessed the perceived and objective reporting behaviors of 328 collegiate athletes and their teams found that

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*Under-Reporting and Pressure from Coaches, Teammates, Fans, and Parents*, 134 SOC. SCI. & MED. 66, 74-76 (2015).

160. Echlin, *Concussion Education, Identification, and Treatment*, *supra* note 161, at 2; Emily Kroshus et al., *Pilot Randomized Evaluation*, *supra* note 143, at 155, 158.

161. However, athletes did consider changing their behavior to prevent concussion altogether, although no measures of actual behavioral change were assessed. Caron et al., *Development, Implementation, and Assessment*, *supra* note 132, at 525.

162. Echlin, *Concussion Education, Identification, and Treatment*, *supra* note 161, at 2-4.

163. *Id.* at 2, 3.

164. *Id.*

165. Michael McCrea et al., *Unreported Concussion in High School Football Players: Implications for Prevention*, 14 CLINICAL J. SPORT MED. 13, 14-15 (2004); *see also* Jeffrey Scott Delaney et al., *Why Professional Football Players Chose Not to Reveal Their Concussion Symptoms During a Practice or Game*, 28 CLINICAL J. SPORT MED., 1, 1 (2018) (in a study of 454 professional football players in Canada, of the 82.1% of players who reported that they did not seek medical attention for a sustained concussion, nearly 40% reported that they did not seek medical attention because they either did not want to be removed from play or “risk missing future games”).

166. Emily Kroshus et al., *Social Norms Theory and Concussion Education*, 30 HEALTH EDUC. RES. 1004, 1007-09 (2015).

athletes perceived their team's reporting behaviors to be worse than the actual tendency to report.<sup>167</sup> However, the athlete reporting behavior tended to align with this *perceived* team norm and not the *actual* team norm.<sup>168</sup> Therefore, if an athlete believes that their teammates would not report concussion symptoms, then the athlete would be less likely to report concussion symptoms, regardless of whether or not the teammates have an objectively high tendency to report.<sup>169</sup> Pressure from parents further compounds the problem because parents may not follow up with appropriate concussion management if they do not properly understand the potential severity of the injury.<sup>170</sup>

Just as players in the heat of a game are focused on staying in the game to compete, a coach in the middle of a big playoff contest is primarily thinking about how to win, not necessarily how to follow concussion education received months prior. Coaches may experience conflict between “the pressure to win and the protection of the long-term health interest of the player.”<sup>171</sup> Coaches may resort to exerting pressure themselves to get their athletes to play: in a study of 789 athletic trainers and 111 team physicians, 64.4% of clinicians reported experiencing pressure from athletes to prematurely clear the athlete for return to play and 53.7% of these clinicians reported experiencing this pressure from coaches.<sup>172</sup>

Given the extent that athletes, coaches, and parents perceive that adherence to concussion protocols is not aligned with winning, the efficacy of concussion education is likely to be minimized. The variety of evidence reviewed above indeed suggests that incentives to win and incentives to improve concussion management are not optimally aligned.

*C. Concussion Education is Not Targeted to Specific Sports, Ages, and Stakeholders*

A third reason why legislatively-mandated concussion education has failed is that it has largely abided by a one-size-fits-all approach.<sup>173</sup> Concussion statutes were developed primarily with football in mind<sup>174</sup> and, likewise, concussion education has not typically been developed with other sports in mind. Moreover,

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167. *Id.* at 1006-07.

168. *Id.* at 1008-09.

169. *Id.*

170. Echlin, *Concussion Education, Identification, and Treatment*, *supra* note 161, at 2, 3.

171. *Id.* at 3-4.

172. Emily Kroshus et al., *Pressure on Sports Medicine Clinicians to Prematurely Return Collegiate Athletes to Play After Concussion*, 50 J. ATHLETIC TRAINING 944, 946-47 (2015).

173. Harvey, *Refereeing the Public Health*, *supra* note 45, at 109.

174. *Id.* at 87.

little attention has been given to the ways that adults and children learn differently.

There is evidence that age matters in the effectiveness of concussion education. For instance, in a study of one concussion education video, the researchers found that knowledge retention was heavily influenced by age: the 14-year-olds who watched the video maintained their knowledge gains for up to two months while the younger cohort who watched the video did not.<sup>175</sup> Common sense suggests that communicating concussion information to fourth graders should be different than communicating the same information to high schoolers. Yet the existing concussion education interventions rarely require any specific programming, much less age-specific programming.

Age is not the only variable that matters. Community factors like socioeconomic status predict whether or not coaches receive education about concussions: a 2017 study found that communities below the poverty line have significantly lower percentages of football coaches that have taken the *Heads Up Football* concussion education course, with community-level poverty being the most significant predictor of course completion.<sup>176</sup> As we have argued elsewhere, concussion policy has generally overlooked dimensions of socioeconomic and racial inequality.<sup>177</sup>

Furthermore, active or multimodal methods of education may help students learn about concussion: a study of 48 students that participated in a “visual arts-based” concussion education program displayed *better* post-assessment knowledge gains (80%) at the 3-month follow-up point than *immediately after the intervention* (72.8%).<sup>178</sup> The two-week program, implemented in high school visual arts classes, utilized artwork created by the students and creative problem solving to communicate knowledge regarding concussion knowledge.<sup>179</sup>

In sum, the failure of concussion education is likely in part due to its inability to develop personalized group-specific, age-specific, sport-specific, and community-specific education programs. A one-size-fits-all approach may save money, but it fails to achieve significant public health improvements in sports concussion care.

#### *D. Further Mixed Results, from NCAA Studies, on the*

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175. Cusimano et al., *supra* note 71, at 144.

176. Emily Kroshus et al., *Community-Level Inequalities in Concussion Education of Youth Football Coaches*, 52 AM. J. PREVENTATIVE MED. 476, 478-80 (2017).

177. Rasmussen et al., *supra* note 17, at 115.

178. Mia T. Minen & Alexandra Boubour, *A Pilot Educational Intervention for Headache and Concussion: The Headache and Arts Program*, NEUROLOGY 90 e1799, e1801 (2018).

179. *Id.* at e1800-01.

*Effects of Concussion Education*

In this Article, we have primarily focused on youth sports, but the National Collegiate Athletic Association (NCAA) has also been active in concussion policy and education. It could be that concussion education is more effective when the athletes are older, or less effective as the competitive stakes become higher. To examine these possibilities, we conducted an additional review of research on NCAA concussion education. We found that the collegiate level also exhibits varying degrees of education effectiveness.

The NCAA implemented its concussion policy in 2010; much like youth sports concussion statutes, this policy requires that each member school adopt annual concussion education for athletes; immediate removal from play and evaluation of athletes suspected of sustaining a concussion by a medical professional; no return to play for the remainder of the day; and medical clearance before an athlete can return to play.<sup>180</sup>

Concussion education materials are widely distributed in college athletics,<sup>181</sup> though there is variation across schools.<sup>182</sup> There remains, however, improvement to be made regarding compliance.<sup>183</sup> A survey of 1,066 NCAA administrators and 97 member schools found that 76.1% of respondents reported some form of system for annual athlete education, despite 92.7% of respondents reporting that their school had a concussion management policy.<sup>184</sup> Moreover, about a third of respondents reported that better coach and athlete education is a necessary improvement (39.7% and 35.2%, respectively).<sup>185</sup>

Although widely disseminated, concussion education for collegiate athletes

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180. Christine M. Baugh et al., *Concussion Management in United States College Sports: Compliance with National Collegiate Athletic Association Concussion Policy and Areas for Improvement*, 43 AM. J. SPORTS MED. 47, 48 (2015).

181. Zachary Y. Kerr et al., *Concussion-Related Protocols and Preparticipation Assessments Used for Incoming Student-Athletes in National Collegiate Athletic Association Member Institutions*, 50 J. ATHLETIC TRAINING 1174, 1176-77 (2015) (of 327 athletic trainers employed at NCAA member institutions, 95.4% and 90.2% of respondents reported that they provided annual concussion education to student-athletes and coaches, respectively).

182. Concussion management also differs in varying collegiate divisions, finding that Division I institutions could provide concussion education and comply with the NCAA concussion management best practices more so than Division III institutions. *See id.* at 1177.

183. Christine M. Baugh et al., *Requiring Athletes to Acknowledge Receipt of Concussion-Related Information and Responsibility to Report Symptoms: A Study of the Prevalence, Variation, and Possible Improvements*, 42 J.L. MED. & ETHICS 297, 299, 305, 308 (2014) (only 59.5% of 734 male NCAA football athletes reported that they were required to acknowledge that concussion education materials were provided to them).

184. Baugh et al., *supra* note 182, at 49-50, 52.

185. *Id.* at 51 tbl. 3.

does not appear to be tremendously effective.<sup>186</sup> In a study of collegiate hockey players, the provision of educational materials did not significantly change concussion knowledge; in fact, education actually slightly *decreased* athlete intention to report concussion symptoms during play.<sup>187</sup> Similarly, athletes who did recall receiving concussion information were significantly more likely to continue playing with a concussion.<sup>188</sup>

Much like the youth studies, there are mixed findings at the collegiate level. For instance, a study evaluating pre- and post-season knowledge of 70 NCAA soccer and basketball players found that concussion education improved post-season knowledge of concussion and that 50% of athletes who sustained a concussion reported that concussion education had a positive impact on their reporting of the concussion to an athletic trainer.<sup>189</sup>

Concussion education for coaches also appears to be potentially beneficial. A 2015 survey of 1,818 NCAA coaches found that education was beneficial for recognizing the signs and symptoms of concussion and developing appropriate concussion management protocols in the 67% of coaches who had received educational materials from their college.<sup>190</sup> In sum, there are mixed results of concussion education at the collegiate level, much like the youth level.

#### IV. LOOKING FORWARD: FIXING CONCUSSION EDUCATION

We have argued thus far that by itself, state-mandated concussion education has failed to significantly impact concussion-related outcomes. In this Part, we propose a path forward. In Section A, we contextualize our argument with a public health perspective. The primary lesson from decades of public health research is that providing information alone is not enough to spur complex behavioral change. Yet this is exactly what concussion education statutes attempt to do.

Section B lays out a vision for the future of concussion education. This education should be: (1) integrated into an incentive structure that concretely rewards concussion identification and management; (2) combined with efforts to improve sports culture; (3) accompanied by rule changes that focus on primary prevention; and (4) targeted to specific populations using evidence-based methods of knowledge transfer. Section C summarizes our vision for the future of concussion education.

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186. Kroshus et al., *NCAA Concussion Education*, *supra* note 72, at 138.

187. *Id.*

188. *Id.*

189. Miyashita et al., *supra* note 103, at 350-51.

190. Kroshus et al., *Content, Delivery, and Effectiveness*, *supra* note 131, at 391, 393-94.

*A. Public Health Perspectives on Concussion Education*

Since the 1970s, public health scholars have explored dimensions of “health literacy.”<sup>191</sup> Health literacy is designed to allow one “to take responsibility for one’s own health as well as one’s family health and community health.”<sup>192</sup> Legislatively-mandated concussion education can be understood as an attempt to improve “concussion literacy” for athletes, parents, and coaches.

The information-based approach in concussion education is, at face value, appealing. Educating consumers—parents and athletes—about the nature and risks of concussions would presumably allow them to make more informed market decisions about whether to play a sport and when to ask for removal from play for a suspected concussion. Educating coaches empowers them to make individual decisions about practices and games, rather than being required to follow a centralized set of protocols.

Yet in practice, we can see that an information-based approach faces serious challenges. As legal scholar Kelli Garcia has argued in the context of public health obesity campaigns, the “information-based, individual change approach taken by most federal programs to prevent obesity appeals to the American values of individualism and personal autonomy and to the skepticism about the role of government.”<sup>193</sup> Although politically appealing, these campaigns are “rarely effective in modifying complex behaviors such as dieting and exercise.”<sup>194</sup>

This finding has been seen in other information-based public health campaigns, and public health scholars now recognize that behavioral change requires more than just providing additional information:

Early models of behavior change were based on the assumption of a relatively stable link between knowledge, attitude and behavior—if people were given relevant information (i.e., too much fat is bad for your health) from a credible source (nutritionist) they would change their attitudes towards their diet and, in turn, their behavior (reducing fat intake). Experience showed that this was not correct . . . .<sup>195</sup>

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191. Don Nutbeam, *Health Literacy as a Public Health Goal: A Challenge for Contemporary Health Education and Communication Strategies into the 21st Century*, 15 HEALTH PROMOTION INT’L 259, 260 (2000).

192. Kristine Sørensen et al., *Health Literacy and Public Health: A Systematic Review and Integration of Definitions and Models*, 12 BMC PUB. HEALTH 80, 80 (2012).

193. Kelli K. Garcia, *The Fat Fight: The Risks and Consequences of the Federal Government’s Failing Public Health Campaign*, 112 PENN ST. L. REV. 529, 537 (2007).

194. *Id.* at 538.

195. FRAN BAUM, THE NEW PUBLIC HEALTH 323 (2d ed. 2002), *quoted in* Micah L. Berman, *A*

Behavior change to promote public health clearly requires more than just information. But what more is needed? We answer that question in the next section.

## *B. Improving Concussion Education*

### *1. Primary Prevention Through Rule Changes*

Few states have included provisions for primary prevention in their concussion legislation.<sup>196</sup> This is an opportunity for improving the efficacy of concussion education because education is likely more effective when combined with preventative interventions such as rule changes that reduce head trauma.<sup>197</sup>

Some youth sports organizations like Pop Warner football have attempted to implement rule changes to limit the amount of player-to-player contact in practices.<sup>198</sup> One study found that the Pop Warner football teams (with the limited contact rules) that had the *Heads Up Football* education program had a lower concussion incidence than similar teams that had the *Heads Up Football* education program, but no rule changes.<sup>199</sup> While more research is required, the results of this study preliminarily suggest that reduced exposure to risky gameplay reduces the risk of sustaining a concussion in ways that a purely information-based intervention does not.

Education might also be more focused on technique and technology. In football, for example, a variety of technologies have been developed to reduce helmet hits. One example is the TackleBar equipment, a harness that aims to teach athletes safer tackling techniques.<sup>200</sup> Another example is the Mobile Virtual

*Public Health Perspective on Health Care Reform*, 21 HEALTH MATRIX 353, 365-66 (2011).

196. Lowrey, *State Laws*, *supra* note 7, at 67.

197. Tator, *Sport Concussion*, *supra* note 27, at 298 (“Although education can be an effective injury prevention measure, education must be supplemented by additional measures to effect a major reduction in the incidence of concussions.”).

198. Anahad O’Connor, *Trying to Reduce Head Injuries, Youth Football Limits Practices*, N.Y. TIMES (Jun. 13, 2012), <https://www.nytimes.com/2012/06/14/sports/pop-warner-football-limits-contact-in-practices.html> (“forbidding all drills that involve full-speed, head-on blocking and tackling”); *see also* Lindsey Strauss, *Most States Now Limit Number and Duration of Full-Contact Practices in High School Football*, SMARTTEAMS (Aug. 24, 2016), <https://concussions.smartteams.org/despite-new-limits-on-full-contact-practices-in-high-school-football-effectiveness-in-reducing-risk-of-concussion-and-long-term-brain-injury-still-unknown/> (demonstrating that state high school athletic associations have begun implementing limitations on full-contact practices, although efforts have been primarily limited to amateur football).

199. Kerr et al., *Youth American Football*, *supra* note 69, at 7.

200. Amy Gill, *TackleBar trying to change youth football*, WPTA21.COM, Mar. 23, 2018, 3:37 PM <http://www.wpta21.com/story/37797341/2018/03/Friday/tacklebar-trying-to-change-youth-football>; *see also* TACKLEBAR, <https://tacklebar.com/>, (last visited Aug. 15, 2018).

Player (MVP), a tackling dummy that is now employed by Dartmouth College Football in lieu of tackle drills between players.<sup>201</sup>

While teaching safer techniques has the potential to improve health outcomes, if there is no incentive to play safer, athletes and coaches may continue riskier techniques if they are deemed more advantageous.<sup>202</sup> In order to avoid this outcome, additional rule changes are needed to modify the incentive structure.

A promising avenue for accomplishing this change in incentives is to directly link safety outcomes with winning.<sup>203</sup> The “Fair Play” model has been developed to do this, and has been implemented in sports such as hockey<sup>204</sup> and football.<sup>205</sup> One example of Fair Play implementation is a collaboration between Minnesota Hockey and the Mayo Clinic Sports Medicine Center.<sup>206</sup>

Teams participating in the Fair Play (FP) program are awarded points for sportsmanlike behavior and are deducted points according to the number of penalty minutes sustained each game.<sup>207</sup> Fair play points (FPPs) are added to game points that are counted for a team’s overall season standing, which incentivizes teams to use sportsmanlike conduct during gameplay.<sup>208</sup>

A longitudinal study of the program was performed in 2016, where 1,514 youth hockey players on 99 teams were separated into two groups.<sup>209</sup> One group of teams played in tournaments using “intensified fair play” rules and the other group played in tournaments using normal rules.<sup>210</sup> While the total number of concussions sustained did not significantly differ between groups, the total

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201. Elliott Kastner, *How a Robot Football Player Will Prevent Concussions*, THAYER SCHOOL OF ENGINEERING AT DARTMOUTH, Sept. 29, 2016, <https://engineering.dartmouth.edu/news/how-a-robot-football-player-will-prevent-concussions>.

202. Echlin, *Concussion Education, Identification, and Treatment*, *supra* note 161 at 2.

203. Daryl Siedentop, *What Is Sport Education And How Does It Work?*, J. PHYSICAL EDUC. RECREATION & DANCE 18, 18-20 (1998).

204. William O. Roberts, Janny Dwyer Brust, Barbara Leonard & Brian J. Hebert, *Fair-Play Rules and Injury Reduction in Ice Hockey*, 150 ARCHIVES PEDIATRICS & ADOLESCENT MED. 140, 141 (1996); Aynsley Smith et al., *Hockey Education Program (HEP): A Statewide Measure of Fair Play, Skill Development, and Coaching Excellence*, in FIFTH INTERNATIONAL SYMPOSIUM ON SAFETY IN ICE HOCKEY (2009).

205. Andrew White, *Fair Play in Youth Football: Reducing Injury Rates Through Improved Sportsmanship Behavior* (2018) (unpublished Ph.D. dissertation, University of Minnesota) available at <https://conservancy.umn.edu/handle/11299/194601>.

206. Aynsley M. Smith et al., *Does Fair Play Reduce Concussions? A Prospective, Comparative Analysis of Competitive Youth Hockey Tournaments*, 2 BMJ OPEN SPORT & EXERCISE MED. e000074, e000074 (2016).

207. *Id.* at e000074-75.

208. *Id.*

209. *Id.* at e000075.

210. *Id.*



number of non-concussive head injuries sustained was significantly less for the Fair Play group, indicating that risk actually decreased through the FP program.<sup>211</sup>

In addition to making sports safer for youth athletes, removing risky gameplay like tackling and checking can be economically advantageous. A study published in 2014 estimated the cost-effectiveness of a ban on body checking in youth ice hockey,<sup>212</sup> and found that greater checking led to significantly higher injury rates and healthcare costs.<sup>213</sup> The difference was substantial: healthcare costs were 2.5 times (about \$289 Canadian dollars per player) higher for the checking group in just one season.<sup>214</sup> Focusing on prevention of the injury, rather than simply care after the injury, is also likely to reduce the rising costs of concussion-related emergency room visits.<sup>215</sup>

The preliminary success of Fair Play rule changes, as well as the many emerging options for changing rules and adopting new technology to minimize head trauma, offer promising avenues for improving concussion policy. Legislatively-mandated concussion education should be revisited to align with these additional reforms.

## 2. Changing Incentives

As presently designed, there are few legal penalties for failure to adhere to concussion guidelines,<sup>216</sup> and compliance with concussion education is not well aligned with incentives to win. A promising way to improve concussion education efficacy is to better integrate it into a sport's reward system. We should design a system in which athletes and teams are tangibly rewarded for better concussion care. Importantly, these tangible rewards need to be closely linked to winning.

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211. Additionally, teams that were more likely to forfeit their FPPs due to unsportsmanlike conduct were five times more likely to sustain any form of injury than the teams who retained their FPPs, and 40-50% of total FPPs forfeited were due to the same recurring teams. It is also worth noting that a small recurring number of teams were primarily responsible for "both the high number of FPPs forfeited and the consequential rate of injury." *Id.* at e000080.

212. Sarah Lacny et al., *Reality Check: The Cost-Effectiveness of Removing Body Checking from Youth Ice Hockey*, BRIT. J. SPORTS MED., Jun 6, 2014 at 1, 1.

213. *Id.* at 3-5.

214. *Id.* at 5 (estimating that for the average 1,273 injuries sustained each season, over \$213,280 Canadian dollars could be saved by athletes and their families).

215. Walter Hardesty, Bhavna Singichetti, Honggang Yi, Julie Leonard, Alyssa Janezic & Jingzhen Yang, *Paediatric Emergency Department Utilisation and Associated Healthcare Costs Before and After Concussion Laws*, 23 INJ. PREVENTION A17-A18 (2017).

216. Francis X. Shen, *Quasi-Professional Negligence* (Aug. 15, 2018) (unpublished manuscript) (on file with author).

There are many ways in which this integration could be achieved. To align incentives, states could design both carrot and stick incentives. Carrot incentives would be akin to what health insurance companies do to encourage weight loss: if you hit your target health goals, you get a material reward, e.g. a reduction in insurance costs or a cash payment. In the context of sports concussions, teams and leagues that demonstrate high quality concussion prevention and care could be provided with additional resources. In youth sports, this could work because a relatively small amount of money can go a long way for resource-strapped youth sports organizations.

To illustrate, consider the current incentives for a 6<sup>th</sup> grade soccer team coached by volunteer parents. Under current law, these already over-extended parents and busy middle-school kids are simply expected to self-teach themselves about concussion through one of the available modules. There is little repercussion if they do not pay attention to the concussion information. As we have reviewed in previous parts, concussion education disseminated in this way is unlikely to work.

Now imagine a different incentive structure. Imagine that the state has created a three-tier set of incentives for concussion prevention. In Tier I, if the team submits a concussion protocol that includes primary preventative measures, such as reducing contact drills during practices, their team gets a \$500 bonus. In Tier II, if the team can demonstrate that they have taken action to improve or maintain high-level concussion care and prevention policies, that bonus goes up to \$1,500. And in Tier III, if the team joins a “fair play” league that disincentivizes risky athlete behaviors by issuing stricter penalties, the bonus reaches \$2,500. For a youth sports team, these levels of funding mean new uniforms, new equipment, and the ability to travel to tournaments. Integrated in this way, concussion education is likely to achieve more buy-in.

While we favor the “carrot” approach, states could consider more punitive measures as well. In contrast to provision of additional resources for successful compliance, the state could impose penalties for non-compliance. For instance, much like the state inspects restaurants and puts a restaurant grade on the front door so patrons can see it, a concussion care grading system could be implemented. The burden would be on the youth sports team to submit verification of compliance with relevant care requirements in their concussion protocols, and those teams that do not comply would be identified on a publicly accessible website. Parents could quickly search to see what the youth sport safety rating is for a particular team. The state could also modify its law to allow for increased civil penalties for failure to comply with educational requirements.

Considering concussion statutes holistically, and not just the educational

components independently, there is some emerging evidence that these statutes may be improving concussion reporting.<sup>217</sup> We think revisions to all components of these statutes, and not just the educational components, as part of a more comprehensive public health intervention could bring about significantly more improvement.

### 3. *Changing Culture*

Youth sports has become a booming \$8 billion industry that increasingly emphasizes preparing athletes for collegiate and professional careers, despite the fact that very few of these athletes will actually play in college or beyond.<sup>218</sup> Athletes, parents, and coaches alike can invest significant amounts of time, money, and physical and emotional commitment to the sport.<sup>219</sup> This creates a culture that values winning more than the experience and, more importantly, the safety of the athlete.<sup>220</sup> Recognizing that this is the landscape of modern youth sports, concussion education interventions must go deeper than simply providing additional information. Culture change will require addressing both athlete attitudes and coaching philosophy.

Thankfully, there are already programs being developed to accomplish these cultural change goals. Some of the programs are peer-to-peer, led by fellow athletes. For instance, the Headway Foundation was formed by former collegiate athletes (each of whom experienced a serious concussion) to engage with athletes on “inspiring a brain-first mindset during competition.”<sup>221</sup> The Headway Foundation’s centerpiece is a campaign called “New Tough.” The Foundation recognizes that “the culture of sports negatively influences concussion reporting and that athletes, coaches and parents do not fully acknowledge the risks of playing while injured,” and aims “to change that by introducing a new type of toughness.”<sup>222</sup> The New Tough principles are:

- It is the toughness to go against your instinct as an athlete and put your brain-health first.

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217. Jingzhen Yang et al., *New and Recurrent Concussions in High-School Athletes Before and After Traumatic Brain Injury Laws, 2005–2016*, 107 AM. J. PUB. HEALTH 1916, 1918-21 (2017); Shen, *supra* note 5, at 14-15.

218. *Probability of Competing Beyond High School*, NCAA, <http://www.ncaa.org/about/resources/research/probability-competing-beyond-high-school> (last accessed Aug. 15, 2018).

219. Echlin, *Concussion Education, Identification, and Treatment*, *supra* note 161, at 2.

220. *Id.* at E7-E8.

221. *The Goals*, HEADWAY FOUNDATION, <http://headwayfoundation.com/thegoals/> (last accessed visited Aug. 15, 2018).

222. *What is New Tough?*, HEADWAY FOUNDATION, <http://headwayfoundation.com/what-is-new-tough-2/> (last visited Aug. 15, 2018).

- It is the strength to report concussion symptoms, and it is the patience to complete recovery before returning to the game you love.
- It is the courage to speak up for brain-injured teammates and offer support while they heal.
- And it is the integrity to play the game within the rules by avoiding illegal hits to the head or neck, no matter how high the stakes or emotions.<sup>223</sup>

Notably, none of the state-mandated concussion education programs approach concussion policy change in this way. Legislative action to date has focused on medical information, e.g. signs and symptoms of concussion, as opposed to this more foundational cultural change. Future policy should look at opportunities to more directly address culture change.

There are also cultural change programs aimed at coaches. For instance, the InsideOut Initiative is a “transformational” football coaching development program pioneered by former collegiate athletes.<sup>224</sup> Supported by the NFL Foundation, the Initiative’s purpose is to facilitate “systemic change” by transforming the current “win-at-all-costs” sports culture to one that fosters moral and emotional development through gameplay.<sup>225</sup> Another key purpose of the program is to dismantle false measures of masculinity that negatively affect youth, focusing on the tenets of “athletic ability, sexual conquest, and economic success.”<sup>226</sup> While there is currently no empirical evidence that this system reduces injury rates, an initial assessment of the program found that over 97% of all respondents reported that an education-based athletic system is a better fit for the athletes, parents, and coaches than the winning-focused system and that over 83% of respondents are changing their athletic policies and practices to reflect the tenets of the Initiative.<sup>227</sup>

These are only two of many programs aimed at changing the culture of youth sports.<sup>228</sup> It is beyond the scope of this article to catalog them, but the point is that there are many viable paths to transform concussion education so that it is more likely to bring about cultural change.

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223. *Id.*

224. INSIDEOUT INITIATIVE, <https://insideoutinitiative.org/>, (last visited Aug. 15, 2018).

225. *Id.*

226. *Id.*

227. *Id.*

228. See, e.g. Stewart A. Vella, Lindsay G. Oades & Trevor P. Crowe, *A Pilot Test of Transformational Leadership Training for Sports Coaches: Impact on the Developmental Experiences of Adolescent Athletes*, 8 INT’L J. SPORTS SCI. & COACHING 513 (2013); THE CHANGING THE GAME PROJECT, <https://changingthegameproject.com/coaching> (last visited Aug. 14, 2018); *Transformational Coaching Program*, SYMBIONT PERFORMANCE GROUP, INC. (Mar. 2014), <http://www.symbiontperformance.com/id83.html>.

#### 4. Targeted, Evidence-Based Education Interventions

Across the wide variety of concussion education programs reviewed in this Article, there is much variation in the educational content, some of which may not be consistent with the latest consensus from experts.<sup>229</sup> Going forward, concussion education should aim to utilize evidence-based principles of knowledge transfer.<sup>230</sup>

Equally important, most concussion education programs were not targeted to specific groups or sports.<sup>231</sup> Looking ahead, more sport-specific programming would likely be beneficial. In 2014, the Coaching Association of Canada (CAC) and the Public Health Agency of Canada's *Active and Safe* initiative developed an interactive concussion e-learning module, called *Making Head Way*, that provides sport-specific concussion training for coaches using a standardized program format.<sup>232</sup> The module, designed to "help coaches reduce the incidence of brain injuries in team sports and to improve decision-making about when it is safe to return to play after a head injury," includes a general non-specific module in addition to sport-specific modules for soccer, football, snowboarding, freestyle skiing, and speed skating.<sup>233</sup> The CAC also provides concussion guidelines that are freely available and individually developed for parents, coaches, athletes, and teachers.<sup>234</sup>

Parents can also be better targeted. Although most legislation requires parents to be educated on concussions, there is relatively little research on the effect of concussion education on this population. What research there is suggests that parental education may be effective.

One study evaluated the effectiveness of *Brain 101* (see Section B) on

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229. Mrazik et al., *supra* note 58, at 1548-53.

230. Gleadhill et al., *supra* note 58, at 8-22.

231. *See* discussion *supra* Part III.

232. Julie Parkins-Forget, *Making Head Way in Sport eLearning module is Now Available at No Charge*, COACH.CA (Jul. 17, 2014), <http://cac-website-drupal.ind.ninja/making-head-way-sport-elearning-module-now-available-no-charge>.

233. *Id.* Each module contains information related to concussion prevention, recognition, management, and return-to-play. In some youth sport organizations, this program has become the educational standard: for example, Football Canada coaches are required to complete the Making Head Way football module before the beginning of each season, but a partnership between Football Canada and the CAC has made this module free of charge to coaches. *Making Head Way in Football E-Learning Now Mandatory for the Upcoming Season*, FOOTBALL CANADA, (Jan. 22, 2015), <http://footballcanada.com/making-head-way-in-football-e-learning-module-now-mandatory-for-upcoming-season/> (last visited Apr. 3, 2018).

234. *Concussion Awareness*, COACH.CA, <https://www.coach.ca/concussion-awareness-s16361>, (last visited Jun. 22, 2018).

parents.<sup>235</sup> Parents of high school student-athletes were then randomly assigned to view the *Brain 101* education materials or to view safety material from the CDC.<sup>236</sup> Parents who had taken the *Brain 101* course had greater concussion knowledge, knowledge application, and behavioral intention than parents who had not.<sup>237</sup> Another study came to a similar conclusion, finding that concussion education resulted in greater concussion knowledge.<sup>238</sup>

### C. *The Future of Concussion Education*

We have shown in this Article that, in many different ways, current concussion education efforts are falling short. Concussion education isn't making concussion policy worse, but it also seems unlikely to make it much better. As such, this is a missed opportunity and a waste of resources. We can do better.

The solution is not simply to tinker with existing educational materials, but to package concussion education along with a host of additional reforms aligned to improve primary prevention of concussion and concussion reporting culture. The task is daunting, because cultural norms that disfavor concussion reporting run deep. However, there is reason to be optimistic about the opportunity for meaningful reform.

As we have discussed above, there are new technologies, new educational programs, new cultural change efforts, and a continued sense in both the legal and policy communities that promoting brain health for youth athletes is a top priority. We hope that the future of concussion education builds on this momentum and becomes more dynamic and effective than it currently is.

## CONCLUSION

Every state has passed legislation aimed at improving the identification and management of concussion in youth athletes. A key component of this legislation is concussion education. Yet as we have reviewed in this Article, the general consensus from 54 peer-reviewed articles on concussion education interventions is that they can produce only short-term gains in concussion knowledge, not

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235. Glang et al., *supra* note 70, at 91-97.

236. *Id.* at 92-93.

237. *Id.* at 94.

238. Mark Hecimovich, Doug King & Ida Marais, Player and Parent Concussion Knowledge and Awareness in Youth Australian Rules Football, *SPORT J.*, Apr. 1, 2016, at 1, 4-9; but see Ian Macdonald & Roxanne Hauber, Educating Parents on Sports-Related Concussions, 48 *J. NEUROSCIENCE NURSING* 297, 299-300 (2016); Tamerah Hunt, N., Chloe Salway, Steve Patterson & Jody Langdon, Concussion Knowledge and Understanding in Guardians Following Administration of Standardized Education Form, 50 *MED. & SCI. SPORTS & EXERCISE* 477 (2018).

lasting changes in concussion behavior or reductions in concussion incidence. We argue that this failure of concussion education is primarily due to its misalignment with incentives to win, its lack of attention to primary prevention, and its one-size-fits-all approach to education. We propose a new type of concussion education intervention, better aligned with incentives to win, focusing on primary prevention, and addressing culture change in concussion reporting.

APPENDIX A1. ANNOTATED SUMMARY TABLE OF STATE CONCUSSION STATUTE EDUCATIONAL MANDATES

State	Provision Text	Citation <sup>239</sup>
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239.. For state statute citations, see: Chris Lau, *Leaders and Laggards: Tackling State Legislative Responses to the Youth Sports Concussion Epidemic*, 85 FORDHAM L. REV. 2879, 2886 (2017).

State	Provision Text	Citation <sup>239</sup>
Alabama	<p>“(a) Each local school system and governing body of each sport or recreational organization shall develop guidelines and other pertinent information and forms to inform and educate youth athletes and their parents or guardians in their program of the nature and risk of concussion and brain injury, including continuing to play after a suspected concussion or brain injury. On a yearly basis, a concussion and head injury information sheet shall be signed and returned by the youth athlete and the athlete’s parent or guardian prior to the youth athlete’s initiating practice or competition.</p> <p>Each local school system and sports or recreational organization governing body shall ensure that coaches receive annual training to learn how to recognize the symptoms of a concussion and how to seek proper medical treatment for a person suspected of having a concussion.</p> <p>(b) Each local school system and sports or recreational organization shall establish by rule the requirements of the training which shall be provided by using designated resources to the extent practicable and timelines to ensure that, to the extent practicable, every coach receives the training before the beginning of practice for the school athletic team.”</p>	ALA. CODE 1975 § 2211E-2 (2018)
Alaska	<p>“(a) The governing body of a school district shall consult with the Alaska School Activities Association to develop and publish guidelines and other information to educate coaches, student athletes, and parents of student athletes regarding the nature and risks of concussions. Guidelines developed under this section must</p>	ALASKA STAT. §§ 14.30.142.143 (2016)



State	Provision Text	Citation <sup>239</sup>
	<p>include a description of the risks of return to play and standards for return to play, including the procedures required under (c) and (d) of this section.</p> <p>(b) A school shall annually provide to a student and the parent or guardian of a student who is under 18 years of age written information on the nature and risks of concussions. A student may not participate in school athletic activities unless the student and the parent or guardian of a student who is under 18 years of age have signed a verification of receipt of the information required under this subsection...”</p>	
Arizona	<p>“(b) Guidelines, information and forms, developed in consultation with a statewide private entity that supervises interscholastic activities, to inform and educate coaches, pupils and parents of the dangers of concussions and head injuries and the risks of continued participation in athletic activity after a concussion. The policies and procedures shall require that, before a pupil participates in an athletic activity, the pupil and the pupil's parent must sign an information form at least once each school year that states that the parent is aware of the nature and risk of concussion...”</p>	ARIZ. REV. STAT. ANN. § 15-341(24)(b) (2016)
Arkansas	<p>“(a)(1) As used in this section, “youth athletic activity” means an organized athletic activity in which the participants, a majority of whom are under nineteen (19) years of age are:</p> <p>(A) Engaged in an athletic game or competition against another team, club, or entity; or</p>	ARK. CODE ANN. §§ 6-18-708, -710 (2017).

State	Provision Text	Citation <sup>239</sup>
	<p>(B) In practice or preparation for an organized athletic game or competition against another team, club, or entity.</p> <p>(2) “Youth athletic activity” does not include a college or university activity or an activity that is incidental to a nonathletic program.</p> <p>(b) The General Assembly finds that:</p> <p>(1)(A) Concussion is one (1) of the most commonly reported injuries in children and adolescents who participate in sports and recreational activities.</p> <p>(B) The Centers for Disease Control and Prevention estimates that as many as three million nine hundred thousand (3,900,000) sports-related and recreation related concussions occur in the United States each year.</p> <p>(C) A concussion is caused by a blow or motion to the head or body that causes the brain to move rapidly inside the skull.</p> <p>(D) The risk of catastrophic injuries or death is significant when a concussion or head injury is not properly evaluated and managed;</p> <p>(2)(A) Concussion is a type of brain injury that can range from mild to severe and can disrupt the way the brain normally works.</p> <p>(B) Concussions can occur in any organized or unorganized sport or recreational activity and can result from a fall or from players colliding with each other, the ground, or with obstacles.</p> <p>(C) Concussions can occur with or without loss</p>	

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	<p>of consciousness, but the vast majority occur without loss of consciousness;</p> <p>(3) Continuing to participate in a youth athletic activity after sustaining a concussion or exhibiting symptoms of head injury leaves the youth athlete especially vulnerable to greater injury and even death;</p> <p>(4) Despite the existence of generally recognized return-to-play standards for concussion and head injury, some affected youth athletes are prematurely returned to play, resulting in a risk of further physical injury or death to youth athletes in the State of Arkansas;</p> <p>(5) The Arkansas Activities Association is a recognized national leader in the development and implementation of concussion protocols for student athletes in grades seven through twelve (7-12); and</p> <p>(6) It is necessary to establish concussion protocols substantially similar to those developed and implemented by the Arkansas Activities Association to protect all student athletes in Arkansas.</p> <p>(c) The Department of Health shall develop concussion protocols substantially similar to those developed and implemented by the Arkansas Activities Association to protect all youth athletes engaged in youth athletic activities in Arkansas.</p> <p>(d) Guidelines developed under this section shall include:</p> <p>(1) Pertinent information and forms to</p>	

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	<p>inform and educate coaches, youth athletes, and the parents or guardians of youth athletes of the nature and risks of concussions and head injuries, including the risks of continuing to play after a concussion or head injury;</p> <p>(2) A requirement that the person operating a youth athletic activity annually<sup>1</sup> shall distribute a concussion and head injury information sheet to each person who intends to participate in the youth athletic activity;</p> <p>(3) A requirement that a person shall not participate in a youth athletic activity unless the person returns the information sheet signed by the person and, if he or she is under eighteen (18) years of age, by his or her parent or guardian...”</p>	
California	<p>“(a) If a school district, charter school, or private school elects to offer an athletic program, the school district, charter school, or private school shall comply with both of the following:</p> <p>... (2) On a yearly basis, a concussion and head injury information sheet shall be signed and returned by the athlete and the athlete's parent or guardian before the athlete initiates practice or competition.”</p>	CAL. EDUC. CODE § 49475 (West 2016)
Colorado	<p>“(1)(a) Each public and private middle school, junior high school, and high school shall require each coach of a youth athletic activity that involves interscholastic play to complete an annual concussion recognition education course.</p> <p>(b) Each private club or public recreation</p>	COLO. REV. STAT. § 25-43-103 (2017).

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	<p>facility and each athletic league that sponsors youth athletic activities shall require each volunteer coach for a youth athletic activity and each coach with whom the club, facility, or league directly contracts, formally engages, or employs who coaches a youth athletic activity to complete an annual concussion recognition education course.</p> <p>(2)(a) The concussion recognition education course required by subsection (1) of this section shall include the following:</p> <p>(I) Information on how to recognize the signs and symptoms of a concussion;</p> <p>(II) The necessity of obtaining proper medical attention for a person suspected of having a concussion; and</p> <p>(III) Information on the nature and risk of concussions, including the danger of continuing to play after sustaining a concussion and the proper method of allowing a youth athlete who has sustained a concussion to return to athletic activity.</p> <p>(b) An organization or association of which a school or school district is a member may designate specific education courses as sufficient to meet the requirements of subsection (1) of this section.”</p>	
Connecticut	<p>“(a) (1) For the school year commencing July 1, 2010, and each school year thereafter, any person who holds or is issued a coaching permit by the State Board of Education and is a coach of intramural or interscholastic athletics shall complete an initial training course</p>	<p>CONN. GEN. STAT. §§ 10149b to - 149c (2017)</p>

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	<p>regarding concussions, developed or approved pursuant to subdivision (1) of subsection (b) of this section, prior to commencing the coaching assignment for the season of such school athletics.</p> <p>(2) For the school year commencing July 1, 2014, and each school year thereafter, any coach who has completed the initial training course described in subdivision (1) of this subsection shall annually review current and relevant information regarding concussions, prepared or approved pursuant to subdivision (2) of subsection (b) of this section, prior to commencing the coaching assignment for the season of such school athletics. Such annual review shall not be required in any year when such coach is required to complete the refresher course, pursuant to subdivision (3) of this subsection, for reissuance of his or her coaching permit.</p> <p>(3) For the school year commencing July 1, 2015, and each school year thereafter, a coach shall complete a refresher course, developed or approved pursuant to subdivision (3) of subsection (b) of this section, not later than five years after completion of the initial training course, as a condition of the reissuance of a coaching permit to such coach. Such coach shall thereafter retake such refresher course at least once every five years as a condition of the reissuance of a coaching permit to such coach.</p> <p>(b) (1) The State Board of Education, in consultation with (A) the Commissioner of Public Health, (B) the governing authority for intramural and interscholastic athletics, (C) an appropriate organization representing licensed</p>	

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	<p>athletic trainers, and (D) an organization representing county medical associations, shall develop or approve a training course regarding concussions. Such training course shall include, but not be limited to, (i) the recognition of the symptoms of a concussion, (ii) the means of obtaining proper medical treatment for a person suspected of having a concussion, and (iii) the nature and risk of concussions, including the danger of continuing to engage in athletic activity after sustaining a concussion and the proper method of allowing a student athlete who has sustained a concussion to return to athletic activity.</p> <p>(2) On or before October 1, 2014, and annually thereafter, the State Board of Education, in consultation with the Commissioner of Public Health and the organizations described in subparagraphs (B) to (D), inclusive, of subdivision (1) of this subsection, shall develop or approve annual review materials regarding current and relevant information about concussions.</p> <p>(3) The State Board of Education, in consultation with the Commissioner of Public Health and the organizations described in subparagraphs (B) to (D), inclusive, of subdivision (1) of this subsection, shall develop or approve a refresher course regarding concussions. Such refresher course shall include, but not be limited to, (A) an overview of key recognition and safety practices, (B) an update on medical developments and current best practices in the field of concussion research, prevention and treatment, (C) an update on new relevant federal, state and local laws and regulations,</p>	

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	<p>and (D) for football coaches, current best practices regarding coaching the sport of football, including, but not limited to, frequency of games and full contact practices and scrimmages as identified by the governing authority for intramural and interscholastic athletics.</p> <p>(c) On or before January 1, 2015, the State Board of Education, in consultation with the Commissioner of Public Health and the organizations described in subparagraphs (B) to (D), inclusive, of subdivision (1) of subsection (b) of this section, shall develop or approve a concussion education plan for use by local and regional boards of education. Each local and regional board of education shall implement such plan by utilizing written materials, online training or videos or in-person training that shall address, at a minimum: (1) The recognition of signs or symptoms of concussion, (2) the means of obtaining proper medical treatment for a person suspected of sustaining a concussion, (3) the nature and risks of concussions, including the danger of continuing to engage in athletic activity after sustaining a concussion, (4) the proper procedures for allowing a student athlete who has sustained a concussion to return to athletic activity, and (5) current best practices in the prevention and treatment of a concussion.</p> <p>(d) For the school year commencing July 1, 2015, and each school year thereafter, each local and regional board of education shall prohibit a student athlete from participating in any intramural or interscholastic athletic activity unless the student athlete, and a parent</p>	



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	<p>or guardian of such student athlete, (1) reads written materials, (2) views online training or videos, or (3) attends in-person training regarding the concussion education plan developed or approved pursuant to subsection (c) of this section.</p> <p>(e) (1) On or before July 1, 2015, the State Board of Education, in consultation with the Commissioner of Public Health and the organizations described in subparagraphs (B) to (D), inclusive, of subdivision (1) of subsection (b) of this section, shall develop or approve an informed consent form to distribute to the parents and legal guardians of student athletes involved in intramural or interscholastic athletic activities regarding concussions. Such informed consent form shall include, at a minimum, (A) a summary of the concussion education plan developed or approved pursuant to subsection (c) of this section, and (B) a summary of the applicable local or regional board of education's policies regarding concussions.</p> <p>(2) For the school year commencing July 1, 2015, and each school year thereafter, each school shall provide each participating student athlete's parent or legal guardian with a copy of the informed consent form developed or approved pursuant to subdivision (1) of this subsection and obtain such parent's or legal guardian's signature, attesting to the fact that such parent or legal guardian has received a copy of such form and authorizes the student athlete to participate in the athletic activity.</p> <p>(f) The State Board of Education may revoke the coaching permit, in accordance with the</p>	

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	provisions of subsection (i) of <u>section 10-145b</u> , of any coach found to be in violation of this section.”	
Delaware	<p>“...(d) The Association shall adopt rules and regulations applicable to member schools regarding the appropriate recognition and management of student athletes exhibiting signs or symptoms consistent with a concussion. The rules and regulations shall include, but not be limited to, the following requirements which shall be effective no later than the 2012-2013 school year:</p> <p>(1) Each student athlete and the athlete's parent or guardian shall annually sign and return a concussion information sheet designed by the Association prior to the athlete initiating practice or competition.</p> <p>(2) Each coach shall complete concussion training consistent with a timetable and curriculum established by the Association.”</p>	DEL. CODE ANN. tit. 14, § 303 (2017)
Florida	<p>“...j) The FHSAA shall adopt guidelines to educate athletic coaches, officials, administrators, and student athletes and their parents of the nature and risk of concussion and head injury.</p> <p>(k) The FHSAA shall adopt bylaws or policies that require the parent of a student who is participating in interscholastic athletic competition or who is a candidate for an interscholastic athletic team to sign and return an informed consent that explains the nature and risk of concussion and head injury,</p>	FLA. STAT. § 1006.20 (2017)

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	<p>including the risk of continuing to play after concussion or head injury, each year before participating in interscholastic athletic competition or engaging in any practice, tryout, workout, or other physical activity associated with the student's candidacy for an interscholastic athletic team.”</p>	
<p>Georgia</p>	<p>“...a) As used in this Code section, the term:</p> <p>(1) “Health care provider” means a licensed physician or another licensed individual under the supervision of a licensed physician, such as a nurse practitioner, physician assistant, or certified athletic trainer who has received training in concussion evaluation and management.</p> <p>(2) “Public recreation facility” means a public facility that conducts an organized youth athletic activity in which a participation fee and registration are required.</p> <p>(3) “Youth athlete” means a participant in a youth athletic activity who is seven years of age or older and under 19 years of age.</p> <p>(4) “Youth athletic activity” means an organized athletic activity in which the majority of the participants are youth athletes and are engaging in an organized athletic game or competition against another team, club, or entity or in practice or preparation for an organized game or competition against another team, club, or entity. This term shall not include college or university activities or an activity which is entered into for instructional purposes only, an athletic activity that is incidental to a nonathletic program, youth</p>	<p>GA. CODE ANN. § 20-2324.1 (2017).</p>

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	<p>athletic activities offered through a church or synagogue, or a lesson; provided, however, that colleges, universities, churches, and synagogues, and any other entities that conduct youth athletic activities but are not subject to this Code section are strongly encouraged to establish and implement a concussion management and return to play policy.</p> <p>(b) Each local board of education, administration of a nonpublic school, and governing body of a charter school shall adopt and implement a concussion management and return to play policy comprising not less than the following components:</p> <p>(1) Prior to the beginning of each athletic season of a youth athletic activity, provide an information sheet to all youth athletes' parents or legal guardians which informs them of the nature and risk of concussion and head injury...</p> <p>(c) Each public recreation facility shall, at the time of registration for a youth athletic activity, provide an information sheet to all youth athletes' parents or legal guardians which informs them of the nature and risk of concussion and head injury; provided, however, that public recreation facilities are strongly encouraged to establish and implement a concussion management and return to play policy.</p> <p>(d) The Department of Public Health shall endorse one or more concussion recognition education courses to inform Georgia citizens of the nature and risk of concussions in youth athletics, at least one of which shall be available online. Such course or courses may</p>	

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	<p>include education and training materials made available, at no charge, by the federal Centers for Disease Control and</p> <p>Prevention or other training materials substantively and substantially similar to such materials.”</p>	
Hawaii	<p>“...The department of kinesiology and rehabilitation science of the University of Hawaii, the department of education, and the Hawaii High School Athletic Association shall jointly develop a concussion monitoring and educational program for school athletics and youth athletic activities that shall require:</p> <p style="padding-left: 40px;">(1) Annual concussion awareness training for coaches, administrators, faculty, staff, and sports officials, including:</p> <p style="padding-left: 80px;">(A) The signs and symptoms of a concussion; (B) The need to obtain:</p> <p style="padding-left: 40px;">(i) Proper medical attention for a person suspected of having a concussion; and</p> <p style="padding-left: 40px;">(ii) Medical clearance from health care professionals trained in concussion management, before a person may engage in any type of physical activity, practice, game, or competition;</p> <p style="padding-left: 40px;">(C) Information on the nature and risk of concussions, including the</p> <p>danger of continuing to play after sustaining a concussion and the proper method of allowing a person who has sustained a concussion to</p>	2012 Haw. Sess. Laws 197.

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	<p>return to activity; and</p> <p>(D) Information on the process of a concussed person's return to school, academic and cognitive issues associated with a concussion, and classroom adjustments that the person may require;</p> <p>(2) Annual concussion awareness education for participants in school athletics or youth athletic activities, including the parents of minor or student participants. The individuals required to receive education pursuant to this paragraph shall sign a concussion information sheet that they have attended, received, and viewed this concussion awareness education..."</p>	
Idaho	<p>"...(1) The state board of education and the Idaho high school activities association shall provide access to appropriate guidelines and information that identify the signs and symptoms of a concussion and head injury and describe the nature and risk of concussion and head injury in accordance with standards of the centers for disease control and prevention through a link on the internet website of the board and the Idaho high school activities association.</p> <p>(2) This section shall apply to any middle school, junior high school and high school in the state participating in or administering an organized athletic league or sport. For the purposes of this section, "youth athlete" or "athlete" means an individual who is eighteen (18) years of age or younger and who is a participant in any middle school, junior high</p>	IDAHO CODE § 33-1625 (2017).

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	<p>school or high school athletic league or sport.</p> <p>(3) At the beginning of each sports season before a youth athlete participates in any organized practice or game, the youth athlete and the youth athlete's parent or guardian shall receive the guidelines and information described in subsection (1) of this section from the school for which the athlete plays, and shall review the guidelines and information. Coaches, referees, game officials, game judges and athletic trainers shall review such guidelines and information upon employment and biennially thereafter.</p> <p>(4) Schools shall obtain written consent from the youth athlete's parent or guardian on an annual basis attesting to the fact that the youth athlete's parent or guardian has received a copy of the concussion information and guidelines as outlined in subsection (3) of this section, acknowledges the inherent risk and authorizes the youth athlete to participate in athletic activity.</p> <p>(7) Students who have sustained a concussion and return to school may need informal or formal accommodations, modifications of curriculum, and monitoring by medical or academic staff until the student is fully recovered. A student athlete should be able to resume all normally scheduled academic activities without restrictions or the need for accommodation prior to receiving authorization to return to play by a qualified health care professional as defined in subsection (6) of this section.</p> <p>(8) If an individual reasonably acts in</p>	

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	<p>accordance with the protocol developed pursuant to subsection (5) of this section, then acting upon such protocol shall not form the basis of a claim for negligence in a civil action.</p> <p>(9) Any youth sport organization or association in this state may comply with this section. If a youth sport organization or association is in full compliance with this section, then the youth sport organization or association shall be afforded the same protections from liability in a civil action pursuant to subsection (8) of this section.”</p>	
Illinois	<p>“...c) This Section applies to any interscholastic athletic activity, including practice and competition, sponsored or sanctioned by a school, the Illinois Elementary School Association, or the Illinois High School Association. This Section applies beginning with the 2016-2017 school year.</p> <p>(d) The governing body of each public or charter school and the appropriate administrative officer of a private school with students enrolled who participate in an interscholastic athletic activity shall appoint or approve a concussion oversight team. Each concussion oversight team shall establish a return-to-play protocol, based on peer-reviewed scientific evidence consistent with Centers for Disease Control and Prevention guidelines, for a student's return to interscholastic athletics practice or competition following a force or impact believed to have caused a concussion. Each concussion oversight team shall also establish a return-to-learn protocol, based on peer-reviewed scientific evidence consistent with Centers for</p>	105 ILL. COMP. STAT. 5/22-80 (2016).



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	<p>Disease Control and Prevention guidelines, for a student's return to the classroom after that student is believed to have experienced a concussion, whether or not the concussion took place while the student was participating in an interscholastic athletic activity.</p> <p>(e) A student may not participate in an interscholastic athletic activity for a school year until the student and the student's parent or guardian or another person with legal authority to make medical decisions for the student have signed a form for that school year that acknowledges receiving and reading written information that explains concussion prevention, symptoms, treatment, and oversight and that includes guidelines for safely resuming participation in an athletic activity following a concussion. The form must be approved by the Illinois High School Association...</p> <p>(h)(1) The Illinois High School Association shall approve, for coaches, game officials, and non-licensed healthcare professionals, training courses that provide for not less than 2 hours of training in the subject matter of concussions, including evaluation, prevention, symptoms, risks, and long-term effects. The Association shall maintain an updated list of individuals and organizations authorized by the Association to provide the training.</p> <p>(2) The following persons must take a training course in accordance with paragraph (4) of this subsection (h) from an authorized training provider at least once every 2 years:</p> <p>(A) a coach of an interscholastic athletic</p>	

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	<p>activity;</p> <p>(B) a nurse, licensed healthcare professional, or non-licensed healthcare professional who serves as a member of a concussion oversight team either on a volunteer basis or in his or her capacity as an employee, representative, or agent of a school; and</p> <p>(C) a game official of an interscholastic athletic activity.</p> <p>(3) A physician who serves as a member of a concussion oversight team shall, to the greatest extent practicable, periodically take an appropriate continuing medical education course in the subject matter of concussions.</p> <p>(4) For purposes of paragraph (2) of this subsection (h):</p> <p>(A) a coach, game official, or non-licensed healthcare professional, as the case may be, must take a course described in paragraph (1) of this subsection (h);</p> <p>(B) an athletic trainer must take a concussion-related continuing education course from an athletic trainer continuing education sponsor approved by the Department;</p> <p>(C) a nurse must take a concussion-related continuing education course from a nurse continuing education sponsor approved by the Department;</p> <p>(D) a physical therapist must take a concussion-related continuing education</p>	

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	<p>course from a physical therapist continuing education sponsor approved by the Department;</p> <p>(E) a psychologist must take a concussion-related continuing education course from a psychologist continuing education sponsor approved by the Department;</p> <p>(F) an occupational therapist must take a concussion-related continuing education course from an occupational therapist continuing education sponsor approved by the Department; and</p> <p>(G) a physician assistant must take a concussion-related continuing education course from a physician assistant continuing education sponsor approved by the Department.</p> <p>(5) Each person described in paragraph (2) of this subsection (h) must submit proof of timely completion of an approved course in compliance with paragraph (4) of this subsection (h) to the district superintendent or the superintendent's designee in the case of a public elementary or secondary school, the chief school administrator or that person's designee in the case of a charter school, or the appropriate administrative officer or that person's designee in the case of a private school.</p> <p>(6) A physician, licensed healthcare professional, or non-licensed healthcare professional who is not in compliance with the training requirements under this subsection (h) may not serve on a concussion oversight team</p>	

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	<p>in any capacity.</p> <p>(7) A person required under this subsection (h) to take a training course in the subject of concussions must complete the training prior to serving on a concussion oversight team in any capacity.”</p>	
Indiana	<p>“... (a) Before July 1, 2012, the department shall disseminate guidelines, information sheets, and forms to each school corporation for distribution to a school to inform and educate coaches, student athletes, and parents of student athletes of the nature and risk of concussion and head injury to student athletes, including the risks of continuing to play after concussion or head injury. Sec. 3. Each year, before beginning practice for an interscholastic sport or an intramural sport in which a head coach or assistant coach elects to or is required to comply with this chapter, a student athlete and the student athlete's parent:</p> <p>(1) must be given the information sheet and form described in section 2 of this chapter; and</p> <p>(2) shall sign and return the form acknowledging the receipt of the information to the student athlete's coach.</p> <p>The coach shall maintain a file of the completed forms.</p> <p>(b) Prior to coaching football to individuals who are less than twenty (20) years of age and are in grades 1 through 12, each head football coach and assistant football coach shall complete a certified coaching education course</p>	IND. CODE §§ 20-34-7-1 to -6 (2016).

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	<p>that:</p> <ul style="list-style-type: none"> <li>(1) is sport specific;</li> <li>(2) contains player safety content, including content on:                             <ul style="list-style-type: none"> <li>(A) concussion awareness...</li> <li>(e) An organizing entity shall maintain a file of certificates of completion awarded under subsection (b)(4) to any of the organizing entity's head coaches and assistant coaches.</li> </ul> </li> </ul> <p>Sec. 7. (a) This section applies after June 30, 2017.</p> <p>(b) This section applies to a head coach or assistant coach who:</p> <ul style="list-style-type: none"> <li>(1) coaches any:                             <ul style="list-style-type: none"> <li>(A) interscholastic sport; or</li> <li>(B) intramural sport and elects to comply or as part of the head coach's or assistant coach's coaching certification requirements is required to comply with this chapter; and</li> </ul> </li> <li>(2) is not subject to section 6 of this chapter.</li> <li>(c) Before coaching a student athlete in any sport, a head coach and every assistant coach described in subsection (b) must complete a certified coaching education course that:                             <ul style="list-style-type: none"> <li>(1) contains player safety content on concussion awareness;</li> <li>(2) requires a head coach or an assistant coach to complete a test demonstrating</li> </ul> </li> </ul>	

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	<p>comprehension of the content of the course; and</p> <p>(3) awards a certificate of completion to a head coach or an assistant coach who successfully completes the course.</p> <p>(d) A course described in subsection (c) must be approved by the department, in consultation with a physician licensed under IC 25-22.5 who has expertise in the area of concussions and brain injuries. The department may, in addition to consulting with a physician licensed under IC 25-22.5, consult with other persons who have expertise in the area of concussions and brain injuries.</p> <p>(e) A head coach and every assistant coach described in subsection (b) must complete a course described in subsection (c) at least once each two (2) year period. If a head coach or an assistant coach receives notice from the school that new information has been added to the course before the end of the two (2) year period, the head coach or the assistant coach shall:</p> <p>(1) complete instruction; and</p> <p>(2) successfully complete a test; concerning the new information to satisfy subsection (c).</p> <p>(f) Each school shall maintain all certificates of completion awarded under subsection (c)(3) to each of the school's head coaches and assistant coaches.</p>	

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Iowa	<p>3. Training.</p> <p>a. The department of public health, Iowa high school athletic association, and the Iowa girls high school athletic union shall work together to develop training materials and courses regarding concussions and brain injuries, including training regarding evaluation, prevention, symptoms, risks, and long-term effects of concussions and brain injuries. Each coach or contest official shall complete such training at least every two years.</p> <p>b. Individuals required to complete training pursuant to this subsection shall submit proof of such completion to the Iowa high school athletic association or the Iowa girls high school athletic union, as applicable.</p> <p>4. Guidelines and information sheet.</p> <p>a. The department of public health, Iowa high school athletic association, and the Iowa girls high school athletic union shall work together to distribute the guidelines of the centers for disease control and prevention of the United States department of health and human services and other pertinent information to inform and educate coaches, students, and the parents and guardians of students of the risks, signs, symptoms, and behaviors consistent with a concussion or brain injury, including the danger of continuing to participate in extracurricular interscholastic activities after suffering a concussion or brain injury and their responsibility to report such signs, symptoms, and behaviors if they occur.</p> <p>b. For school years beginning on or after</p>	IOWA CODE § 280.13C(2016)

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	<p>July 1, 2018, each school district and nonpublic school shall provide to the parent or guardian of each student in grades seven through twelve a concussion and brain injury information sheet, as provided by the department of public health, the Iowa high school athletic association, and the Iowa girls high school athletic union. The student and the student's parent or guardian shall sign and return a copy of the concussion and brain injury information sheet to the student's school prior to the student's participation in any extracurricular interscholastic activity..."</p>	
<p>Kansas</p>	<p>"...(c) The state board of education, in cooperation with the Kansas state high school activities association, shall compile information on the nature and risk of concussion and head injury including the dangers and risks associated with the continuation of playing or practicing after a person suffers a concussion or head injury. Such information shall be provided to school districts for distribution to coaches, school athletes and the parents or guardians of school athletes.</p> <p>(d) A school athlete may not participate in any sport competition or practice session unless such athlete and the athlete's parent or guardian have signed, and returned to the school, a concussion and head injury information release form. A release form shall be signed and returned each school year that a student athlete participates in sport competitions or practice sessions."</p>	<p>KAN. STAT. ANN. § 72135 (2017)</p>



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Kentucky	<p>“...(1) (a) The Kentucky Board of Education or organization or agency designated by the board to manage interscholastic athletics shall require each interscholastic coach to complete a sports safety course consisting of training on how to prevent common injuries. The content of the course shall include but not be limited to emergency planning, heat and cold illnesses, emergency recognition, head injuries including concussions, neck injuries, facial injuries, and principles of first aid. The course shall also be focused on safety education and shall not include coaching principles.</p> <p>(b) The state board or its agency shall:</p> <ol style="list-style-type: none"> <li>1. Establish a minimum timeline for a coach to complete the course;</li> <li>2. Approve providers of a sports safety course;</li> <li>3. Be responsible for ensuring that an approved course is taught by qualified professionals who shall either be athletic trainers, registered nurses, physicians, or physician's assistants licensed to practice in Kentucky; and</li> <li>4. Establish the minimum qualifying score for successful course completion.</li> </ol> <p>(c) A course shall be reviewed for updates at least once every thirty (30) months and revised if needed.</p> <p>(d) A course shall be able to be completed through hands-on or online teaching methods in ten (10) clock hours or less.</p>	<p>KY. REV. STAT. ANN. § 160.445 (West 2017)</p>

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	<p>(e) 1. A course shall include an end-of-course examination with a minimum qualifying score for successful course completion established by the board or its agency.</p> <p>2. All coaches shall be required to take the end-of-course examination and shall obtain at least the minimum qualifying score.</p> <p>(f) Beginning with the 2009-2010 school year, and each year thereafter, at least one (1) person who has completed the course shall be at every interscholastic athletic practice and competition.</p> <p>(2) (a) Beginning with the 2012-2013 school year, and each year thereafter, the state board or its agency shall require each interscholastic coach to complete training on how to recognize the symptoms of a concussion and how to seek proper medical treatment for a person suspected of having a concussion. The training shall be approved by the state board or its agency and may be included in the sports safety course required under subsection (1)(a) of this section.</p> <p>(b) The board or its agency shall develop guidelines and other pertinent information or adopt materials produced by other agencies to inform and educate student athletes and their parents or legal guardians of the nature and risk of concussion and head injury, including the continuance of play after concussion or head injury. Any required physical examination and parental authorization shall include acknowledgement of the education information required under this paragraph.</p> <p>(c) Upon request, the board or its agency shall</p>	

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	<p>make available to the public any training materials developed by the board or agency used to satisfy the requirements of paragraph (a) of this subsection. The board or its agency shall not be held liable for the use of any training materials so disseminated.”</p>	
<p>Louisiana</p>	<p>“...A. The governing authority of each public and nonpublic elementary school, middle school, junior high school, and high school shall:</p> <p>(1) Prior to beginning of each athletic season, provide pertinent information to all coaches, officials, volunteers, youth athletes, and their parents or legal guardian which informs of the nature and risk of concussion and head injury, including the risks associated with continuing to play after a concussion or head injury.</p> <p>(2) Require each coach, whether such coach is employed or a volunteer, and every official of a youth athletic activity that involves interscholastic play to complete an annual concussion recognition education course which is in accordance with the provisions of Subsection C of this Section.</p> <p>(3) Require as a condition of participation in any athletic activities that the youth athlete and the youth athlete's parents or legal guardian sign a concussion and head injury information sheet which provides adequate notice of the statutory requirements which must be satisfied in order for an athlete who has or is suspected to have suffered a concussion or head injury to return to play.</p>	<p>LA. STAT. ANN. §§ 40:1089.1-.5 (2016).</p>

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	<p>B. Each private club or public recreation facility and each athletic league which sponsors youth athletic activities shall:</p> <p>(1) Prior to beginning of each athletic season, provide pertinent information to all coaches, officials, volunteers, youth athletes, and their parents or legal guardian which informs of the nature and risk of concussion and head injury, including the risks associated with continuing to play after a concussion or head injury.</p> <p>(2) Require each volunteer coach for a youth athletic activity and each coach with whom the club, facility, or league directly contracts with, formally engages, or employs who coaches a youth athletic activity and each official to complete an annual concussion recognition course which is in accordance with the provisions of Subsection C of this Section.</p> <p>(3) Require as a condition of participation in any athletic activities that the youth athlete and the youth athlete's parents or legal guardian sign a concussion and head injury information sheet which includes but is not limited to adequate notice of the statutory requirements which must be satisfied in order for an athlete who has or is suspected to have sustained a concussion or head injury to return to play.</p> <p>C. (1) The concussion recognition education course required by this Section shall include the following information:</p> <p>(a) How to recognize the signs of and symptoms of a concussion.</p>	

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	<p>(b) The necessity of obtaining proper medical attention for a person suspected of having sustained a concussion.</p> <p>(c) The nature and risk of concussions, including the danger of continuing to play after sustaining a concussion and the proper method and statutory requirements which must be satisfied in order for a youth athlete to return to play in the athletic activity.</p> <p>(2)(a) An organization or association of which a school or school district is a member may designate specific education courses as sufficient to meet the requirements of Subsection A of this Section.</p> <p>(b) Training material made available by the Centers for Disease Control and Prevention “CDC” entitled, “Heads Up: Concussion in Youth Sports” and any amendments or updates thereto, training material made available by the National Federation of High Schools for the Louisiana High School Athletic Association and any amendments or updates thereto, or other training materials substantively and substantially similar to the CDC materials, along with dissemination of a copy of the statutory requirements which must be satisfied in order for a youth athlete who has or is suspected to have sustained a concussion to return to play in the athletic activity, shall be deemed to satisfy the education requirements provided for in this Section.</p> <p>The office of public health within the Louisiana Department of Health shall promulgate and make available to all public</p>	

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	and private middle schools, junior high schools, and high schools, private clubs, public recreation facilities, and each athletic league which sponsors youth athletic activities information which informs of the nature and risk of concussion and head injury, including the risks associated with continuing to play after a concussion or head injury.”	
Maine	<p>“... 1. Training. A requirement that athletic directors, coaches and other school personnel involved with school activities and athletics must be trained in the identification and management of concussive and other head injuries; 2. Student and parental acknowledgment. A requirement that prior to each school year each student participating in a school athletic activity and the student's parent or</p> <p>legal guardian must review the school's policy for the management of concussive and other head injuries and sign a statement acknowledging that review...”</p>	MAINE §254, sub-§17 (2017)
Maryland	<p>“...(b)(1) The Department shall develop policies and implement a program to provide awareness to coaches, school personnel, students, and the parents or guardians of students, in collaboration with the Maryland Department of Health, each county board, the Maryland Public Secondary Schools Athletic Association, the Maryland Athletic Trainers' Association, the Brain Injury Association of Maryland, and representatives of licensed health care providers who treat concussions, on:</p> <p>(i) The nature and risk of a concussion or</p>	MD. CODE ANN., EDUC. § 7-433 (West 2017).

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	<p>head injury;</p> <p>(ii) The criteria for removal from and return to play;</p> <p>(iii) The risks of not reporting injury and continuing to play; and</p> <p>(iv) Appropriate academic accommodations for students diagnosed as having sustained a concussion or head injury.</p> <p>(2) The program shall include a process to verify that a coach has received information on the program developed under paragraph (1) of this subsection.</p> <p>(3)(i) Before a student enrolled in a public school system in the State may participate in an authorized interscholastic athletic activity, the county board shall provide a concussion and head injury information sheet to the student and a parent or guardian of the student.</p> <p>(ii) The student and the parent or guardian of the student shall sign a statement acknowledging receipt of the information sheet.</p> <p>(iii) The Department shall create the information sheet and acknowledgment statement required under this paragraph.</p> <p>(4) The Department may use materials available from the Centers for Disease Control and Prevention, the Brain Injury Association of Maryland, or any other appropriate entity to carry out the requirements of this subsection.</p> <p>(d)(1) Before an individual participates in an</p>	

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	<p>authorized athletic activity on school property, the county board shall provide, or require that a third party provide:</p> <p>(i) Information on concussions and head injuries to the individual and, if applicable, a parent or guardian of the individual; and</p> <p>(ii) Notice that acknowledgment of the receipt of the information by the individual and, if applicable, the parent or guardian of the individual, is required.</p> <p>(2) The information required under paragraph (1) of this subsection shall be in the form of:</p> <p>(i) A separate information sheet; or</p> <p>(ii) A notice on the registration form for a youth sports program stating that information on concussion and head injury is available, including directions on how to receive the information electronically.</p> <p>(3) The individual and, if applicable, the parent or guardian of the individual shall:</p> <p>(i) Acknowledge receipt of the information by:</p> <ol style="list-style-type: none"> <li>1. Signature;</li> <li>2. Checking an acknowledgment box on the registration form; or</li> <li>3. Another method of written or electronic acknowledgment; and</li> </ol> <p>(ii) Return the acknowledgment to the county board or third party.”</p>	



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Massachusetts	<p>“...(a) The department shall direct the division of violence and injury prevention to develop an interscholastic athletic head injury safety training program in which all public schools and any school subject to the Massachusetts Interscholastic Athletic Association rules shall participate. Participation in the program shall be required annually of coaches, trainers and parent volunteers for any extracurricular athletic activity; physicians and nurses who are employed by a school or school district or who volunteer to assist with an extracurricular athletic activity; school athletic directors; directors responsible for a school marching band; and a parent or legal guardian of a child who participates in an extracurricular athletic activity.</p> <p>In developing the program, the division may use any of the materials readily available from the Centers for Disease Control and Prevention. The program shall include, but not be limited to: (1) current training in recognizing the symptoms of potentially catastrophic head injuries, concussions and injuries related to second impact syndrome; and (2) providing students that participate in any extracurricular athletic activity, including membership in a marching band, the following information annually: a summary of department rules and regulations relative to safety regulations for students participation in extracurricular athletic activities, including the medical protocol for post-concussion participation or participation in an extracurricular athletic activity; written information related to the recognition of symptoms of head injuries, the biology and the short-term and long-term consequences of a</p>	MASS. GEN. LAW SCH. 111, § 222 (2017)

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	<p>concussion...</p> <p>(b) The department shall develop forms on which students shall be instructed to provide information relative to any sports head injury history at the start of each sports season. These forms shall require the signature of both the student and the parent or legal guardian thereof. Once complete, the forms shall be forwarded to all coaches prior to allowing any student to participate in an extracurricular athletic activity so as to provide coaches with up-to-date information relative to an athlete's head injury history and to enable coaches to identify students who are at greater risk for repeated head injuries.</p> <p>(d) A coach, trainer or volunteer for an extracurricular athletic activity shall not encourage or permit a student participating in the activity to engage in any unreasonably dangerous athletic technique that unnecessarily endangers the health of a student, including using a helmet or any other sports equipment as a weapon..."</p>	
Michigan	<p>"...(1) Before June 27, 2013, the department shall develop, adopt, or approve educational materials on the nature and risk of concussions.</p> <p>(2) Before June 27, 2013, the department shall develop, adopt, or approve a concussion awareness training program in an electronic format that includes all of the following:</p> <p>(a) The nature and risk of concussions.</p> <p>(b) The criteria for the removal of an</p>	MICH. COMP. LAWS §§ 333.9155-.9156 (2016).

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	<p>athlete from physical participation in an athletic activity due to a suspected concussion and his or her return to that athletic activity.</p> <p>(c) The risks to an athlete of not reporting a suspected concussion and continuing to physically participate in the athletic activity.</p> <p>(3) As soon as they are available, the department shall make the educational materials and training program required under this section available to the public on the department's internet website. The department shall make the training program available to all individuals required to participate in the program under section 9156<del>1</del> and to any interested individual including school personnel, coaches, parents, students, and athletes. The department shall periodically review the training program required under this section and, for purposes of section 9156, make recommendations regarding the frequency of the training program based on changes to the training program that are developed, adopted, or approved by the department.</p> <p>(2) Before a youth athlete may participate in an athletic activity sponsored by or operated under the auspices of an organizing entity, the organizing entity shall do all of the following:</p> <p>(a) Comply with all the requirements of this section with regard to its coaches, employees, volunteers, and other adults who are involved with the participation of youth athletes in athletic activity sponsored by or operated under the auspices of that organizing entity and who are required to participate in</p>	

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	<p>the concussion awareness training program developed under section 9155.<u>1</u></p> <p>(b) Ensure that each coach, employee, volunteer, and other adult who is required to participate in the concussion awareness training program developed under section 9155 completes the training program once every 3 years, unless the department recommends more frequent training.</p> <p>(c) Provide the educational materials developed under section 9155 to each youth athlete who participates in an athletic activity sponsored by or operated under the auspices of the organizing entity and a parent or guardian of the youth athlete.</p> <p>(d) Obtain a statement signed by each youth athlete and a parent or guardian of the youth athlete acknowledging receipt of the educational material developed under section 9155. The organizing entity shall maintain the statement obtained under this subdivision in a permanent file for the duration of that youth athlete's participation in athletic activity sponsored by or operated under the auspices of that organizing entity or until the youth athlete is 18 years of age. Upon request, the organizing entity shall make the statements obtained under this subdivision available to the department.”</p>	
Minnesota	“...(a) Consistent with <u>section 121A.38</u> , any municipality, business, or nonprofit organization that organizes a youth athletic activity for which an activity fee is charged shall:	MINN. STAT. §§ 121A.37.38 (2017).

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	<p>(1) make information accessible to all participating coaches, officials, and youth athletes and their parents or guardians about the nature and risks of concussions, including the effects and risks of continuing to play after receiving a concussion, and the protocols and content, consistent with current medical knowledge from the Centers for Disease Control and Prevention, related to:</p> <ul style="list-style-type: none"> <li>(i) the nature and risks of concussions associated with athletic activity;</li> <li>(ii) the signs, symptoms, and behaviors consistent with a concussion;</li> <li>(iii) the need to alert appropriate medical professionals for urgent diagnosis and treatment when a youth athlete is suspected or observed to have received a concussion; and</li> <li>(iv) the need for a youth athlete who sustains a concussion to follow proper medical direction and protocols for treatment and returning to play; and</li> </ul> <p>(2) require all participating coaches and officials to receive initial online training and online training at least once every three calendar years thereafter, consistent with clause (1) and the Concussion in Youth Sports online training program available on the Centers for Disease Control and Prevention Web site.”</p>	

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Mississippi	<p>“...Each local board of education, administration of a nonpublic school, and governing body of a charter school shall adopt and implement a concussion management and return to play policy that includes the following components:</p> <p>(a) Parents or guardians shall receive and sign a copy of the concussion policy before the start of the regular school athletic event season.”</p>	MISS. CODE ANN. § 3724-5 (2017).
Missouri	<p>“...1. The provisions of this section shall be known as the “Interscholastic Youth Sports Brain Injury Prevention Act”. No later than December 31, 2011, the department of health and senior services shall work with a statewide association of school boards, a statewide activities association that provides oversight for athletic or activity eligibility for students and school districts, and an organization named by the department of health and senior services that specializes in support services, education, and advocacy of those with brain injuries to promulgate rules which develop guidelines, pertinent information, and forms to educate coaches, youth athletes, and parents or guardians of youth athletes of the nature and risk of concussion and brain injury including continuing to play after concussion or brain injury. The primary focus of rules promulgated under this section shall be the safety and protection against long-term injury to the youth athlete.</p> <p>2. On a yearly basis, each school district shall distribute a concussion and brain injury information sheet to each youth athlete participating in the district's athletic program. The information form shall be signed by the</p>	MO. REV. STA. § 167t.765 (2016).

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	youth athlete's parent or guardian and submitted to the school district prior to the youth athlete's participation in any athletic practice or competition.”	
Montana	<p>“...(1) Each school district, nonpublic school, or youth athletic organization in this state offering organized youth athletic activities shall adopt policies and procedures to inform coaches, officials, youth athletes, and parents or guardians of the nature and risk of brain injuries, including the effects of continuing to play after a concussion. The policies, content, and protocols must be consistent with current medical knowledge as to:</p> <ul style="list-style-type: none"> <li>(a) the nature and risk of brain injuries associated with athletic activity;</li> <li>(b) the signs, symptoms, and behaviors consistent with a brain injury;</li> <li>(c) the need to alert a licensed health care professional for urgent recognition and treatment when a youth athlete exhibits signs, symptoms, or behaviors consistent with a concussion; and</li> <li>(d) the need to follow proper medical direction and protocols for treatment and returning to play after a youth athlete sustains a concussion.</li> </ul> <p>(2) A form documenting that educational materials referred to in subsection (1) have been provided to and viewed by each youth athlete and the youth athlete's parent or guardian must be signed by each youth athlete and the youth athlete's parent or guardian and</p>	MONT. CODE ANN. §§ 20-7-1301 to - 1304 (2017)

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	<p>returned to an official designated by the school district, nonpublic school, or youth athletic organization prior to the youth athlete's participation in organized youth athletic activities. The form must apply for a period not to exceed 1 year.</p> <p>(3) School districts, nonpublic schools, and youth athletic organizers shall ensure access to a training program consistent with subsection (1). Each coach and official participating in organized youth athletic activities shall complete the training program at least once each year.</p> <p>(4) School districts, nonpublic schools, and youth athletic organizations may invite the participation of appropriate advocacy groups and appropriate sports governing bodies to facilitate the requirements of subsections (1) through (3).”</p>	
Nebraska	<p>“(1) Each approved or accredited public, private, denominational, or parochial school shall:</p> <p>(a) Make available training approved by the chief medical officer on how to recognize the symptoms of a concussion or brain injury and how to seek proper medical treatment for a concussion or brain injury to all coaches of school athletic teams;</p> <p>(b) Require that concussion and brain injury information be provided on an annual basis to students and the students' parents or guardians prior to such students initiating practice or competition. The information provided to students and the students' parents</p>	NEB. REV. STAT. §§ 719101 to 9106 (2016)



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	<p>or guardians shall include, but need not be limited to:</p> <ul style="list-style-type: none"> <li>(i) The signs and symptoms of a concussion;</li> <li>(ii) The risks posed by sustaining a concussion; and</li> <li>(iii) The actions a student should take in response to sustaining a concussion, including the notification of his or her coaches; and</li> </ul> <p>(c) Establish a return to learn protocol for students that have sustained a concussion. The return to learn protocol shall recognize that students who have sustained a concussion and returned to school may need informal or formal accommodations, modifications of curriculum, and monitoring by medical or academic staff until the student is fully recovered.</p> <p>(1) Any city, village, business, or nonprofit organization that organizes an athletic activity in which the athletes are nineteen years of age or younger and are required to pay a fee to participate in the athletic activity or whose cost to participate in the athletic activity is sponsored by a business or nonprofit organization shall:</p> <ul style="list-style-type: none"> <li>(a) Make available training approved by the chief medical officer on how to recognize the symptoms of a concussion or brain injury and how to seek proper medical treatment for a concussion or brain injury to all coaches; and</li> <li>(b) Provide information on concussions and brain injuries to all coaches and athletes</li> </ul>	

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	<p>and to a parent or guardian of each athlete that shall include, but need not be limited to:</p> <p>(i) The signs and symptoms of a concussion;</p> <p>(ii) The risks posed by sustaining a concussion; and</p> <p>(iii) The actions an athlete should take in response to sustaining a concussion, including the notification of his or her coaches.”</p>	
Nevada	<p>“...1. The Nevada Interscholastic Activities Association shall adopt a policy concerning the prevention and treatment of injuries to the head which may occur during a pupil's participation in interscholastic activities and events, including, without limitation, a concussion of the brain. The policy must provide information concerning the nature and risk of injuries to the head which may occur during a pupil's participation in interscholastic activities and events, including, without limitation, the risks associated with continuing to participate in the activity or event after sustaining such an injury...</p> <p>3. Before a pupil participates in an interscholastic activity or event, and on an annual basis thereafter, the pupil and his or her parent or legal guardian:</p> <p>(a) Must be provided with a copy of the policy adopted pursuant to subsection 1; and</p> <p>(b) Must sign a statement on a form prescribed by the Nevada Interscholastic Activities Association acknowledging that the pupil and his or her parent or guardian have</p>	NEV. REV. STAT. § 385B.080 (2016)

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	read and understand the terms and conditions of the policy.”	
New Hampshire	“...Education is the key to identification and appropriate management of all concussions. The school board of each school district shall develop guidelines and other pertinent information and forms for student sports to inform and educate coaches, student-athletes, and student-athletes' parents or guardians of the nature and risk of concussion and head injury including continuing to play after concussion or head injury. On an annual basis, a school district or school shall distribute a concussion and head injury information sheet to all student athletes. The Brain Injury Association of New Hampshire is available to educate and assist the public with implementing and/or updating concussion management protocols.”	N.H. REV. STAT. ANN. §§ 200:49:52 (2017).
New Jersey	“...a. The Department of Education shall work to develop and implement, by the 2011-2012 school year, an athletic head injury safety training program. The program shall be completed by a school physician, a person who coaches a public school district or nonpublic school interscholastic sport, intramural sport, or cheerleading program, and an athletic trainer involved in a public or nonpublic school interscholastic sports program, intramural sports program, or cheerleading program. The safety training program shall include, but need not be limited to, the following:	N.J. STAT. ANN. §§ 18A:40-41.1 to -41.7 (West 2017)

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	<p>(1) the recognition of the symptoms of head and neck injuries, concussions, and injuries related to second-impact syndrome; and</p> <p>(2) the appropriate amount of time to delay the return to competition or practice of a student-athlete or cheerleader who has sustained a concussion or other head injury.</p> <p>b. The department shall update the safety training program as necessary to ensure that it reflects the most current information available on the nature, risk, and treatment of sports-related concussions and other head injuries.</p> <p>c. The department shall develop an educational fact sheet that provides information about sports-related concussions and other head injuries. A school district or a nonpublic school that participates in an interscholastic sports program, intramural sports program, or cheerleading program shall distribute the educational fact sheet annually to the parents or guardians of student-athletes and cheerleaders and shall obtain a signed acknowledgment of the receipt of the fact sheet by the student-athlete or cheerleader and his parent or guardian.</p> <p>d. As used in <u>P.L.2010, c. 94 (C.18A:40-41.1 et seq.)</u>, “student-athlete” means any student enrolled in a public or nonpublic school in this State who is a participant in an interscholastic sports program or intramural sports program organized by the school.”</p>	

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New Mexico	<p>“... C. Each school district shall ensure that each coach participating in school athletic activities and each student athlete in the school district receives training provided pursuant to Paragraph (1) of Subsection D of this section.</p> <p>D. The New Mexico activities association shall consult with the brain injury advisory council and school districts to promulgate rules to establish:</p> <p>(1) protocols and content consistent with current medical knowledge for training each coach participating in school athletic activities and each student athlete to:</p> <p>(a) understand the nature and risk of brain injury associated with athletic activity;</p> <p>(b) recognize signs, symptoms or behaviors consistent with a brain injury when a coach or student athlete suspects or observes that a student athlete has received a brain injury;</p> <p>(c) understand the need to alert appropriate medical professionals for urgent diagnosis or treatment; and</p> <p>(d) understand the need to follow medical direction for proper medical protocols; and</p> <p>(2) the nature and content of brain injury training and information forms and educational materials for, and the means of providing these forms and materials to, coaches, student athletes and student athletes' parents or guardians regarding the nature and risk of brain injury resulting from athletic activity, including the risk of continuing or returning to</p>	N.M. STAT. ANN. § 2213-31 (2017)

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	<p>athletic activity after a brain injury.</p> <p>E. At the beginning of each academic year or the first participation in school athletic activities by a student athlete during an academic year, a school district shall provide a brain injury training and information form created pursuant to Subsection D of this section to a student athlete and the student athlete's parent or guardian. The school district shall receive signatures on the brain injury training and information form from the student athlete and the student athlete's parent or guardian confirming that the student athlete has received the brain injury training required by this section and that the student athlete and parent or guardian understand the brain injury information before permitting the student athlete to begin or continue participating in school athletic activities for that academic year. The form required by this subsection may be contained on the student athlete sport physical form...</p> <p>C. Each youth athletic league shall ensure that each coach participating in youth athletic activities and each youth athlete in the league receives training provided pursuant to Paragraph (1) of Subsection D of this section.</p> <p>D. The department of health shall consult with the brain injury advisory council to promulgate rules to establish...</p> <p>(2) the nature and content of brain injury training and information forms and educational materials for, and the means of providing these forms and materials to, coaches, youth athletes and youth athletes'</p>	

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	<p>parents or guardians regarding the nature and risk of brain injury resulting from youth athletic activity, including the risk of continuing or returning to youth athletic activity after a brain injury.</p> <p>E. At the beginning of each youth athletic activity season or the first participation in youth athletic activities by a youth athlete during a youth athletic activity season, a youth athletic league shall provide a brain injury training and information form created pursuant to Subsection D of this section to a youth athlete and the youth athlete's parent or guardian. The youth athletic league shall receive signatures on the brain injury training and information form from the youth athlete and the youth athlete's parent or guardian confirming that the youth athlete has received the brain injury training required by this section and that the youth athlete and parent or guardian understand the brain injury information before permitting the youth athlete to begin or continue participating in youth athletic activities for the athletic season or term of participation.”</p>	
New York	<p>“...42. a. The commissioner, in conjunction with the commissioner of health, shall promulgate and review as necessary rules and regulations relating to pupils who suffer mild traumatic brain injuries, also referred to as a “concussion,” while receiving instruction or engaging in any school sponsored or related activity. In developing such rules and regulations, the commissioner shall consider comments from stakeholders and other interested parties including but not limited to parents, teachers, students, school</p>	<p>N.Y. EDUC. LAW § 305(42) (McKinney 2017).</p>

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	<p>administrators, school athletic trainers, sport coaches, medical and health professionals, the public schools athletic league (PSAL), the New York state public high school athletic association (NYSPHSAA), and other athletic associations. Such regulations shall include, but not be limited to:</p> <p>(i) requiring a course of instruction relating to recognizing the symptoms of mild traumatic brain injuries and monitoring and seeking proper medical treatment for pupils who suffer mild traumatic brain injuries. Such course of instruction shall be required to be completed on a biennial basis by all school coaches, physical education teachers, nurses and athletic trainers. The course of instruction required by this subparagraph shall include, but not be limited to, the definition of a “concussion,” signs and symptoms of mild traumatic brain injuries, how such injuries may occur, practices regarding prevention, and the guidelines for the return to school and to certain school activities after a pupil has suffered a mild traumatic brain injury regardless of whether such injury occurred outside of school. Such training may be completed by means of courses of instruction, including but not limited to, courses provided online and by teleconference approved by the department;</p> <p>(ii) providing that the department and the department of health shall post on their internet websites information relating to mild traumatic brain injuries, which shall include but not be limited to, the definition of a “concussion,” signs and symptoms of mild traumatic brain injuries, how such injuries may occur, and the</p>	



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	<p>guidelines for the return to school and to certain school activities after a</p> <p>pupil has suffered a mild traumatic brain injury regardless of whether such injury occurred outside of school. Schools shall be required to include such information in any permission form or parent or person in parental relation consent form or similar document that may be required for a pupil's participation in interscholastic sports and shall also include such information, or reference how to obtain such information from the department and the department of health internet websites, on the school's internet website, if one exists...</p> <p>(iv) authorizing each school or school district, in its discretion, to establish a concussion management team which may be composed of the athletic director (if any), a school nurse, the school physician, a coach of an interscholastic team, an athletic trainer or such other appropriate personnel as designated by the school or school district. The concussion management team shall oversee the implementation of the rules and regulations promulgated pursuant to this subdivision as it pertains to their associated school including the requirement that all school coaches, physical education teachers, nurses and athletic trainers that work with and provide instruction to pupils engaged in school sponsored athletic activities complete training relating to mild traumatic brain injuries.</p> <p>Furthermore, every concussion management team may establish and implement a program which provides information on mild traumatic brain injuries to parents and persons in parental</p>	

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	relation throughout each school year.”	
North Carolina	<p>“...(a) The Matthew A. Gfeller Sport-Related Traumatic Brain Injury Research Center at UNC-Chapel Hill in consultation with the North Carolina Medical Society, the North Carolina Athletic Trainers Association, the Brain Injury Association of North Carolina, the North Carolina Neuropsychological Society, the North Carolina High School Athletic Association, Inc., and the Department of Public Instruction shall develop an athletic concussion safety training program. The program shall be developed for the use of coaches, school nurses, school athletic directors, volunteers, students who participate in interscholastic athletic activities in the public schools, and the parents of these students.</p> <p>SECTION 2.(b) The program shall include, but not be limited to, the following:</p> <p>(1) Written information detailing the recognition of the signs and symptoms of concussions and other head injuries.</p> <p>(2) A description of the physiology and the potential short-term and long-term effects of concussions and other head injuries.</p> <p>(3) The medical return-to-play protocol for post-concussion participation in interscholastic athletic activities.</p> <p>Concussion safety requirements for</p>	N.C. GEN. STAT. § 115C-12.23 (2016)

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	<p>interscholastic athletic competition.</p> <p>SECTION 3. G.S. 115C-12(23) reads as rewritten:</p> <p>“(23) Power to Adopt Eligibility Rules for Interscholastic Athletic Competition. - The State Board of Education shall adopt rules governing interscholastic athletic activities conducted by local boards of education, including eligibility for student participation. With regard to middle schools and high schools, the rules shall provide for the following:</p> <p>a. All coaches, school nurses, athletic directors, first responders, volunteers, students who participate in interscholastic athletic activities, and the parents of those students shall receive, on an annual basis, a concussion and head injury information sheet. School employees, first responders, volunteers, and students must sign the sheet and return it to the coach before they can participate in interscholastic athletic activities, including tryouts, practices, or competition. Parents must sign the sheet and return it to the coach before their children can participate in any such interscholastic athletic activities. The signed sheets shall be maintained in accordance with sub-subdivision d. of this subdivision.”</p>	
North Dakota	<p>“...1. Each school district and nonpublic school that sponsors or sanctions any athletic activity in this state and requires a participating student to regularly practice or train, and compete, is subject to the terms of a</p>	<p>N.D. CENT. CODE § 15.1-18.2-04 (2017)</p>

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	<p>concussion management program...</p> <p>7. The student's school district or nonpublic school shall ensure that before a student is allowed to participate in the athletic activity described in subsection 1, the student and the student's parent shall document that they have viewed information regarding concussions incurred by students participating in athletic activities. The required information must be provided by the student's school district or nonpublic school and must be made available in printed form or in a verifiable electronic format.”</p>	
Ohio	<p>“... (B) No school district board of education or governing authority of a chartered or nonchartered nonpublic school shall permit a student to practice for or compete in interscholastic athletics until the student has submitted, to a school official designated by the board or governing authority, a form signed by the parent, guardian, or other person having care or charge of the student stating that the student and the parent, guardian, or other person having care or charge of the student have received the concussion and head injury information sheet required by <u>section 3707.52 of the Revised Code</u>. A completed form shall be submitted each school year, as defined in <u>section 3313.62 of the Revised Code</u>, for each sport or other category of interscholastic athletics for or in which the student practices or competes.</p> <p>(C)(1) No school district board of education or governing authority of a chartered or nonchartered nonpublic school shall permit an individual to coach interscholastic athletics</p>	OHIO REV. CODE ANN. § 3313.539 (West 2016).

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	<p>unless the individual holds a pupil-activity program permit issued under <u>section 3319.303 of the Revised Code</u> for coaching interscholastic athletics.</p> <p>(2) No school district board of education or governing authority of a chartered or nonchartered nonpublic school shall permit an individual to referee interscholastic athletics unless the individual holds a pupil-activity program permit issued under <u>section 3319.303 of the Revised Code</u> for coaching interscholastic athletics or presents evidence that the individual has successfully completed, within the previous three years, a training program in recognizing the symptoms of concussions and head injuries to which the department of health has provided a link on its internet web site under <u>section 3707.52 of the Revised Code</u> or a training program authorized and required by an organization that regulates interscholastic athletic competition and conducts interscholastic athletic events.”</p>	
Oklahoma	<p>“...B. The State Department of Health shall create a concussion management section on its website to provide the guidelines necessary for each school district board of education and youth sports organization to develop their own policies and procedures pertaining to, but not limited to:</p> <p>1. A concussion and head injury information sheet for game officials, team officials, athletes, parents or guardians and other persons having care or charge of athletes of the signs and symptoms of concussion or</p>	OKLA. STAT. tit. 70, § 24-155 (2017)

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	<p>head injury and the risk of continuing to practice or compete in an athletic event or activity after sustaining a concussion or head injury;</p> <p>2. “Return to Learn” guidelines for teachers and relevant school personnel pertaining to athletes who are returning to the classroom after sustaining a concussion or head injury;</p> <p>3. “Graduated Stepwise Return to Athletic Participation” guidelines for team officials pertaining to athletes returning to practice or competition after a concussion or head injury; and</p> <p>4. Links to one or more free online concussion training programs as provided by the Centers for Disease Control and Prevention (CDC), the National Federation of State High School Associations (NFHS) or a comparable program or resource.</p> <p>C. Each school district board of education and youth sports organization or association shall develop policies and procedures pursuant to subsection B of this section to inform and educate their respective coaches, game officials, team officials, athletes and their parents or guardians of the nature and risk of concussion and head injury, including continuing to play after concussion or head injury. On an annual basis, information regarding concussion and head injuries shall be disseminated to the athlete and his or her parent or guardian. Acknowledgment and understanding of the information shall be completed by the athlete and the athlete's</p>	

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	<p>parent or guardian and maintained by the school or the youth sports organization or association prior to the athlete's participation in practice or competition.</p> <p>1. On an annual basis, game officials and team officials shall undergo concussion training provided by the CDC, the NFHS or a comparable program or resource. A record of completion of the training course shall be readily available upon request.”</p>	
Oregon	<p>“...(2)(a) Each school district shall ensure that coaches receive annual training to learn how to recognize the symptoms of a concussion and how to seek proper medical treatment for a person who is suspected of having a concussion.</p> <p>(b) The board shall establish by rule:</p> <p>(A) The requirements of the training described in paragraph (a) of this subsection, which shall be provided by using community resources to the extent practicable; and</p> <p>(B) Timelines to ensure that, to the extent practicable, every coach receives the training described in paragraph (a) of this subsection before the beginning of the season for the school athletic team.”</p>	OR. REV. STAT. §§ 336.485, 417.875 (2016).
Pennsylvania	<p>“...(a) <b>Educational materials.</b>--The Department of Health and the Department of Education shall develop and post on their Internet websites guidelines and other relevant materials to inform and educate students participating in or desiring to participate in an athletic activity, their parents and their coaches</p>	24 PA. CONS. STAT. §§ 5322-5323 (2016)

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	<p>about the nature and risk of concussion and traumatic brain injury, including the risks associated with continuing to play or practice after a concussion or traumatic brain injury. In developing the guidelines and materials, the departments shall utilize existing materials developed by the Centers for Disease Control and Prevention. A student participating in or desiring to participate in an athletic activity and the student's parent or guardian shall each school year, prior to participation by the student in an athletic activity, sign and return to the student's school an acknowledgment of receipt and review of a concussion and traumatic brain injury information sheet developed under this subsection.</p> <p><b>(e) Training course.</b>--Once each school year, a coach shall complete the concussion management certification training course offered by the Centers for Disease Control and Prevention, the National Federation of State High School Associations or another provider approved by the Department of Health. A coach shall not coach an athletic activity until the coach completes the training course required under this subsection.”</p>	
Rhode Island	<p>“(a) The department of education and the department of health shall work in concert with the Rhode Island Interscholastic League to develop and promulgate guidelines to inform and educate coaches, teachers, school nurses, youth athletes, and their parents and/or guardians of the nature and risk of concussion and head injury, including continuing to play after concussion or head injury. A concussion and head injury information sheet shall be signed and returned by the youth athlete and</p>	16 R.I. GEN. LAWS §§ 16-91-1 to -4 (2016)



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	<p>the athlete's parent and/or guardian prior to the youth athlete's return to practice or competition.</p> <p>(b) School districts are required to use training materials made available by the United States Center for Disease Control and Prevention entitled “Heads Up:</p> <p>Concussion in the High School Sports/Concussion in Youth Sports” and any updates or amendments thereto, or training materials substantively and substantially similar thereto. The department of education shall post training materials made available by the Center for Disease Control and Prevention and the Rhode Island Interscholastic League on its website. All coaches and volunteers involved in a youth sport or activity covered by this chapter must complete a training course and a refresher course annually thereafter in concussions and traumatic brain injuries. All school nurses must complete a training course and an annual refresher course in concussions and traumatic brain injuries. Teachers and teachers' aides are strongly encouraged to complete the training course in concussions and traumatic brain injuries. Training may consist of videos, classes, and any other generally accepted mode and medium of providing information.</p> <p>(c) School districts are encouraged to have all student athletes perform baseline neuropsychological testing, computerized or otherwise. Parents and/or guardians shall be provided with information as to the risk of concussion and/or traumatic brain injuries prior to the start of every sport season and they shall</p>	

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	sign an acknowledgement as to their receipt of such information.”	
South Carolina	<p>“(A) The South Carolina Department of Health and Environmental Control, in consultation with the State Department of Education, shall post on its website nationally recognized guidelines and procedures regarding the identification and management of suspected concussions in student athletes. The Department of Health and Environmental Control also shall post on its website model policies that incorporate best practices guidelines for the identification, management, and return to play decisions for concussions reflective of current scientific and medical literature developed by resources from or members of sports medicine community organizations including, but not limited to, the Brain Injury Association of South Carolina, the South Carolina Medical Association, the South Carolina Athletic Trainer's Association, the National Federation of High Schools, the Centers for Disease Control and Prevention, and the American Academy of Pediatrics. Guidelines developed pursuant to this section apply to South Carolina High School League-sanctioned events.</p> <p>(B) A local school district shall develop guidelines and procedures based on the model guidelines and procedures referenced in subsection (A).</p> <p>(C) Each year prior to participation in athletics, each school district shall provide to</p>	S.C. CODE ANN. § 59-63-75 (2016).

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	<p>all coaches, volunteers, student athletes, and their parents or legal guardian, an information sheet on concussions which informs of the nature and risk of concussion and brain injury, including the risks associated with continuing to play after a concussion or brain injury. The parent or legal guardian's receipt of the information sheet must be documented in writing or by electronic means before the student athlete is permitted to participate in an athletic competition or practice.”</p>	
<p>South Dakota</p>	<p>“...The South Dakota High School Activities Association, in concert with the 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, including continuing to play after sustaining a concussion. A concussion information sheet shall be signed and returned by any athlete who seeks to compete in activities sanctioned by the South Dakota High School Activities Association and the athlete's parent or guardian prior to the athlete's participation in any youth athletic activities sanctioned by the South Dakota High School Activities Association. A signed information sheet is effective for one academic year.</p> <p>The guidelines and information sheet shall include protocols and content consistent with current medical knowledge for informing and educating each member school, coach, and athlete participating in athletic activities sanctioned by the South Dakota High School Activities Association, and the athlete's parent or guardian as to:</p>	<p>S.D. CODIFIED LAWS §§ 1336-4 to -14 (2017)</p>

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	<p>(1) The nature and risk of concussions associated with athletic activity;</p> <p>(2) The signs, symptoms, and behaviors consistent with a concussion;</p> <p>(3) The need to alert appropriate medical professionals for urgent diagnosis or treatment if an athlete is suspected to have received a concussion; and</p> <p>(4) The need to follow proper medical direction and protocols for treatment and return to play after an athlete sustains a concussion.</p> <p>The South Dakota High School Activities Association and the South Dakota Department of Education shall develop a training program consistent with § 13-36-9. Each coach participating in athletic activities sanctioned by the South Dakota High School Activities Association shall complete the training program each academic year.”</p>	
Tennessee	<p>“(a) This section applies to school youth athletic activity.</p> <p>(b)(1) The governing authority of each public and nonpublic elementary school, middle school, junior high school and high school, working through guidance approved by the department of health and communicated through the department of education, shall at a minimum:</p> <p>(A) Adopt guidelines and other pertinent information and forms as approved by the</p>	TENN. CODE ANN. §§ 68-55-501 to 503 (2016).

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	<p>department of health to inform and educate coaches, school administrators, youth athletes and their parents or guardians of the nature, risk and symptoms of concussion and head injury, including continuing to play after concussion or head injury;</p> <p>(B) Require annual completion by all coaches, whether the coach is employed or a volunteer, and by school athletic directors of a concussion recognition and head injury safety education course program approved by the department. In developing the program, the department may use any of the materials readily available from the centers for disease control and prevention, but shall include the centers' concussion signs and symptoms checklist which must be used by a licensed health care professional, coach or other designated person making a determination as to whether a youth athlete exhibits signs, symptoms or behaviors consistent with a concussion. The department shall make the concussion recognition and head injury safety education course program available on its web site for any school to access free of charge. The program shall include, but not be limited to:</p> <p>(i) Current training in recognizing the signs and symptoms of potentially catastrophic head injuries, concussions and injuries related to second impact syndrome;</p> <p>(ii) The necessity of obtaining proper medical attention for a person suspected of having sustained a concussion; and</p> <p>(iii) The nature and risk of concussions,</p>	

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	<p>including the danger of continuing to play after sustaining a concussion and the proper method and statutory requirements that must be satisfied in order for a youth athlete to return to play in the athletic activity;</p> <p>(C) Require that, on a yearly basis, a concussion and head injury information sheet be signed and returned by each coach and athletic director and, if appointed, a licensed health care professional to the lead administrator of a nonpublic school or, for a public school, the local education agency's director of schools prior to initiating practice or competition for the year;</p> <p>(D) Require that, on a yearly basis, a concussion and head injury information sheet be reviewed by all youth athletes and an athlete's parent or guardian. The information sheet shall be signed and returned by the youth athlete, if the youth athlete is eighteen (18) years of age or older, otherwise by the athlete's parent or guardian, prior to the youth athlete's initiating practice or competition to confirm that both the parent or guardian and the youth athlete have reviewed the information and understand its contents. The information sheet shall include, but not be limited to:</p> <p>(i) Written information related to the recognition of symptoms of head injuries;</p> <p>(ii) The biology and the short-term and long-term consequences of a concussion written in layman's terminology;</p> <p>(iii) A summary of state board of education rules and regulations relative to safety regulations for the student's</p>	

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	<p>participation in extracurricular athletic activities; and</p> <p>(iv) The medical standard of care for post-concussion participation or participation in an extracurricular athletic activity;</p> <p>(E) Maintain all documentation of the completion of a concussion recognition and head injury safety education course program and signed concussion and head injury information sheets for a period of three (3) years...</p> <p>(a) This section applies to community-based youth athletic activity.</p> <p>(b)(1) Any city, county, business or nonprofit organization that organizes a community-based youth athletic activity for which an activity fee is charged, working through guidance from the department of health, shall at a minimum:</p> <p>(A) Adopt guidelines and other pertinent information and forms as developed by the department of health to inform and educate the director of the youth athletic activity, coaches, youth athletes and their parents or guardians of the nature, risk and symptoms of concussion and head injury, including continuing to play after concussion or head injury;</p> <p>(B) Require annual completion by the director of the youth athletic activity, all coaches, whether a coach is employed or a volunteer, and, if appointed, the licensed health care professional of a concussion recognition and head injury safety education</p>	

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	<p>course program developed by the department. In developing the program, the department may use any of the materials readily available from the centers for disease control and prevention, but shall include the centers' concussion signs and symptoms checklist which must be used by a licensed health care professional, coach or other designated person making a determination as to whether a youth athlete exhibits signs, symptoms or behaviors consistent with a concussion. The department shall make the</p> <p>concussion recognition and head injury safety education course program available on its web site for any youth athletic activity operated by a city, county, business or nonprofit organization to access free of charge. The program shall include, but not be limited to:</p> <ul style="list-style-type: none"> <li>(i) Current training in recognizing the signs and symptoms of potentially catastrophic head injuries, concussions and injuries related to second impact syndrome;</li> <li>(ii) The necessity of obtaining proper medical attention for a person suspected of having sustained a concussion; and</li> <li>(iii) The nature and risk of concussions, including the danger of continuing to play after sustaining a concussion and the proper method and statutory requirements that must be satisfied in order for a youth athlete to return to play in the athletic activity;</li> </ul> <p>(C) Require that, on a yearly basis, a concussion and head injury information sheet be signed and returned by each coach to the head of the youth athletic activity prior to</p>	



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	<p>initiating practice or competition for the year;</p> <p>(D) Require that, on a yearly basis, a concussion and head injury information sheet be reviewed by all youth athletes and an athlete's parent or guardian. The information sheet shall be signed and returned by the youth athlete, if the youth athlete is eighteen (18) years of age or older, otherwise by the athlete's parent or guardian, prior to the youth athlete's initiating practice or competition to confirm that both the parent or guardian and the youth athlete have reviewed the information and understand its contents. The information sheet shall include, but not be limited to:</p> <p>(i) Written information related to the recognition of symptoms of head injuries;</p> <p>(ii) The biology and the short-term and long-term consequences of a concussion written in layman's terminology; and</p> <p>(iii) The medical standard of care for post-concussion participation or participation in an athletic activity;</p> <p>(E) Maintain all documentation of the completion of a concussion recognition and head injury safety education course program and signed concussion and head injury information sheets for a period of three (3) years...”</p>	
Texas	<p>“...A student may not participate in an interscholastic athletic activity for a school year until both the student and the student's parent or guardian or another person with legal authority to make medical decisions for the</p>	<p>TEX. EDUC. CODE ANN. §§ 38.151.160 (West 2015)</p>

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	<p>student have signed a form for that school year that acknowledges receiving and reading written information that explains concussion prevention, symptoms, treatment, and oversight and that includes guidelines for safely resuming participation in an athletic activity following a concussion. The form must be approved by the University Interscholastic League.</p> <p>a) The University Interscholastic League shall approve for coaches of interscholastic athletic activities training courses that provide for not less than two hours of training in the subject matter of concussions, including evaluation, prevention, symptoms, risks, and long-term effects. The league shall maintain an updated list of individuals and organizations authorized by the league to provide the training.</p> <p>(b) The Texas Department of Licensing and Regulation shall approve for athletic trainers training courses in the subject matter of concussions and shall maintain an updated list of individuals and organizations authorized by the board to provide the training.</p> <p>(c) The following persons must take a training course in accordance with Subsection (e) from an authorized training provider at least once every two years:</p> <p>(1) a coach of an interscholastic athletic activity;</p> <p>(2) a licensed health care professional who serves as a member of a concussion oversight team and is an employee, representative, or agent of a school district or open-enrollment</p>	

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	<p>charter school; and</p> <p>(3) a licensed health care professional who serves on a volunteer basis as a member of a concussion oversight team for a school district or open-enrollment charter school.</p> <p>(d) A physician who serves as a member of a concussion oversight team shall,</p> <p>to the greatest extent practicable, periodically take an appropriate continuing medical education course in the subject matter of concussions.</p> <p>(e) For purposes of Subsection (c):</p> <p>(1) a coach must take a course described by Subsection (a);</p> <p>(2) an athletic trainer must take:</p> <p>(A) a course described by Subsection (b); or</p> <p>(B) a course concerning the subject matter of concussions that has been approved for continuing education credit by the appropriate licensing authority for the profession; and</p> <p>(3) a licensed health care professional, other than an athletic trainer, must take:</p> <p>(A) a course described by Subsection (a) or (b); or</p> <p>(B) a course concerning the subject matter of concussions that has been approved for continuing education credit by the appropriate licensing authority for the profession.</p>	

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	<p>(f) Each person described by Subsection (c) must submit proof of timely completion of an approved course in compliance with Subsection (e) to the school district superintendent or the superintendent's designee or, in the case of a home-rule school district or open-enrollment charter school, a person who serves the function of a superintendent or that person's designee.</p> <p>(g) A licensed health care professional who is not in compliance with the training requirements under this section may not serve on a concussion oversight team in any capacity.”</p>	
Utah	<p>“...Each amateur sports organization shall:</p> <p>(1) adopt and enforce a concussion and head injury policy that: (a) is consistent with the requirements of <u>Section 26-53-301</u>; and</p> <p>(b) describes the nature and risk of:</p> <p>(i) a concussion or a traumatic head injury; and</p> <p>(ii) continuing to participate in a sporting event after sustaining a concussion or a traumatic head injury;</p> <p>(2) ensure that each agent of the amateur sports organization is familiar with, and has a copy of, the concussion and head injury policy; and</p> <p>(3) before permitting a child to participate in a sporting event of the amateur sports</p>	UTAH CODE ANN. §§ 26-53-101 to 102, -201, 301, -401 (West 2016).

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	<p>organization:</p> <p>(a) provide a written copy of the concussion and head injury policy to a parent or legal guardian of a child; and</p> <p>(b) obtain the signature of a parent or legal guardian of the child, acknowledging that the parent or legal guardian has read, understands, and agrees to abide by, the concussion and head injury policy.”</p>	
Vermont	<p>“... b) Guidelines and other information. The Secretary of Education or designee, assisted by members of the Vermont Principals' Association selected by that association, members of the Vermont School Boards Insurance Trust, and others as the Secretary deems appropriate, shall develop statewide guidelines, forms, and other materials, and update them when necessary, that are designed to educate coaches, youth athletes, and the parents and guardians of youth athletes regarding:</p> <p>(1) the nature and risks of concussions and other head injuries;</p> <p>(2) the risks of premature participation in athletic activities after receiving a concussion or other head injury;</p> <p>(3) the importance of obtaining a medical evaluation of a suspected concussion or other head injury and receiving treatment when necessary;</p> <p>(4) effective methods to reduce the risk of concussions occurring during athletic</p>	VT. STAT. ANN. tit. 16, § 1431 (2016)

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	<p>activities; and</p> <p>(5) protocols and standards for clearing a youth athlete to return to play following a concussion or other head injury, including treatment plans for such athletes.</p> <p>(c) Notice and training. The principal or headmaster of each public and approved independent school in the State, or a designee, shall ensure that:</p> <p>(1) the information developed pursuant to subsection (b) of this section is provided annually to each youth athlete and the athlete's parents or guardians;</p> <p>(2) each youth athlete and a parent or guardian of the athlete annually sign a form acknowledging receipt of the information provided pursuant to subdivision (1) of this subsection and return it to the school prior to the athlete's participation in training or competition associated with a school athletic team;</p> <p>(3)(A) each coach of a school athletic team receive training no less frequently than every two years on how to recognize the symptoms of a concussion or other head injury, how to reduce the risk of concussions during athletic activities, and how to teach athletes the proper techniques for avoiding concussions; and</p> <p>(B) each coach who is new to coaching at the school receive training prior to beginning his or her first coaching assignment for the school; and</p> <p>(4) each referee of a contest involving a high</p>	

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	<p>school athletic team participating in a collision sport receive training not less than every two years on how to recognize concussions when they occur during athletic activities.”</p>	
Virginia	<p>“...A. The Board of Education shall develop and distribute to each local school division guidelines on policies to inform and educate coaches, student-athletes, and their parents or guardians of the nature and risk of concussions, criteria for removal from and return to play, risks of not reporting the injury and continuing to play, and the effects of concussions on student-athletes' academic performance.</p> <p>B. Each local school division shall develop policies and procedures regarding the identification and handling of suspected concussions in student-athletes. Such policies shall:</p> <ol style="list-style-type: none"> <li>1. Require that in order to participate in any extracurricular physical activity, each student-athlete and the student-athlete's parent or guardian shall review, on an annual basis, information on concussions provided by the local school division. After having reviewed materials describing the short- and long-term health effects of concussions, each student-athlete and the student-athlete's parent or guardian shall sign a statement acknowledging receipt of such information, in a manner approved by the Board of Education...”</li> </ol>	VA. CODE ANN. § 22.1271.5 (2017)

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Washington	<p>“...(2) Each school district's board of directors shall work in concert with the Washington interscholastic activities association to develop the guidelines and other pertinent information and forms to inform and educate coaches, youth athletes, and their parents and/or guardians of the nature and risk of concussion and head injury including continuing to play after concussion or head injury. On a yearly basis, a concussion and head injury information sheet shall be signed and returned by the youth athlete and the athlete's parent and/or guardian prior to the youth athlete's initiating practice or competition.”</p>	WASH. REV. CODE § 28A.600.190 (2016)
Washington D.C.	<p>“... (a) The Mayor shall establish, through rulemaking, a training program on:</p> <ul style="list-style-type: none"> <li>(1) The nature and risk of a concussion;</li> <li>(2) The criteria for the removal of an athlete from physical participation in an athletic activity and his or her return to it; and</li> <li>(3) The risks to an athlete of not reporting an injury and continuing to physically participate in the athletic activity.</li> </ul> <p>(b) The Mayor shall determine, through rulemaking, which individuals shall be required to complete the training program.</p> <p>(c) In addition to those individuals required to complete the training program, the Department of Health may make the program available to any interested individual, including school personnel, parents, students, and athletes.”</p>	D.C. CODE §§ 72871.01-.05 (2017)



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West Virginia	<p>“... (d) The rules required by this section shall include, but are not limited to, the following:</p> <p>Guidelines and other pertinent information to inform and educate appropriate school administrators, coaches, interscholastic athletes and their parents or guardians of the nature and risk of concussion and head injury including the risks of continuing to play or practice after a concussion or head injury;</p> <p>A concussion and head injury information sheet that shall be signed and returned by the interscholastic athlete and the athlete's parent or guardian on an annual basis before the interscholastic athlete begins practice or competition;</p> <p>A requirement that each head coach of an interscholastic sport at a high school or middle school who is a member of the West Virginia Secondary School Activities Commission complete a commission-approved concussion and head injury recognition and return-to-play protocol course annually...”</p>	W. VA. CODE § 18-2-25a (2016)
Wisconsin	<p>“... (2) In consultation with the Wisconsin Interscholastic Athletic Association, the department shall develop guidelines and other information for the purpose of educating athletic coaches and pupil athletes and their parents or guardians about the nature and risk of concussion and head injury in youth athletic activities.</p> <p>(3)(a) At the beginning of a season for a youth athletic activity, the person operating the youth athletic activity shall distribute a concussion and head injury information sheet to each</p>	WIS. STAT. § 118.293 (2017)

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	<p>person who will be coaching that youth athletic activity and to each person who wishes to participate in that youth athletic activity. No person may participate in a youth athletic activity unless the person returns the information sheet signed by the person and, if he or she is under the age of 19, by his or her parent or guardian.</p> <p>(b) 1. Notwithstanding par. (a), a public or private school is not required to distribute an information sheet to a pupil enrolled in the school who wishes to participate in a youth athletic activity operated by the school during a school year, and a pupil enrolled in the school may participate in that youth athletic activity without returning an appropriately signed information sheet for that activity, if the pupil has returned an appropriately signed information sheet for another youth athletic activity operated by the school during the same school year.</p> <p>2. Notwithstanding par. (a), a private club is not required to distribute an information sheet to a person who wishes to participate in a youth athletic activity operated by the private club, and a person may participate in that youth athletic activity without returning an appropriately signed information sheet for the activity, if the person has returned an appropriately signed information sheet to the club within the previous 365 days.”</p>	

State	Provision Text	Citation <sup>239</sup>
Wyoming	<p>“... (xxxiii) To assist local school districts in developing protocols under <u>W.S. 21-3-110(a)(xxxii)</u> and in sufficient time to enable school districts to adopt and implement protocols commencing school year 2011-2012, develop model protocols for addressing risks associated with concussions and other head injuries resulting from athletic injuries. No district shall be required to adopt any part of the model protocols...</p> <p>(xxxii) Commencing school year 2011-2012, adopt protocols to address risks associated with concussions and other head injuries resulting from athletic injuries. Implementation of this paragraph shall be subject to the immunity provisions of the Wyoming Governmental Claims Act. The protocols shall:</p> <ul style="list-style-type: none"> <li>) Include training of coaches and athletic trainers to facilitate the recognition of symptoms of concussions;</li> <li>) Address restrictions concerning participation in school athletic events after suffering a concussion or head injury;</li> <li>) Include means for providing to students and parents information on head injuries and concussions and related restrictions on participation in athletic activities.”</li> </ul>	WYO. STAT. ANN. §§ 21-2-202(a)(xxxiii), 21-3110(a)(xxxii) (2017).

APPENDIX A2. ANNOTATED SUMMARY TABLE OF RESEARCH STUDIES ON  
CONCUSSION EDUCATION INTERVENTIONS

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Cook et al. (2003) <sup>240</sup>	In the 2001-2002 hockey season, 3 of 5 hockey teams were randomly assigned to view the ThinkFirst Canada Smart Hockey video (60 minutes), viewed at mid-season.	2 of 5 hockey teams were randomly assigned to receive no educational intervention.	Youth hockey	75 11-year old male youth hockey players from 5 teams in the Greater Toronto Youth Hockey League (15% response rate).	2 question quiz (short answer) on the signs and causes of concussion given to treatment group immediately before and after video at midseason and 3 months later. The quiz was given to control group at mid-season	Treatment group showed increased knowledge from before the video to immediately after the video, with this improved knowledge maintained 3 months later while control group showed no knowledge gains from mid-season to 3 months later; Although there were no changes in the total number of	Comparisons are made across teams; Treatment video was viewed as a team; Mean number of penalties /1,000 player hours was calculated and used in data analysis; Cross checking and checking from

240. D. J. Cook et al., *Evaluation of the Thinkfirst Canada, Smart Hockey, Brain and Spinal Cord Injury Prevention Video*, 9 INJ. PREVENTION 361 (2003).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					and 3 months later; Number and type of penalties by each team were recorded throughout the entire season, although methods of obtaining this information were not specified.	penalties committed by both groups after the video, athletes in the treatment group had fewer cross checking and checking from behind penalties after watching the video; There were no changes in the frequency of these penalties from athletes in the control group.	behind penalties put players at a high risk of injury and the consequences of these behaviors were emphasized in the video.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Goodman et al. (2006) <sup>241</sup>	Study 1: Some participants (specific number not specified) were randomly assigned by the computer to play the computer game Symptom Shock <sup>3</sup> (6 minutes) that used an audio	Study 1: Some participants (specific number not specified) were randomly assigned by the computer to play a control version of the Symptom Shock computer game.	Youth hockey	Study 1: 130 youth hockey players ages 11-17 from 11 different teams in the Kamloops Minor Hockey Association in British Columbia, Canada; Gender not specified but assumed to be	Study 1: 36 question quiz (true/false) where participants indicated whether or not the item listed is a concussion symptom was given immediately after playing Symptom Shock.	Study 1: Participants in treatment group identified more concussion symptoms correctly than participants in the control group. In addition, the participants in the treatment group completed the quiz faster than participants in the control group.	Symptoms listed on the quiz were the same concussion symptoms seen in the treatment condition of Symptom Shock; The only difference between Study 1 and Study 2 was the participa

241. David Goodman et al., *Video Gaming Promotes Concussion Knowledge Acquisition in Youth Hockey Players*, 29 J. ADOLESCENCE 351 (2006). 3 The Symptom Shock computer game shows concussion and non-concussion symptoms on a screen and players must match identical symptoms and then identify whether or not they are appropriate symptoms for a concussion. Correct responses move your puck forward towards your opponent's net and incorrect responses move you backwards, and the aim is to score a goal in your opponent's net. The control version of the game has players match animals and faces instead of concussion symptoms.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	overlay to explain game instructions; Years of data collection not specified.			males.			nts and the way that that instructions were presented to participants. In Study 1, participants were
	Study 2: 16 of 33 participants were randomly assigned by the computer to play Symptom Shock using an interactive tutorial to explain game instructions;	Study 2: 17 of 33 participants were randomly assigned by the computer to play a control version of the Symptom Shock computer game.	Youth hockey	Study 2: 33 youth hockey players ages 13-14 from 7 different teams playing in a Richmond Minor Hockey Association Bantam C Tournament in British Columbia	Study 2: 36 question quiz (true/false) where participants indicated whether or not the item listed is a concussion symptom was given immediately after playing Symptom Shock.	Study 2: Participants in treatment group identified more concussion symptoms correctly than participants in the control group. In addition, the participants in the treatment group completed the quiz faster than participants in the control group.	given instructions via an audio overlay while in Study 2, participants were given instructions via an interactive tutorial. The game itself and the quiz remained the same.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	Years of data collection not specified.			ia, Canada; Gender not specified but assumed to be males.			
Gianotti and Hume (2007) <sup>242</sup>	From July 2003 to June 2005, 30,000 Sideline Concussion Check cards (SCCs) were mailed to rugby coaches or distributed to rugby coaches at	Concussion/brain injury (CBI) moderate to serious claims (MSCs) made in 2002/2003, before the distribution of SCCs, were compared to CBI MSCs made in 2003/2004 and	Focused on rugby, but included data for skiing and horseback riding (both of which also distributed SCCs), as well as for cycling, motorsports,	People who made claims to New Zealand's Accident Compensation Corporation (ACC); claims can be made from any age group and were not	In January 2006, data from July 1999 to June 2005 were extracted from the Accident Compensation Corporation (ACC) database. This data included: the number of CBI MSCs	There was a 10.7% decrease in rugby CBI MSCs from 2002/2003 (before treatment) to 2004/2005 even though there was an increase in the number of rugby players in this time period.; Comparatively, there was only a 4.2% decrease in CBI MSCs	A medical doctor makes the diagnosis for a CBI claim to the ACC; It is not stated when the other sports received their Sideline Concussion Check cards, although it is

242. Simon Gianotti & Patria Hume, *Concussion Sideline Management Intervention for Rugby Union Leads To Reduced Concussion Claims*, 22 NEUROREHABILITATION 181 (2007).



Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	RugbySmart workshops (20,000 SCCs were mailed or distributed at workshops in 2003/2004 and 10,000 SCCs were distributed at workshops in 2004/2005).	2004/2005, after the distribution of SCCs; Outcomes measured in rugby were compared to outcomes measured in other sports and nonsports from 1999 to 2005; CBI MSCs in sports in which the SCCs were distributed were compared to sports where the SCCs were not	league, and water-related sports (all of which did not distribute SCCs) when making comparisons	specified in the article.	made to the ACC, where the CBI MSC occurred (sport or non-sport), the type of sport in which the CBI MSC occurred, and the number of days between the CBI occurrence and seeking of medical treatment. The cost effectiveness of the SCCs was also calculated.	in other sports and a 16.9% increase in non-sport CBI MSCs; Sports where SCCs were distributed showed a decrease in CBI MSCs after 2003/2004 while most sports without SCC distribution showed a continual increase in CBI MSCs from 1999/2000 to 2004/2005; There was a decrease in the median number of days between getting a CBI MSC and seeing a medical	assumed that they were also distributed between 2003 and 2005.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
		distributed from 1999 to 2005.				professional in rugby players from 6 days in 1999 to 2003 to 4 days in 2003 to 2005, but a similar decrease was seen in other sports; It was estimated that SCC distribution saves \$690,690 with a return on investment of \$12.60 for every \$1 invested.	
Mitchko et al. (2007) <sup>243</sup>	Pretesting of CDC video: Focus groups of high school	Not applicable.	High school football, track, soccer, softball, lacrosse, swimming	Two focus groups, one containing 6 male high	Discussion on thoughts of video and how the video might change	After viewing the video, athletes stated that they would be more likely to see	Pretesting and pilot testing led to the final version of

243. Jane Mitchko et al., *CDC's Approach to Educating Coaches About Sports-Related Concussion*, 38 AM. J. HEALTH EDUC. 105 (2007).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	students and one coach, where the CDC video was viewed; Years of data collection not specified.		g, baseball, wrestling, basketball, volleyball, and field hockey.	school football players and coach from Maryland and one containing 14 male and female high school student athletes from Virginia.	their behavior.	a healthcare professional after a head injury and more likely to consider whether they had symptoms of concussion after being hit in the head.	CDC's Heads Up: Concussion in High School Sports toolkit; The years in which this pretesting and pilot testing took place were not specified, but it was before September 2005.
	Pretesting of CDC toolkit for coaches: Focus groups of high school coaches regarding the toolkit; Years of data	Not applicable.	High school football, basketball, baseball, soccer, softball, wrestling, and volleyball	6 in-person focus groups with 50 high school coaches from Texas, Virginia, and California and 2 conference calls	Discussion on coaches' thoughts of the toolkit and how it might change their behavior.	After reviewing the toolkit, coaches reported that they were more educated about concussions, believed concussions to be more severe than they previously	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	collection not specified.			with 14 high school coaches from rural Montana, California, Colorado, Virginia, Pennsylvania, and Alabama; Coaches were male and female and coached male and female athletes.		thought, and had the intent to form an effective plan to manage concussions.	
	1,000 coaches were mailed the CDC toolkit	No control group.	High school soccer, softball, football, lacrosse,	500 high school coaches from Texas, Maine,	Phone surveys were used to determine coach opinions	Most coaches found the toolkit useful and easy to use, with many	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	and then asked to complete a phone survey 2 weeks later; Years of data collection not specified.		wrestling, basketball, volleyball, gymnastics, ice hockey, and field hockey	Michigan, California, and North Carolina (1,000 coaches were selected to participate); Gender not specified.	on the toolkit about 2 weeks after the toolkit was mailed to them.	coaches saying that they would distribute the CDC concussion material to educate others; Many coaches also thought that the toolkit could be useful in developing a concussion management plan in their school.	
Valovich McLeod et al. (2007) <sup>244</sup>	250 coaches were asked to complete a survey via mail, at coaches' meetings, or	Not applicable	Not specified	156 coaches of youth (ages 8-14) sports (62% response rate)	21 question quiz, with 16 yes/no questions asking about concussion symptoms, 1 question	Coaches who had participated in a coach education program prior to completing the survey were more likely to recognize a greater	

244. Valovich McLeod et al., *Sport-Related Concussion Misunderstandings Among Youth Coaches*, 17 CLINICAL J. SPORTS MED. 140 (2007)

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	after practice; Years of data collection not specified.				presenting a scenario and requiring a yes/no answer about whether a concussion occurred, and 4 true/false questions on managing concussions.	number of concussion symptoms.	
Gianotti et al. (2009) <sup>245</sup>	At the beginning of the rugby season in March 2001, RugbySmart was	Survey data from 1996, 1997, and 1998 (before RugbySmart implementation)	Rugby	Rugby players (all ages) from the New Zealand Rugby Union; 1,125 male	In September 2006, the number of reported MSCs was collected from the	The injury claim rate for head/neck/spine injuries decreased from 122 per 100,000 players in 2001 to 93 per 100,000 players in	The incidence data reported here is not specific to concussions and therefore

245. Simon Gianotti et al., *Evaluation of Rugbysmart: A Rugby Union Community Injury Prevention Programme*, 12 J. SCI. & MED. SPORT 371 (2009).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	implemented.	were compared to survey data from 2005 (after RugbySmart implementation); Moderate to serious injury claims (MSCs) reported to the Accident Compensation Corporation (ACC) were compared from 2001, when RugbySmart was first implemented,		rugby players in a senior amateur club over the age of 19 completed the ACC survey (554 from 1996, 1997, and 1998 combined and 571 from 2005).	ACC database for the years 2001 through 2005. The number of rugby participants each year was collected from the New Zealand Rugby Union. Survey data on self-reported safe behaviors from the ACC was collected in 1996, 1997, 1998 (before RugbySmart), and in	2005. There was an increase in the percentage of players who self-reported safe tackling, safe scrum, and safe ruck from 1996, 1997, and 1998 (before RugbySmart) to 2005 (after RugbySmart).	was not included in the article.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
		through 2005.			2005 (after RugbySmart).		
O'Donoghue et al. (2009) <sup>246</sup>	221 high school coaches were asked to complete a survey; Years of data collection not specified.	Not applicable	17 high school sports, including football, lacrosse, soccer, gymnastics, and basketball; the other 12 sports were not specified	126 high school coaches (57% response rate) from 12 high schools (35% response rate) in 4 Virginia cities agreed to participate.	24 question quiz (multiple choice) on concussion knowledge with 8 questions on concussion recognition, 8 questions on concussion management, and 8 questions on concussion prevention	Coaches who had previously attended a concussion workshop had higher scores on concussion management questions than coaches who had not previously attended a concussion workshop; No difference in concussion knowledge between coaches who indicated they had previously reviewed CDC's Heads	Concussion defined as "injury to the brain after a blow to the head resulting in transient alterations in neurological functioning".

246. Erin M. O'Donoghue et al., *Assessment of High School Coaches' Knowledge of Sport-Related Concussions*, 1 ATHLETIC TRAINING SPORTS HEALTH CARE 120 (2009).



Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					n.	Up toolkit and those who had not.	
Echlin et al. (2010) <sup>247</sup>	At the beginning of the 2009-2010 hockey season, 16 of 58 hockey players were randomly assigned to view the ThinkFirst concussion DVD (length of video not specified)	22 of 58 players were randomly assigned to receive no educational intervention.	Junior league hockey	58 male junior league hockey players (ages 16-21) from two teams; Location is not specified.	26 question quiz (multiple choice and true/false) on concussion knowledge and concussion management given to treatment groups before and after treatment at the beginning of the season,	There was no change in knowledge of concussions or concussion management over time for participants in the DVD, ICM, or control groups; When the data for the DVD and ICM groups were combined, participants in the treatment group appeared to have greater improvement	Comparison made between players; One team dropped out 21 days after the treatment so there was not a large enough sample size to analyze the effect of the treatment after 30

247. Paul S. Echlin et al., *A Prospective Study of Concussion Education in 2 Junior Ice Hockey Teams: Implications for Sports Concussion Education*, 29 NEUROSURGICAL FOCUS E6 (2010).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	d) and 20 of 58 players were randomly assigned to do the Interactive Computer Module (ICM, length not specified).				after 15 games (50 days), and after 30 games (91 days). The same quiz was given to the control group at the beginning of the season, after 15 games, and after 30 games.	s in quiz score after 15 games than participants in the control group, although this difference only approached significance.	games; This study was part of the Hockey Concussion Education Project.
Glang et al. (2010) <sup>248</sup>	40 of 75 coaches were randomly assigned to view the ACTive:	35 of 75 coaches were randomly assigned to read a CDC article on	Not specified	75 coaches of youth ages 10-14 in community sport; National	50-question quiz containing 45 true/false questions on concussion	Coaches in the treatment group had greater gains in concussion symptom recognition, general	

248. Ann Glang et al., *Online Training in Sports Concussions for Youth Sports Coaches*, 5 INT'L J. SPORTS SCI & COACHING 1 (2010).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	Athletic Concussion Training using Interactive Video Education online video (3 short modules , 1520 minutes in total); Years of data collection not specified.	bicycle and pedestrian safety (15-20 minutes).		1 sample.	on symptoms, general concussion knowledge, and concussion misperceptions; and 10 questions on self-efficacy and behavioral intention rated on a 5-point Likert was given immediately before and after reviewing material.	concussion knowledge, concussion misperception recognition, self-efficacy, and behavioral intention after viewing the material compared to coaches in the control group.	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Sarmiento et al. (2010) <sup>249</sup>	1,009 high school coaches who had ordered and received the CDC's Heads Up: Concussion in High School Sports toolkit between September 2005 and July 2006 were asked to complete a survey.	No control group.	High school football, boys/girls basketball, boys/girls soccer, baseball, boys hockey, boys gymnastics, boys lacrosse, boys rugby, boys/girls tennis, fencing, girls volleyball, softball, and track and field	333 high school coaches who had received the Heads Up toolkit (33% response rate); National sample; 6 focus groups were conducted with 23 coaches who completed the survey.	Survey containing multiple choice, Likert scale, and open-ended questions was mailed to participants regarding concussion knowledge, attitudes, and behaviors; Focus groups of about 4 coaches were conducted using open-	Half of coaches viewed concussions more seriously after using the toolkit; One-third of coaches reported learning something new; coaches who implemented the toolkit being more likely to report learning something new and to report an attitude change. The majority of coaches educated other coaches and athletes	

249. Sarmiento et al., *Evaluation of the Centers for Disease Control and Prevention's Concussion Initiative for High School Coaches: 'Heads Up: Concussion in High School Sports'*, 80 J. SCHOOL HEALTH 112 (2010).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					ended questions .	about concussions following review of the toolkit, and 38% changed the way they prevent and manage concussions.	
Sawyer et al. (2010) <sup>250</sup>	In 2005, 5,121 high school coaches were mailed the CDC Heads Up: Concussion in High School Sports toolkit and were selected to complet	No control group.	High school football, boys/girls basketball, boys/girls softball, boys/girls volleyball, boys/girls soccer, boys/girls wrestling, girls	497 randomly selected high school coaches employed in Maine, Michigan, California, North Carolina, and Texas (10% response rate).	40 question telephone survey (open-ended and closed-ended questions) on demographic information, use of the toolkit, and assessment of the toolkit	About 80% of coaches displayed or planned to display the CDC concussion poster from the toolkit in high traffic areas and about 80% planned to disseminate the Fact Sheets for Athletes and Parents. Almost all coaches rated the toolkit	

250. Richard J. Sawyer et al., *High School Coaches' Assessments, Intentions to Use, and Use of a Concussion Prevention Toolkit: Centers for Disease Control and Prevention's Heads Up: Concussion in High School Sports*, 11 HEALTH PROMOTION PRAC. 34 (2010).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	see a survey.		field hockey, ice hockey, boys/girls lacrosse, and gymnastics		was given about two weeks after mailing the toolkit.	positively and found it useful. About 80% found the toolkit easy to use.	
Chrisman et al. (2011) <sup>251</sup>	In 2009, 500 pediatricians, 500 family physicians, and 500 internists were selected from the American Medical Association	250 physicians from each group were randomly selected to receive the survey, but not the CDC Heads Up physician	No sport specified.	414 physicians (27.2% response rate)	A four-page survey, consisting of 35 items designed to measure physician concussion knowledge, experience with concussion	There was no significant difference between the intervention and control group in general concussion knowledge. There was a significant difference between these groups for the return-to-play	

251. Sara P. Chrisman et al., *Physician Concussion Knowledge and the Effect of Mailing the CDC's "Heads Up" Toolkit*, 50 *CLINICAL PEDIATRICS* 1031 (2011). 14 The toolkit consisted of a cover letter, a 23-page booklet describing the nature, diagnosis, and management of concussions, a concussion check card, a concussion evaluation form, concussion information for patients, and a CD-ROM with more concussion resources.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	physician master file to receive the CDC Heads Up physician toolkit <sup>14</sup> and a concussion knowledge survey. 250 physicians from each group were randomly selected to receive the materials.	n toolkit.			ons, and concussion management scenarios. The knowledge section contained nine true-false questions, with responses along a 5-item Likert scale, ranging from strongly disagree to strongly agree. The concussion management scenario, which measure	scenario, with physicians who received the intervention less likely to recommend next-day return-to-play than the control group.	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					d likelihood of physician to recommend return to play, consisted of one scenario with five different symptom presentations, with each presentation requiring a response on a 4item Likert scale, ranging from ‘definitel y not safe to return to play’ to ‘definitel y safe to		



Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					return to play’.		
Koh (2011) <sup>252</sup>	In the 2008-2009 snowboarding season, students in a snowboarding class were given a concussion education presentation related to snowboarding developed by the research	No control group.	Snowboarding	208 male and female college students ages 18-32 in a snowboarding class at a South Korea university (93% response rate).	20 question quiz (question type not specified) on concussion knowledge given immediately before and after treatment; survey on concussion history and use of protective equipment given	Concussion knowledge significantly increased following treatment; There was no difference in concussion knowledge between snowboarders who got a concussion during the course and who did not.	Concussion defined as “direct or indirect blow to the head or elsewhere on the body...with an impulsive force transmitted to the head resulting in various physiological signs and symptoms as

252. Jae O. Koh, *Effect of Snowboard-Related Concussion Safety Education for Recognizing Possible Concussions*, 51 J. SPORTS MED. & PHYSICAL FITNESS 625 (2011).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	er on the first day of class (30 minutes)				on the last day of class.		identified from a symptoms checklist;" 1 snowboard exposure is 1 snowboarder on 1 day.
Bagley et al. (2012) <sup>253</sup>	599 students participated in the Sports Legacy Institute Community Educators (SLICE) curriculum (40-60 minute presentation);	No control group.	Not specified	599 male and female students ages 9-18 from 18 elementary, middle, and high schools; Location not specified.	7 question quiz containing 2 free response questions asking students to list concussions and to identify appropriate concussions	The average quiz score improved after treatment; Additionally, 80% of students passed the quiz (scored 50% or higher) after treatment compared to 34% of students who passed the quiz prior to treatment.	

253. Alexander F. Bagley et al., *Effectiveness of the SLICE Program for Youth Concussion Education*, 22 CLINICAL J. SPORTS MED. 385 (2012).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	Years of data collection not specified.				on responses and 5 true/false and multiple choice questions on concussion knowledge given before and after treatment.		
Bramley et al. (2012) <sup>254</sup>	In the winter of 2009-2010, 183 student athletes were mailed a survey.	Not applicable	High school soccer	60 male and female high school soccer players (9 <sup>th</sup> -12 <sup>th</sup> grade) from Ohio and Pennsylvania	4 question quiz: one yes/no question asking if athletes had received concussion education; one question	Statistically significant association between having concussion education and athlete intention to tell a coach about a potential concussion; No	

254. Harry Bramley et al., *High School Soccer Players with Concussion Education are More Likely to Notify Their Coach of a Suspected Concussion*, 51 CLINICAL PEDIATRICS 332 (2012).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
				(33% response rate).	asking if it is OK for athletes to continue play if they suffer a concussion, rated as never OK, sometimes OK, or always OK; 2 questions with different potential concussion scenarios asking if the athlete would never, sometimes, or always tell their coach.	relationship between prior concussion education and intention to return to a game after receiving a concussion, although almost all players indicated that someone with a concussion should not return to play.	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Covassin et al. (2012) <sup>255</sup>	1,000 coaches were selected to complete a survey after utilizing CDC Heads Up: Concussions in Youth Sports materials; Years of data collection not specified.	No control group.	Youth football, soccer, softball, basketball, cheerleading, baseball, teeball, and volleyball	340 randomly selected coaches in the National Alliance for Youth Sports (NAYS) <sup>256</sup> who had received CDC Heads Up materials (34% response rate); National sample.	22 question surveys were given to coaches after they had seen the materials on the usefulness of the CDC material, their awareness and perceptions of concussion, the role of coaches in concussion	The majority of coaches learned something from the CDC materials and they self-reported that they can now more easily identify concussion symptoms, believe concussions to be a serious issue, and recognize the role of concussion safety; Most coaches educated others about	

255. Tracey Covassin et al., *Educating Coaches About Concussion in Sports: Evaluation of the CDC's "Heads Up: Concussion in Youth Sports" Initiative*, 82 J. SCHOOL HEALTH 233 (2012).

256. The NAYS is an organization that advocates for safety in youth sports. NAYS offers a coach training program through the National Youth Sports Coaches Association (now called the NAYS Coach Training and Membership Program). Being a member of NAYS gives coaches access to the NYSKA training program, which provides information on building kids' confidence, sportsmanship, safety, and how to teach skills for a specific sport. NAYS also offers a free concussion training course.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					on safety, and concussion incidence.	concussion prevention and management after receiving the CDC materials; 66/321 coaches reported a concussion during the previous season.	
Miyashita et al. (2013) <sup>257</sup>	50 participants sat through a PowerPoint lecture regarding concussion symptoms, side effects, and concussion	No control group.	College Division II soccer and basketball	50 NCAA Division II male and female soccer and basketball players at Metropolitan State University	10 question quiz, including 4 questions on personal concussion history and 6 multiple choice and true/false questions	Concussion knowledge increased from before treatment to the end of the sports season; At the end of the season, 6 participants self-reported that they got a concussion during that season, with 3 of the 6	

257. Theresa L. Miyashita et al., *The Impact of an Educational Intervention on College Athletes' Knowledge of Concussions*, 23 CLINICAL J. SPORT MED. 349 (2013).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	on management, presented by the researcher at the beginning of the season (20 minutes); Years of data collection not specified.			ity of Denver.	on concussion knowledge, was given before the season (immediately before treatment), and after the season (January for soccer and March for basketball).	stating that the treatment lecture influenced their immediate reporting and management of the concussion.	
Torres et al. (2013) <sup>258</sup>	919 Division I athletes were emailed a link to a	Not applicable	College Division I football, basketball, lacrosse	262 Division I male and female athletes at the Univers	35 question quiz on concussion reporting intentions rated	Athletes who indicated that they had previously experienced a concussion were more likely to be	

258. Daniel M. Torres et al., *Sports-Related Concussion: Anonymous Survey of a Collegiate Cohort*, 3 NEUROLOGY: CLINICAL PRAC. 279 (2013).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	survey; Year of data collection not specified.		, soccer, wrestling, and others.	ity of Pennsylvania (29% response rate).	on a 5-point Likert scale, knowledge of concussion symptoms, whether they had discussed concussions with their athletic trainer or doctor, concussion history, and whether they had received formal concussion education.	formally educated about concussions; No analyses were done comparing the knowledge and behavioral intentions of athletes who had received formal concussion education and those who had not.	
Cournoyer and Tripp (2014)	In first half of the 2012 football	Not applicable	High school football	314 male high school football	75 question quiz (true/false)	No relationship found between prior	



Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
259	season, 334 student athletes were asked to complete a survey.			players (94% response rate) from 11 high schools in North Central Florida (85% response rate).	containing 50 questions asking participants to identify concussion symptoms, 24 questions asking participants to identify possible long-term consequences of mismanaged concussions, and 1 question asking whether participants had been	concussion education given by a parent, formal source, or both and knowledge of concussion symptoms or long-term consequences of concussions.	

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259. Janie Cournoyer & Brady L. Tripp, *Concussion Knowledge in High School Football Players*, 49 J. ATHLETIC TRAINING, 654 (2014).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					previously educated about concussions.		
Cusimano et al. (2014) <sup>260</sup>	8 of 17 teams were randomly assigned to view the Smart Hockey: More Safety, More Fun video; Length of video not specified; Years of data collection not specified	9 of 17 teams were randomly assigned to have a discussion with the researcher about injuries in hockey instead of viewing the video. There was time for questions from	Youth hockey	135 youth hockey players ages 10 (n=89) and 14 (n=46) from 17 teams in the Greater Toronto Area; 267 players from 31 teams began the study but did not complete the 2	22 question quiz containing 11 multiple choice questions on general concussion knowledge, signs of concussion, and return to play; 4 questions rated on a 4-point Likert scale regarding	There was an increase in concussion knowledge for participants in the treatment group immediately following the video, but this knowledge decreased to where it was before the video after two months; There was no difference in concussion knowledge between the treatment	Video is shown as a team.

260. Michael D. Cusimano et al., *Effectiveness of an Education Video on Concussion Knowledge in Minor League Hockey Players: A Cluster Randomised Controlled Trial*, 48 BRIT. J. SPORTS MED. 141 (2014).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	d.	players and the discussion included information on the symptoms and management of concussions.		month follow up, thus they were not included in the analysis ; Gender not specified.	g attitudes of concussion; and 7 questions rated on a 4-point frequency scale from never to frequently on behaviors related to concussion given to treatment and control group immediately before the video or discussion; The 11 concussion knowledge	and control group both before the video or discussion and two months later; When splitting participants by age, the 10 year-olds in both the treatment and control groups did not show changes in concussion knowledge from before the video or discussion to 2 months later; However, the 14 year-olds in the treatment group showed increased concussion knowledge both immediately	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					<p>questions were given to the treatment group again immediately after the video. The entire quiz retaken by both groups 2 months later.</p>	<p>after the video and 2 months later when compared to their knowledge before the video while the 14 year-olds in the control group did not show changes in concussion knowledge 2 months later; There was no change in concussion attitudes or concussion-related behaviors from before the video or discussion to 2 months later for both the treatment and control groups.</p>	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Echlin et al. (2014) <sup>261</sup>	In the winter term of the 2012-2013 school year, 146 of 299 students were randomly assigned to view a concussion education module (40 minutes).	153 of 299 students were randomly assigned to receive no education training.	Not applicable	299 male and female ninth grade students ages 13-14 from 4 public high schools in Ontario, Canada	25 question quiz (multiple choice and true/false) on basic concussion knowledge given to treatment and control groups one week before treatment. Given to treatment group immediately after treatment and given to	Students in both the treatment and control groups showed gains in concussion knowledge from the first quiz to the second quiz, but these gains were significantly greater for students in the treatment group.	This study was part of the Sport Concussion Education Project

261. Paul S. Echlin et al., *The Sport Concussion Education Project. A Brief Report on an Educational Initiative: From Concept to Curriculum*, 121 J. NEUROSURGERY 1331 (2014).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					control group one week after first quiz.		
Higginson et al. (2014) <sup>262</sup>	160 NCAA Division I student athletes were surveyed about their concussion history, reporting history, and perceived effectiveness of NCAA concussion education in a cross-	No control group.	No sport specified.	160 NCAA Division I student athletes from a Midwestern university.	Participants were provided a written knowledge test and asked questions regarding their history of concussion, their history of reporting past concussions or concussion symptoms, and their personal assessment of the	54 student athletes reported that they had sustained at least one concussion through participating in NCAA sports. Of these student athletes, 62.9% didn't report their concussion symptoms. Athletes who reported their symptoms and athletes who didn't report their symptoms did not have	

262. Liam Higginson et al., *The Evaluation of the Effectiveness of NCAA Concussion Education Legislation: 640 Board# 55 May 28, 2*, MED. & SCI. SPORTS & EXERCISE 162 (2014).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	sectional research study.				effectiveness of NCAA concussion education.	significantly different perceptions of the effectiveness of NCAA concussion education.	
Kroshus et al. (2014) <sup>263</sup>	In fall 2012, all athletes from 6 college hockey teams received concussion education from their institution, as required by the NCAA; Delivery of concussion education	No control group.	College Division Ice hockey	146 male college hockey players from 6 teams in the same NCAA Division I hockey conference	42 question quiz containing 25 true/false questions on concussion knowledge with 10 questions regarding attitudes towards concussions, 5 questions regarding subjective norms towards	There were no significant changes in concussion knowledge, attitudes, or subjective norms after receiving concussion education; Following concussion education, there was a small change in behavioral intention, such that players indicated they would be less likely to continue	Players receive concussion education as a team; one of the 6 teams received concussion education materials over the summer so this team only took one quiz,

263. Emily Kroshus et al., *NCAA Concussion Education in Ice Hockey: An Ineffective Mandate*, 48 BRIT. J. SPORTS MED. 135 (2014).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	n varied by team, but players from all teams received a concussion handout either in person (4/6) or via email (2/6); Players from 4 teams were also given a lecture on concussions, and players from 1 team were given both a lecture				concussions, and 1 question on intention to play with concussion symptoms rated on a 5-point Likert scale from strongly disagree to strongly agree, as well as an open ended question asking participants to describe their concussion education; The quiz was	playing if they thought they got a concussion; Not all athletes remembered receiving concussion education, but those who did remember receiving a lecture had a greater change in behavioral intention than players who did not remember or did not receive a lecture; Players on the team that had both a lecture and video had significantly greater improvements in concussion knowledge	which was included with quizzes that other teams took after concussion education



Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	and a video (length of lectures and video not specified).				given the day before participants received concussion education (before the hockey season) and the day after participants received concussion education.	compared to other teams; Although no changes were significant, players on the team that had both a lecture and video had significantly better attitudes and behavioral intentions following education than players on other teams.	
Kurowski et al. (2014) <sup>264</sup>	496 student athletes were asked to complete a quiz during preseason	Not applicable	High school football, boys/girls soccer, boys/girls basketball	496 male and female high school athletes ages 13-18	38 question quiz containing 27 true/false questions on concussion	Previous concussion education was associated with greater concussion knowledge but not better	

264. Brad Kurowski et al., *Factors that Influence Concussion Knowledge and Self-Reported Attitudes in High School Athletes*, 77 J. TRAUMA & ACUTE CARE SURGERY, S12 (2014).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	n training.		all, and boys/girls wrestling.	from 2 suburban high schools near Cincinnati, Ohio.	on symptoms and general concussion knowledge and 11 questions rated as never, sometimes, or always regarding concussion attitudes and behaviors; quiz was given during preseason training.	attitudes and behavioral intentions.	
Manasse, Cohick and Shapley	160 football players received a concussion	No control group.	High school football	160 football players from 2 Southern	41 question quiz containing 9 true/false	Players showed a statistically significant improvement in concussion	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
(2014) 265	Concussion education presentation conducted by the researcher, which included a video modified from the CDC's Heads Up: Concussion in High School Sports—Information for Coaches (5 minutes) and a PowerPoint presentation			California high schools; Gender not specified.	Concussion knowledge questions, 14 true/false questions on concussion knowledge, 3 true/false questions based on scenarios that makes up the concussion knowledge index, and 15 questions regarding concussion attitudes rated on a 5-point Likert	Concussion knowledge following treatment but did not show significant changes in concussion attitudes following treatment.	

265. Nancy J. Manasse-Cohick & Kathy L. Shapley, *Concussion Education for High School Football Players: A Pilot Study*, 35 COMMUNICATIONS DISORDERS Q. 182 (2014).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	tion (20 minutes) with time for a question /answer session afterwards; Years of data collection not specified.				scale that make up the concussion attitude index; quiz given 2 weeks before treatment and immediately after treatment.		
Rivara et al. (2014) <sup>266</sup>	In the 2012 fall sports season, 778 student athletes participated in a study examining concussion	Not applicable	High school football and girls' soccer	20 Washington high schools; 68 high schools were contacted 778 football and girls' soccer	Coaches given survey on awareness of return to play recommendations and concussion education as well as 6	122 out of 778 athletes reported 147 concussions in the 2012 fall sports season. 100 out of the 147 reported were concussions new for that season. Cumulative incidence=10	Defined concussion as: 2 or more symptoms that were given a score greater than a 1 on the 6point scale from the

266. Frederick P. Rivara et al., *The Effect of Coach Education on Reporting of Concussions Among High School Athletes After Passage of a Concussion Law*, 42 AM. J. SPORTS MED. 1197 (2014).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	incidence			players in grades 9-12 and their parents	question quiz on concussion knowledge before season. Athletes are given a baseline survey about prior concussions; athletes call in weekly throughout the fall sports season to report the number of games and practices they participated in and whether they experienced concussion	.7%. Overall incidence=3.6/1,000 athlete exposures (greater incidence rate in games than practice in both football and soccer). Coach concussion education did have an effect on whether the coach was aware or unaware of the athlete concussions that occurred in the 2012 fall sports season. When coach education was provided by quiz or video, coaches were less likely to be aware of concussions.	SCAT-2 OR 1 symptom with a score of 5 of 6 that persisted for more than a few hours. Cumulative incidence: the number of new cases of concussions divided by the number of athletes in the study Overall incidence rate: number of new cases of concussions

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					n symptoms; parents call in weekly to report the number of games and practices their child participated in and whether their child experienced concussive symptoms; if concussive symptoms were reported by parent or athlete, the athlete was called by a		divided by the number of reported athlete exposures.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					research assistant to get more information about symptoms and severity.		
Glang et al. (2015) <sup>267</sup>	In August-November 2011, 13 of 25 high schools (including 445 of 1,004 parents and 2,264 of 4,804 athletes) were randomly assigned to receive access to Brain	12 of 25 schools (including 559 of 1,004 parents and 2,180 of 4,804 athletes) were randomly assigned to review safety material from the CDC; Parents read material	High school fall sports, including football, soccer, cheerleading, volleyball, water polo, wrestling, basketball, and color guard	4,804 male and female fall student athletes and 1,004 parents from 25 Oregon high schools	36 question quiz containing 26 true/false questions on concussion knowledge, 6 questions rated on a 5-point Likert scale regarding knowledge application, and 4 questions	Parents and athletes in the treatment group had greater gains in concussion knowledge, knowledge application, and behavioral intention than those in the control condition; More schools in the treatment program created a concussion management	Comparison made between schools

267. Ann E. Glang et al., *The Effectiveness of a Web-Based Resource in Improving Post-Concussion Management in High Schools*, 56 J. ADOLESCENT HEALTH 91 (2015).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	101: The Concussion Playbook website and online training (about 45 minutes) ; Athletic directors and principals of these schools were asked to implement Brain 101 policies, such as starting a concussion management team.	on safe teen drivers while student athletes read material on teen safety while working.			rated on a 5-point Likert scale measuring intention to report a concussion given to student athletes immediately before and after reviewing materials ; 38 question quiz containing 18 true/false questions on symptom identification, 10 questions rated on a 5-point Likert	team than schools in the control program; There were 201 documented concussions in the treatment group for an incidence rate of 51.5 concussions/1,000 Fall athletes and 153 documented concussions in the control group for an incidence rate of 43.2 concussions/1,000 Fall athletes; There was no statistically significant difference in concussion incidence rates between schools; Out	



Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					scale regarding knowledge application and 10 questions providing a concussion scenario with the intention to respond to the concussion rated on a 5-point Likert scale given to parents immediately before and after reviewing materials ; Interview with	of the athletes who received a concussion, there were no statistically significant differences between schools in the average time for the athlete to return to play, whether the athlete saw a healthcare professional, the average days of school missed, and whether the athlete received special accommodations at school.	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					school administration asked about the development of concussion management team; Athletic trainers kept concussion logs to keep track of incidence		
Hotz et al. (2015) <sup>268</sup>	20 high school football teams (10 in fall 2013 and 10 in fall 2014) with a total of 563	In fall 2014, 9 high school football teams with a total of 483 athletes were assigned to	High school football	1,046 high school football players ages 13-18 from 29 high schools in Miami-Dade County;	17 question multiple choice quiz on concussion knowledge given to treatment group before	Participants in the treatment group demonstrated no significant changes in concussion knowledge from before treatment to immediately	

268. Gillian Hotz et al., *The Challenges of Providing Concussion Education to High School Football Players*, 2 CURRENT RES.: CONCUSSION 103 (2015).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	athletes were assigned to receive Sports Legacy Institute Community Educators (SLICE) training (30 minutes) before the first game of the football season.	receive no training.		Gender not specified.	treatment, immediately after treatment, and 6 months after treatment. Quiz given to control group at the beginning of the football season and 6 months later.	after treatment and from before treatment to 6 months later; However, participants in the control group had increased concussion knowledge 6 months later compared to the beginning of the season, and this knowledge was significantly greater than the knowledge of participants in the treatment group.	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Hunt (2015) <sup>269</sup>	34 of 68 student athletes were randomly assigned to watch a concussion video created by the researchers (9 minutes); Years of data collection not specified.	34 of 68 athletes were randomly assigned to watch a nutrition video from McGraw Hill's Fitness Video Series (10 minutes).	High school volleyball and football	68 male and female high school varsity and junior varsity athletes ages 13-18 from 3 Division I high schools in South Carolina (81% response rate).	17 question quiz (true/false) on concussion symptom identification given to participants immediately before and after viewing the appropriate video.	Significant difference for time and group-by-time interaction but not for group, meaning that overall (including both groups) there was a significant increase in number of concussion symptoms identified from before the video to after the video and that when separated out by group, the improvement in symptom identification in the treatment group was	Participants viewed video with those in the appropriate treatment/control group at their school; each school had participants in both treatment and control groups.

269. Tamerah N Hunt, *Video Educational Intervention Improves Reporting of Concussion and Symptom Recognition*, 10 *ATHLETIC TRAINING EDUC. J.* 65 (2015).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
						significantly greater than the improvement in the control group.	
Kerr et al. (2015) <sup>270</sup>	In 2014 season, data was collected from 741 of 2,108 players from 27 teams in 2 leagues that had completed USA Football's Heads Up Football program <sup>271</sup> and were	704 of 2,108 players from 29 teams in 3 leagues who had not completed USA Football's Heads Up Football program and were not affiliated with Pop Warner Football.	Youth football	2,108 youth football players ages 5-15 from 100 teams in 10 leagues in Arizona, Indiana, Massachusetts, and South Carolina;	Athletic trainers attended practices and games for each team, recording concussions and exposure time.	45 concussions were reported in the 2014 season; concussion rates in practice: Heads Up Football+Pop Warner=0.19/1,000 AEs, Heads Up Football Only=0.65/1,000 AEs, No Heads Up Football=0.59/1,000 AEs; Significant difference in	Athlete-exposure (AE): 1 athlete in 1 game or practice; Injury rate: total # of concussions/ total # of AE

270. Zachary Y. Kerr et al., *Comprehensive Coach Education and Practice Contact Restriction Guidelines Result in Lower Injury Rates in Youth American Football*, 3 ORTHOPAEDIC J. SPORTS MED. 1 (2015).

271. USA Football's Heads Up Football program educates coaches on a variety of topics, including concussion education, correct use of equipment, and proper tackling techniques

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	affiliated with Pop Warner Football; <sup>272</sup> and from 663 of 2,108 players from 44 teams in 4 leagues that had completed USA Football's Heads Up Football program but were not affiliated with Pop Warner Football.			Gender not specified.		concussion rates in practice between Heads Up Football + Pop Warner and Heads Up Football Only but no difference between Heads Up Football + Pop Warner or Heads Up Football Only and No Heads Up Football; Concussion rates in games: Heads Up Football + Pop Warner=0.68 /1,000 AEs, Heads Up Football Only=1.5/1,0	

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272. Pop Warner Football sets specific guidelines, such that affiliates cannot do full-speed head-on tackling/blocking drills in practice and cannot have more than 1/3 of practice dedicated to contact drills

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
						00 AEs, No Heads Up Football=1.46/1,000AEs; no significant difference in concussion rates in games between all three groups; appears that differences in concussion rates is due to the presence of Pop Warner Football and not Heads Up Football	
Kerr et al. (2015) <sup>273</sup>	In the 2014 football season, data were collected from 38 players from 7	32 players from 8 teams from 2 leagues in South Carolina and 1 league in Arizona	Youth football	70 male youth football players ages 8-15 from 5 leagues in Arizona and	xPatch accelerometers were placed inside athlete helmets to determine the	7,478 head impacts of 10g or greater were recorded (2,841 in the Heads Up Football group and 4,637 in the non-Heads	This is a subsample of the data collected in the Kerr et al (2015) study above; One of

273. Zachary Y. Kerr et al., *Comprehensive Coach Education Reduces Head Impact Exposure in American Youth Football*, 3 ORTHOPAEDIC J. SPORTS MED 1 (2015).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	teams from 1 league from South Carolina and 1 league from Arizona who had completed USA Football's Heads Up Football program .	that did not participate in USA Football's Heads Up Football program .		South Carolina.	frequency of head impacts in games and practices.	Up Football group); 6 concussions were reported, all in the non-Heads Up Football group; Participants in the non-Heads Up Football group experienced significantly more 10g and 20g head impacts in practice than participants in the Heads Up Football group but this difference was not seen in games	the 7 teams in the Heads Up Football group is also affiliated with Pop Warner Football.



Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Kroshus et al. (2015) <sup>274</sup>	At the midpoint of the 2012-2013 hockey season, 22 athletes from 4 of 12 teams were randomly assigned to view the Concussions in Ice Hockey video (12 minutes). 56 athletes from 4 of 12 teams	26 athletes from 4 of 12 teams only received CDC's Heads Up Concussion in High School Sport: A Fact Sheet for Athletes.	Junior league hockey	103 male hockey players ages 18 or older from 12 teams in the same Tier III junior hockey league; teams were based in the northeast United States.	57 question quiz containing 48 questions regarding concussion knowledge, concussion attitudes, subjective reporting norms, concussion knowledge, reporting intention, and self-efficacy of reporting a concussion that	Under-reporting of concussions was significantly greater one month after treatment for participants who watched Head Games compared to before treatment, but there were no changes in reporting behavior for participants in the two other groups; Participants in all groups showed significant changes in subjective norms of reporting from baseline	Comparisons are made across teams; videos were viewed as a team

274. Emily Kroshus et al., *Pilot Randomized Evaluation of Publicly Available Concussion Education Materials: Evidence of a Possible Negative Effect*, 42 HEALTH EDUC. & BEHAV. 153 (2015).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	<p>were randomly assigned to view the documentary Head Games (90 minutes); All teams also received the CDC's Heads Up Concussion in High School Sport: A Fact Sheet for Athletes.</p>				<p>were rated on a 7point Likert scale and 9 true/false questions on the experience of concussion symptoms during the season and whether a coach was informed was given before treatment, one day after treatment, and one month after treatment.</p>	<p>to both one day and one month later, such that participants were more likely to indicate that their teammates would support playing through concussive symptoms one month after treatment compared to before treatment; Participants who viewed the Concussions in Ice Hockey video showed greater changes in subjective norms one day after treatment compared to</p>	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
						the control group; There were no differences between groups in concussion knowledge, attitudes about concussions, reporting intentions, or self-efficacy and no changes in these outcomes across all three time points.	
Kurowski et al. (2015) <sup>275</sup>	In the fall 2012 season and the winter 2012-2013 season, 234	262 student athletes from a different high school were assigned to	High school football, boys/girls soccer, boys/girls basketball, and	496 male and female student athletes ages 13 to 18 from two	36 question quiz with 25 true/false questions on concussion	Participants in the treatment group showed gains in concussion knowledge, concussion attitudes, and	Comparisons were made between schools; lectures were given in groups

275. Kurowski et al., *Impact of Preseason Concussion Education on Knowledge, Attitudes, and Behaviors of High School Athletes*, 79 J. TRAUMA & ACUTE CARE SURGERY S22 (2015).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	student athletes in one high school were assigned to receive a concussion education lecture from the research coordinator (20 minutes) before the season began.	receive no educational training.	boys/girls wrestling	high schools in Cincinnati, Ohio.	knowledge and symptoms and 11 questions on behavioral intention and attitudes that students rated as never, sometimes, or always was given to the treatment group before treatment, immediately after treatment, and at the end of the season. The quiz was	behavioral intention immediately after treatment but these gains declined to baseline at the end of the season. There were no changes in these outcomes measures for participants in the control group, and at the end of the season there were no differences in these measures between the treatment and control groups; 43/167 students in the treatment group and 77/222 students in the control	of 20-30 people.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					<p>given to the control group before the season began and at the end of the season; At the end of the</p>	<p>group reported concussion symptoms; 11/167 students in the treatment group and 13-122 students in the control</p>	
					<p>season athletes received a survey asking if they had experienced concussion during the season to measure incidence .</p>	<p>group received a concussion diagnosis from a healthcare professional; Of the students who self-reported concussion symptoms, 13/43 in the treatment group and 68/77 in the control group continued to play with</p>	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
						their concussion symptoms, which was found to be a significant difference; 3/11 students diagnosed with a concussion in the treatment group and 3/13 students diagnosed with a concussion in the control group returned to play while still experiencing concussion symptoms, which was not a significant difference	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Parker et al. (2015) <sup>276</sup>	From November 2012 to July 2013, pretest and post test data was obtained for all users of the National Federation of	No control group.	62% of participants were coaches, with sports including baseball, boys/girls basketball, bowling, boys/girls cross	133,764 participants completed the online training for the first time between November 2012 and July 2013; National sample	5 question quiz (multiple choice) on concussion knowledge taken immediately before and after treatment.	Overall, knowledge improved from before treatment to after treatment, but statistical analyses were not performed.	
	State High School Associations (NFHS)/ CDC online course Concussions in Sports:		country, field hockey, flag football, football, boys/girls golf, boys/girls gymnastics, ice				

276. Erin M. Parker et al., *Reach and Knowledge Change Among Coaches and Other Participants of the Online Course: "Concussion in Sports: What You Need to Know"*, 30 J. HEAD TRAUMA REHABILITATION 198 (2015).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	What You Need to Know (20 minutes)		hockey, boys/girls lacrosse, rugby, boys/girls soccer, softball, spirit, swimming, boys/girls tennis, boys/girls track, volleyball, boys/girls water polo, wrestling, and other				
Anderson et al. (2016) <sup>277</sup>	On the first day of football camp in summer 2012,	Not applicable.	High school football	120 male high school football players from	Quiz containing multiple choice and true/false	Prior concussion education was not associated with greater concussion	Two different quizzes both asking about concussi

277. Brit L. Anderson et al., *High School Football Players' Knowledge And Attitudes About Concussions*, CLINICAL J. SPORT MED. 206 (2016).



Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	120 high school football players completed a survey.			three high schools near Cincinnati, Ohio.	questions on concussion knowledge, questions rated on a Likert scale to measure concussion attitudes, and a question asking whether the athlete had been previously educated about concussions was given.	knowledge or concussion attitudes.	on knowledge and attitudes were used, although each participant only took one of the quiz versions.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Chinn and Porter (2016) <sup>278</sup>	Before the Fall 2014 sports season, 986 student athletes were given a survey.	Not applicable.	Community college football, volleyball, men's/women's soccer, and men's/women's water polo	986 male and female student athletes from seven community colleges; Specific age of participants not specified.	59 question quiz with true/false questions asking about concussion knowledge, questions rated on a 7-point Likert scale to determine concussion attitudes, and a question on prior concussion education.	There was an association between the number of times an athlete received concussion education and concussion knowledge, such that the more education received, the greater the concussion knowledge; No statistical tests were performed to determine whether a relationship between concussion attitudes and prior education exists.	

278. Nancy R. Chinn & Paul Porter, *Concussion Reporting Behaviours Of Community College Student-Athletes and Limits of Transferring Concussion Knowledge During the Stress of Competition*, *BMJ OPEN SPORT & EXERCISE MED.*, Aug. 31, 2016 at 1 (2016).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Eagles et al. (2016) <sup>279</sup>	At the beginning of the 2014-2015 youth hockey season, 43 players were given a Concussion-U presentation by a college hockey player who had retired due to concussions (30 minutes).	No control group.	Youth hockey	43 male youth hockey players ages 13-17 from 4 teams in the metropolitan area of St. John's.	41 question quiz containing 10 true/false questions on concussion symptoms, 13 true/false questions on concussion knowledge, 3 true/false questions based on scenarios that made up the concussion knowledge index, and 15 questions	There was a significant increase in concussion knowledge from before treatment to immediately after treatment and from before treatment to 4-6 months after treatment; Concussion attitude improved from before treatment to immediately after treatment but this increase was not sustained 4-6 months later.	

279. Matthew E. Eagles et al., *The Impact of a Concussion-U Educational Program on Knowledge of and Attitudes About Concussion*, 43 CAN. J. NEUROLOGICAL SCI. 659 (2016).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					regarding concussion attitudes rated on a 5-point Likert scale that made up the attitude index given immediately before and after treatment, and 4-6 months after treatment.		
Elliott et al. (2016) <sup>280</sup>	From April 2014 to March 2015, 858 students received	No control group.	66% of students indicated they participate in sports, including	858 youth ages 11-16 in grades 6-8 from 5	10 question quiz with multiple choice, true/false, and open-	Participants showed statistically significant improvements in concussion knowledge	

280. Ross-Jordan S. Elliott et al., *Pediatric Sport-Related Concussion Education: Effectiveness and Long-Term Retention of the Head Safety in Youth Sports (HSYS) Program for Youth Athletes Aged 11-16*, 3 COGENT EDUC. 1 (2016).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	the Head Safety in Youth Sports concussion education program, which is a PowerPoint presentation with videos presented by medical students (3545 minutes)		g: basketball, soccer, football, track, baseball, gymnastics, cycling, skating, wrestling, hockey, rugby, volleyball, tennis, and swimming	middle schools in Texas.	ended questions on concussion knowledge given immediately before treatment and immediately after treatment.	following treatment.	
Hecimovich et al. (2016) <sup>281</sup>	From March 2015 to July 2015, parents of youth		Youth Australian Rules Football	1,441 male and female parents of youth ages 19	24 question quiz with 16 true/false questions on	Parents with prior concussion education had greater concussion knowledge	

281. Mark Hecimovich et al., *Player and Parent Concussion Knowledge and Awareness in Youth Australian Rules Football*, SPORT J., Apr. 1, 2016, at 1.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	football players were asked to complete a survey.			or younger in Australian Rules Football.	concussion symptoms, 5 true/false questions on concussion knowledge, 2 scenarios with the intended behavior rated on a 3-point Likert scale, and 1 question regarding previous concussion education.	than parents without prior concussion education;	
Kroshus et al. (2016) <sup>282</sup>	In September 2013, 28,183 coaches	Not applicable.	Sports not specified; 55.1%	1,818 coaches of NCAA Division	18 question quiz containing 9	Coaches who indicated that they had previously received	

282. Emily Kroshus et al., *Content, Delivery, and Effectiveness of Concussion Education For US College Coaches*, 26 CLINICAL J. SPORTS MED. 391 (2016).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	<p>were emailed a survey.</p>		<p>of coaches coached a contact/collision sport, as determined by the NCAA Sports Medicine Handbook</p>	<p>n I, II, or II sports teams from 755 institutions (6% response rate); National sample.</p>	<p>questions on general concussion knowledge rated on a 5-point Likert scale, 4 scenarios of possible concussions rated on a 5-point scale from likely not a concussion to definitely a concussion, and 5 true/false questions regarding concussion management and return to</p>	<p>concussion training had greater general concussion knowledge, better ability to identify symptoms, and were less likely to allow a player to return to play with sustained concussion symptoms than coaches without previous concussion training.</p>	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					play.		
Macdonald and Hauber (2016) <sup>283</sup>	In August 2014, 47 parents were given a presentation about concussions that included three parts: the CDC Heads Up Concussion Online Training, the CDC Heads	No control group.	High school contact sports, including football	29 parents of athletes in contact sports at an urban high school in the Southeastern United States (47 parents sat through the presentation but not all completed the quiz).	20 question quiz with 18 questions rated on a 5-point Likert scale asking about how each part of the presentation affected their concussion knowledge, concussion attitudes, and concussion awareness. The CDC handout was rated as the second-most helpful tool in improving these outcomes with the YouTube video rated third;	Participants indicated that the CDC Online Training was most helpful in changing their concussion knowledge, concussion attitudes, and concussion awareness. The CDC handout was rated as the second-most helpful tool in improving these outcomes with the YouTube video rated third;	

283. Ian Macdonald & Roxanne Hauber, *Educating Parents on Sports-Related Concussions*, 48 J. NEUROSCIENCE NURSING 297 (2016).



Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	Up to School: Know Your Concussion ABCs handout, and the YouTube video “Know Your Impact: Concussion Awareness” (30-40 minutes total).				on awareness, one question asking whether or not the parent would seek out more concussion information, and one question asking parents to rank the three parts of the presentation in terms of motivating them to seek out more information on concussions.	however, the CDC handout was rated as the most likely tool to motivate them to seek out more concussion information, followed by the YouTube video and then the CDC Online Training; a majority of participants had no desire to seek more information on concussions following the presentation.	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
McDonald et al. (2016) <sup>284</sup>	During the 2011, 2012, and 2013 school years, 77 female high school athletes completed a survey.	Not applicable.	High school female soccer, softball, basketball, volleyball, track, cross country, dance, cheerleading, equestrian, swimming, gymnastics, tennis, bowling, and motocross	77 female high school athletes from three large high schools in metropolitan areas.	Quiz containing questions on the prior experience of concussion symptoms, number of concussions, actions taken following a suspected concussion, and whether or not the participant had previously had concussion	Participants who had previously had concussion education did not have more concussion diagnoses than participants without prior concussion education; participants with prior concussion education were not removed from play after reporting symptoms more often and did not seek medical help after a suspected concussion more often	

284. Tracy McDonald et al., *Underreporting of Concussions and Concussion-Like Symptoms in Female High School Athletes*, 23 J. TRAUMA NURSING 243 (2016).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					education was given.	than participants without prior concussion education.	
Bosshardt et al. (2017) <sup>285</sup>	120 male rugby players were given an educational presentation developed by the researchers, which consisted of a concussion knowledge assessment and a questionnaire of	No control group.	Rugby	120 male rugby players ages 16-18 from three rugby union schools in England	A knowledge assessment of concussion symptoms, diagnosis, and management, and a questionnaire of behavioral responses to concussion scenarios were administered before the	Athletes significantly improved the number of correct behavioral responses to the concussion scenarios, increasing from 46.1% pre-intervention to 53.9% post-intervention. Athletes also increased the number of correct responses in the knowledge assessment, from 37.85% pre-intervention	

285. Chris Bosshardt et al., *Does Concussion Education Have an Impact in Behaviours Amongst School-Age Rugby Players?*, 51 BRIT. J SPORTS MED. A15 (2017).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	behavioral responses to concussion scenarios. Years of data collection were not specified.				intervention and between 2-3 months after the intervention.	on to 44.07% post-intervention, but this difference remained insignificant. Athletes significantly increased their awareness of union and school concussion guidelines, from 19.4% pre-intervention to 73.2% post-intervention.	
Caron et al. (2017) <sup>286</sup>	35 participants were given a concussion education	No control group.	High school basketball and hockey.	35 male high school athletes ages 15-17 from a private school	55 question quiz containing 37 true/false questions on symptom	Concussion knowledge increased from before treatment to after the fourth presentation and from	The first three presentations were given to all 35 participants at

286. Jeffrey G. Caron et al., *Development, Implementation and Assessment of a Concussion Education Programme for High School Student-Athletes*, 36 J. SPORTS SCI. 48 (2017).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	program developed by the researchers that contained four different interactive oral presentations, given about one week apart (30 minutes each session); the content of the presentations was different each week and included signs			in a large Canadian city; Two focus groups with a total of 11 participants were held.	s and general concussion knowledge (which, taken together, comprise the concussion knowledge index), and 18 questions regarding concussion attitudes rated on a 5-point Likert scale that make up the attitude index taken immediately before the first presentation, immediately	before treatment to two months after the fourth presentation; there was no difference in scores from after the fourth presentation to two months after the fourth presentation; there were no significant changes in concussion attitudes throughout the study; data from the focus groups supported these findings since athletes reported learning more about concussions from the presentation	once and the last presentation was given separately to the basketball and ice hockey teams.

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	of concussion, return to play guidelines, long term consequences of concussion, and how to prevent concussion; Years of data collection not specified.				ely after the fourth presentation, and two months after the fourth presentation; focus groups were held two weeks after the fourth presentation to get feedback on the treatment.	but not necessarily being more likely to report concussions as a result of the presentations; however, some athletes indicated that they may try to change their behavior to protect themselves from getting a concussion.	
Carroll - Alfano (2017) <sup>287</sup>	From March 2012 to April 2014, data was collected from 89 of 249	In spring 2012, data was collected from 160 of 249 who graduated high school	College football, softball, men's/women's basketball, men's/women's	249 male and female athletes in the National Association of	4 question quiz with one true/false question asking if the participant had	Participants who had received concussion training were not more likely to seek treatment after a	In summer 2011, Illinois and Indiana passed a law requiring high

287. Miriam Carroll-Alfano, *Mandated High-School Concussion Education and Collegiate Athletes' Understanding of Concussion*, 52 J. ATHLETIC TRAINING 689 (2017).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	participants who should have received mandatory concussion education in high school.	before the mandatory concussion education legislation was passed.	cross-country, men's/women's track, men's/women's soccer, men's/women's volleyball, and others.	Intercollegiate Athletics at St. Xavier University who had attended high school in Indiana or Illinois.	attended concussion training, 2 true/false questions asking if the participant had received a concussion, and if so, if they sought treatment afterwards, and one open-ended question asking participants to list concussion symptoms.	concussion or able to list more concussion symptoms than participants who had not received training. Those who were in high school when concussion education was required did not appear to be more likely to seek treatment after receiving a concussion, although this statistical test was not performed; nor able to name more concussion symptoms than participants who were not in high	schools to provide concussion education materials to athletes; therefore, freshman entering college starting fall 2012 should have received the required concussion education; nonetheless, groups were split into those who reported receiving concussi

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
						school for this mandate	on training and those who did not for comparison in statistical analyses.
Conley and Savenye (2017) <sup>288</sup>	In spring 2012, data was collected from 11 of 23 students who had completed the Brainbook elearning course (50 minutes)	12 of 23 students who had not taken the Brainbook training were used as a control group.	78% of students participated in sports, including volleyball, boys basketball, soccer (boys and girls), baseball, football, girls	23 male and female students in grades 9, 10, and 12 from a charter school in Arizona; archival data consisted of surveys from	20 question quiz on concussion knowledge was given 6 months after Brainbook training occurred; face to face interviews with students with 7 open-	The majority of students who had taken the Brainbook training did not change the way they played sports after the training, but some said they are more aware of concussions as a result of the training; students who had Brainbook	Statistical tests were not performed on this data.

288. Quincy Conley & Willi Savenye, *Brainbook: An Impact Study of a Statewide Concussion Awareness Training for High School Athletes*, 56 PERFORMANCE IMPROVEMENT, 28 (2017).



Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	) in October 2011; archival data of surveys completed by students after Brainbook training was also used.		tennis, wrestling, and softball	150,000 students from Arizona high schools who had previously completed the Brainbook course.	ended questions on concussion knowledge and attitude graded by the researchers on a 3-point rubric were given immediately before or after the quiz.	training had greater concussion knowledge compared to students without the training; students with Brainbook training stated they were less likely to take action in response to a concussion in a teammate or themselves than students without training; students in surveys from the archival data indicated they were made more aware of the risks of concussions from the training.	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Kobitowich et al. (2017) <sup>289</sup>	162 undergraduate students from a university participated in a prospective randomized controlled trial. Students were separated into one of three intervention groups: a control group, which was not provided with educational	The control group was not provided with any educational materials.	No sport specified	162 undergraduate students from a university.	Participants completed an 18-item knowledge questionnaire before and after the intervention.	All groups demonstrated significantly higher postintervention scores compared to the preintervention scores. The presentation group demonstrated significantly higher postintervention scores than the control and internet group. There was no significant difference in post-intervention scores between the control group and the internet	

289. Tara Kobitowich & Martin Mrazik, *Concussion Education: A Randomised Trial with Undergraduate Students*, 51 BRIT. J. SPORTS MED. A62 (2017).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	materials; an internet group, which was provided with three educational websites and 30 minutes to review the website content; and the presentation group.					group.	
Payne et al. (2017) <sup>290</sup>	41 student athletes participated in an educational session	No control group.	High school boys and girls basketball and girls soccer.	41 male and female student athletes from a Pennsylvania	13 question quiz (true/false) on general concussion	There was no significant improvement in concussion knowledge following treatment.	

290. Ellen K. Payne et al., *Investigation of the Concussion Goggles Education Program with Secondary School Athletic Team: A Pilot Study*, 2 J. SPORTS MED. & ALLIED HEALTH SCI.: OFFICIAL J. OHIO ATHLETIC TRAINERS ASS'N 1 (2017).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	developed by Innocorp, Ltd, the manufacturers of Concussion Goggles™, which gave students hands on experience with the Concussion Goggles™ (60 minutes); Years of data collection not specified.			high school.	knowledge given immediately before and after treatment.		

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Caron et al. (2018) <sup>291</sup>	35 high school athletes were exposed to four oral concussion education presentations	No control group.	High school boys basketball and hockey.	35 male high school athletes, ages 15 to 17, from a private school in Canada.	Athlete knowledge and attitudes regarding concussions were evaluated at three time points (preintervention, post-intervention, and 2 months post-intervention) using the Rosenbaum Concussion Knowledge and Attitudes Survey, Student Version.	While athlete concussion knowledge significantly differed over time, with significant improvement noted between pre- and post-intervention, there was no significant difference in concussion attitudes over time. There was no significant difference between post-intervention and the 2-month follow-up.	

291. Jeffrey G. Caron et al., *Development, implementation and assessment of a concussion education programme for high school student-athletes*, J. SPORTS SCI. (2018).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Daugherty et al. (2018) <sup>292</sup>	A usability and effectiveness assessment of a mobile application game (Heads Up Rocket Blades), developed by the CDC, was conducted by with 12 adults and 13 children at two time points: January 2015, and May/June 2015.	No control group.	No sport listed.	12 adults and 13 of their children.	The usability assessment consisted of parent and child questions regarding how easy the interface was to use, whether the game was enjoyable to play, and overall impressions of the game. The effectiveness assessment	During the second round of game testing, all children reported that the game was fun and enjoyable. All children correctly identified at least one core objective, and most were able to identify all three core objectives. All parents reported that the game was a good learning tool for teaching concussions, and most reported that they would download	

292. Jill Daugherty et al., *A Description and Evaluation of the Concussion Education Application HEADS UP Rocket Blades*, HEALTH PROMOTION PRAC. (2018).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	ne 2016.				determined whether or not children who played the game could understand at least one of the three core learning objectives predetermined by the CDC. These learning objectives were formulated using research on youth concussion and how youth retain concussi	the game for their children to play at home. Strengths of the game included how easy the game was to understand, how it taught children about important health issues, and its convenience.	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					on-related information.		
Hotz et al. (2018) <sup>293</sup>	During 2015-2016, 152 high school football players were provided a 15-minute concussion education video created by UConcussion.	No control group.	Football	152 high school athletes from three high school football teams.	Athlete knowledge was surveyed through ten multiple choice questions at three time points (preintervention, immediately postintervention, and three months postintervention). Attitudes, and behavioral questions	Athlete knowledge significantly differed across all time points measured. Athlete knowledge was significantly higher postintervention, and no significant differences were observed between postintervention and the 3-month follow-up. The attitudes and behavioral questions	The authors only surveyed athlete behaviors and attitudes at the 3-month follow-up time point. Therefore, this study did not reveal how athlete behaviors and attitudes changed as a result of the

293. Gillian Hotz, *Concussion: Video Education Program for High School Football Players*, 20 *SPORT J.* (2018).



Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
					were surveyed at the 3month postintervention	revealed significant differences across schools.	intervention.
Hunt et al. (2018) <sup>294</sup>	102 parents whose children are involved in athletics within the Georgia High School Association (GHSA) completed a survey that measured concussion knowledge	No control group.	No sport listed.	102 GHSA parents. Survey participants were divided into two groups: those that reported receiving the GHSA concussion information sheet <i>only</i> (n = 54),	The 34-item on-paper survey contained questions about demographic information, concussion knowledge, and concussion scenarios designed to apply concussion knowledge.	Overall, parents displayed moderate knowledge of concussion. There was no significant difference in knowledge between parents that only received the GHSA information sheet and those that completed additional concussion training. There was	

294. Tamerah Hunt, N., Chloe Salway, Steve Patterson & Jody Langdon, *Concussion Knowledge and Understanding in Guardians Following Administration of Standardized Education Form*, 50 MED. & SCI. SPORTS & EXERCISE 477 (2018).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	ge.			and those that completed additional concussion education (n = 48).		no significant difference between performance on the concussion knowledge questions and the concussion scenario questions.	
Sullivan et al. (2018) <sup>295</sup>	From 2016-2017, 229 (59 participated) of 428 secondary school athletes from the Gaelic Athletic Association of Ireland participated	199 (153 participated) of the 428 athletes were assigned to a control group that did not receive the education	Football and/or hurling/camogie	428 (212 participated) secondary school athletes from 35 (5 participated) teams in the Gaelic Athletic Association of	Athletes completed a questionnaire at three time points (pre-intervention, immediately after the intervention and 3 months after the	Post-intervention, athletes who completed the intervention exhibited increased behavioral control over concussion symptom recognition, immediate disclosure of symptoms, and reporting intentions	

295. L. Sullivan, L. Pursell & M. Molcho, *Evaluation of a theory-based concussion education program for secondary school student-athletes in Ireland*, HEALTH EDUC. RES. (2018).

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
	ted in a concussion education program based on the theory of planned behavior .			Ireland. Of the 428 participants, only	intervention) on their knowledge, attitudes toward concussion reporting, subjective reporting norms, perceived behavioral control, and reporting intention regarding concussion.	compared to their baseline attitudes. There were no significant differences between intervention athletes preintervention and postintervention regarding attitudes of perceived outcomes of concussion reporting and subjective reporting norms. Athletes who completed the intervention had significantly higher knowledge post-intervention and compared to controls. Athletes who	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
						<p>completed the intervention has significantly higher reporting intentions at the 3-month follow-up compared to controls, but there were no significant differences in perceived behavioral control, subjective reporting norms, and attitudes towards perceived consequences of concussion reporting.</p>	

Study	Treatment / Intervention	Control conditions	Sport	Subject Population, with N	Outcome measures	Results	Notes on methods
Wallace et al. (2018) <sup>296</sup>	In fall 2016, 102 high school athletes participated in a Concussion Bingo activity.	No control group.	High school football, volleyball, and women's basketball.	102 male and female high school athletes from two Title I urban high schools in northeast Ohio.	Concussion knowledge, including signs/symptoms (true/false), loss of consciousness, injured anatomical structures, risk of multiple concussions, and premature return to play, was assessed pre- and post-intervention using a 10-minute,	Post-intervention, athletes exhibited higher knowledge of "lesser" common signs and symptoms of concussion (i.e. fogginess, changes in mood, and nausea) and information regarding a concussive injury. Athletes exhibited moderately greater general concussion knowledge postintervention compared to pre-	Participants "marked" concussion terms on a bingo card as they appeared in a concussion education presentation.

296. Jessica Wallace, Tracey Covassin & Erica Beidler, *Concussion Bingo: Taking an active learning approach to concussion education with vulnerable populations*, HEALTH EDUC. J. (2018).

<b>Study</b>	<b>Treatment / Intervention</b>	<b>Control conditions</b>	<b>Sport</b>	<b>Subject Population, with N</b>	<b>Outcome measures</b>	<b>Results</b>	<b>Notes on methods</b>
					45-question survey.	intervention (78.3% correct to 86.1% correct).	