

GAO

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CONCUSSION IN HIGH SCHOOL SPORTS

Overall Estimate of Occurrence Is Not Available, but Key State Laws and Nationwide Guidelines Address Injury Management

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Highlights of [GAO-10-569T](#), a testimony before the Committee on Education and Labor, House of Representatives

Why GAO Did This Study

Participation in school sports can benefit children but also carries a risk of injury, including concussion. Concussion is a brain injury that can affect memory, speech, and muscle coordination and can cause permanent disability or death. Concussion can be especially serious for children, who are more likely than adults both to sustain a concussion and to take longer to recover. These factors may affect return-to-play decisions, which determine when it is safe for an athlete to participate in sports again.

GAO was asked to testify on concussion incurred in high school sports. This statement focuses on (1) what is known about the nationwide occurrence of concussion, (2) federal concussion prevention programs, (3) the components of key state laws related to the management of concussion, and (4) the recommendations of voluntary nationwide concussion management guidelines. To do this work, GAO conducted literature searches; reviewed injury databases, state laws, and documents from federal agencies and organizations that conduct work in high school athletics or sports medicine; and interviewed federal officials and experts who identified key state laws and nationwide guidelines and provided other information. GAO shared the information in this statement with the relevant federal agencies.

[View GAO-10-569T or key components.](#)
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What GAO Found

GAO identified three national databases that, as part of broader data collection efforts, collect information on the occurrence of concussion in high school sports, but they do not provide an overall national estimate of occurrence. Although the High School Reporting Information Online database provides national estimates of occurrence of concussion, it covers only 20 sports for high schools with certified athletic trainers. It may underestimate occurrence because some athletes may be reluctant to report symptoms of a possible concussion to avoid being removed from a game. The Consumer Product Safety Commission's (CPSC) National Electronic Injury Surveillance System provides national estimates only on concussions treated in an emergency room. The National Center for Catastrophic Sports Injury Research database provides information only on cases of concussion with serious complications and cannot provide national estimates of the occurrence of all concussions.

The Centers for Disease Control and Prevention's program, Heads Up: Concussion in High School Sports, which began in September 2005, is the primary federal prevention program directed toward concussion. In addition, CPSC carries out prevention initiatives that include distributing educational materials, but these initiatives are directed more broadly at sports and recreation safety, such as appropriate helmets for football, baseball, and bicycling.

The three key laws regarding the management of concussion in high school sports that were identified by federal officials and experts—those of Oregon, Texas, and Washington—all address concussion education and return to play, but their specific requirements vary. The education requirements vary with respect to who is to receive the education. For example, the Washington law targets coaches, athletes, and parents, while the Oregon law targets coaches only. There is also variation with respect to the content and frequency of education. The return-to-play requirements vary in the conditions under which athletes may return to play and in who may authorize it. For example, the Texas requirements apply specifically to athletes who lose consciousness, which excludes many concussions, and the Washington law requires return-to-play authorizations to be made by health professionals specifically trained in the evaluation and management of concussion.

GAO found five sets of voluntary nationwide guidelines, which were developed by organizations that conduct work in high school athletics or sports medicine, that address the management of concussion in high school sports. All recommend monitoring an athlete with a concussion on the sidelines and assessing cognitive function regularly for signs of deterioration. All guidelines also recommend returning an athlete to play on a gradual basis, tailored to an individual's recovery and based on symptoms and the results of memory, cognition, and balance tests.

Mr. Chairman and Members of the Committee:

I am pleased to be here today to discuss concussion incurred in competitive high school sports. More than 7.5 million high school students participated in high school sports in 2008-2009, according to the National Federation of State High School Associations (NFHS).¹ Participation in school sports can benefit children, but it also carries a risk of injury, including concussion. Concussion is an injury to the brain that results in the temporary loss of normal brain function and can have serious, long-term consequences. Concussion among athletes has recently received increased attention, and the long-term effects of concussion among professional football players has been the focus of several congressional hearings.

Concussion is caused by a bump or blow to the head or by a jolt to the body that causes the head to move rapidly back and forth. Even a mild blow to the head could result in a concussion. Concussion can affect memory, judgment, reflexes, speech, balance, and muscle coordination and can result in serious complications, such as swelling, bruising, or bleeding of the brain, which can cause permanent disability or death. Most concussions, however, do not result in a loss of consciousness, and some athletes may not experience symptoms until hours or days after sustaining a concussion. Therefore, according to the Centers for Disease Control and Prevention (CDC), all coaches, parents, and athletes need to learn concussion signs and symptoms and what to do if a concussion occurs.

Several factors may affect decisions about when it is safe for an athlete to participate in sports again, which are referred to as return-to-play decisions. For example, research has shown that athletes who have sustained one concussion are at increased risk of sustaining another concussion.² An athlete who sustains a repeat concussion before the brain recovers from the first—within hours, days, or weeks—may recover more slowly or may have increased likelihood of long-term consequences.

¹National Federation of State High School Associations, *2008-2009 High School Athletics Participation Survey* (Indianapolis, Ind., 2009). NFHS leads the development of education-based sports and activities for its member associations. NFHS membership consists of the high school athletic or activity associations of the 50 states and the District of Columbia, from which it collects information on the numbers of students participating in high school sports.

²According to scientific literature, the increased risk may be due to the athlete's style of play or to changes in the brain resulting from the previous concussion.

Research has also shown that children and adolescents are more likely than adults to sustain a concussion and take longer to recover from one, although the reasons for this difference remain unclear.³

Several federal agencies have responsibility for working to promote the health and wellness of children and youth, such as by developing programs for the prevention or management of injuries. Within the Department of Health and Human Services (HHS), CDC is responsible for promoting the health and well-being of the U.S. population, including creating policies to prevent unintentional injuries among children and adolescents and to minimize the consequences of these injuries. These responsibilities encompass conducting research and developing programs and educational initiatives related to the prevention and management of injuries, such as concussion. HHS's National Institutes of Health (NIH) is responsible for conducting and supporting medical research to improve health and save lives, including developing strategies to prevent childhood illness and death and developing techniques and technologies for the rehabilitation of individuals with physical disabilities resulting from injuries, such as concussion. HHS's Health Resources and Services Administration (HRSA) is responsible for strengthening the maternal and child health infrastructure in concert with states, communities, and private partners, including promoting children's health and increasing access to comprehensive services for patients with severe head injuries.

Other federal agencies that have responsibilities for promoting the health and wellness of children and youth are the Department of Education (Education) and the Consumer Product Safety Commission (CPSC). Education has responsibility for administering programs that promote the health and well-being of students, including a discretionary grant program related to physical education. CPSC regulates thousands of consumer products, including sports equipment, with the goal of protecting the public from unreasonable risks of serious injury or death.

³M. Field, M.W. Collins, M.R. Lovell, and J. Maroon, "Does Age Play a Role in Recovery from Sports-Related Concussion? A Comparison of High School and Collegiate Athletes," *Journal of Pediatrics*, vol. 142, no. 5 (2003). M.W. Kirkwood, K.O. Yeates, and P.E. Wilson, "Pediatric Sport-Related Concussion: A Review of the Clinical Management of an Oft-Neglected Population," *Pediatrics*, vol. 117, no. 4 (2006). J. Gilchrist, K.E. Thomas, M. Wald, and J. Langlois, "Nonfatal Traumatic Brain Injuries from Sports and Recreation Activities, United States, 2001-2005," *Morbidity and Mortality Weekly Report*, vol. 56, no. 29 (2007).

In addition to these federal efforts, several private organizations and states have either studied the occurrence of concussion in high school sports or developed concussion prevention and management guidelines. For example, research on sports injuries has been conducted by the Center for Injury Research and Policy at Nationwide Children's Hospital in Columbus, Ohio, through the National High School Sports Related Injury Surveillance Study's High School Reporting Information Online (High School RIO). In addition, the National Center for Catastrophic Sports Injury Research (NCCSI) at the University of North Carolina, Chapel Hill, studies catastrophic sports injuries in high school and college athletes. Some states have passed laws related to concussion incurred in school sports. In addition, several organizations that conduct work in high school athletics or sports medicine have developed voluntary guidelines for the management of concussion.

You expressed interest in obtaining information on concussion incurred by young athletes. My statement today focuses on concussions incurred by students while playing or practicing competitive high school sports⁴ and addresses the following questions: (1) What is known about the nationwide occurrence of concussion incurred in high school sports? (2) What federal programs are directed specifically at the prevention of concussion incurred in high school sports? (3) What are the components of key state laws regarding the management of concussion incurred in high school sports? (4) What are the recommendations of voluntary nationwide guidelines for the management of concussion incurred in high school sports?

To determine what is known about the nationwide occurrence of concussion incurred in high school sports, we conducted a literature search of social science and medical databases to find articles published from 1999 through 2009 that discuss or report national data from public or private programs for tracking the occurrence of concussion in high school sports. We reviewed documentation and interviewed officials from CPSC, the Center for Injury Research and Policy, and NCCSI. The interviews focused on information about data collection methods and the generalizability, strengths, and limitations of the data that these organizations collect. We also conducted interviews with federal officials and experts from organizations that conduct work in the area of high

⁴For the purposes of this statement, we are excluding sports played as part of physical education classes.

school athletics or sports medicine to obtain assistance in identifying relevant data sources and to obtain information about the strengths and limitations of existing data sources.⁵ We identified these organizations from interviews with federal officials, literature we reviewed, and interviews with other experts. We then examined the characteristics of the national databases we identified, including how data are collected, the target population, and the sports studied. We did not analyze the data to generate and report incidence statistics, but rather to determine the manner in which the data are collected and to analyze how this affects the availability of data on nationwide occurrence. To determine what federal programs are directed specifically at the prevention of concussion incurred in high school sports, we searched federal Web sites to identify prevention programs related to concussion in high school sports. We also interviewed federal officials to identify federal prevention programs and to obtain information and program materials, and we reviewed these materials to determine when these programs were developed, how educational materials are disseminated, and who the target audience is.

To describe the components of key state laws regarding the management of concussion incurred in high school sports, we interviewed federal officials and experts who provided assistance in identifying relevant state laws. We then reviewed the laws and identified their key components, similarities, and differences. The state laws we reviewed were those identified to us by federal officials and experts and do not necessarily constitute a complete list of all state laws that might address, specifically or in a broader context, the management of concussion incurred in high school sports. To describe the recommendations of voluntary nationwide guidelines for the management of concussion incurred in high school sports, we interviewed federal officials and experts to obtain assistance in identifying nationwide guidelines and to obtain information about the development of the guidelines. We excluded those guidelines that focused on one sport only or were developed prior to 1995. We then reviewed the guidelines and relevant documents and identified the guidelines' key recommendations and the similarities and differences across guidelines. The guidelines we reviewed were those identified to us by federal officials and experts and do not necessarily constitute a complete list of all

⁵Specifically, we interviewed officials from CDC, CPSC, Education, HRSA, NIH, the American Academy of Pediatrics, the American College of Sports Medicine, the National Athletic Trainers' Association, NFHS, and others. We also interviewed officials from these federal agencies and organizations to answer our remaining research questions.

nationwide guidelines that might address the management of concussion incurred in high school sports.

We shared the information in this report with CDC, CPSC, Education, HRSA, and NIH. The agencies provided technical comments, which we incorporated as appropriate.

We conducted our work from October 2009 through May 2010 in accordance with all sections of GAO's Quality Assurance Framework that are relevant to our objectives. The framework requires that we plan and perform the engagement to obtain sufficient and appropriate evidence to meet our stated objectives and to discuss any limitations in our work. We believe that the information and data obtained, and the analysis conducted, provide a reasonable basis for any findings and conclusions in this product.

Available Information about the Occurrence of Concussion in High School Sports Cannot Provide an Overall National Estimate

We identified three national databases that, as part of broader data collection efforts, collect information on the occurrence of concussion in high school sports, but they do not provide an overall national estimate of occurrence. These databases are the NCCSI database, the CPSC's National Electronic Injury Surveillance System (NEISS), and the Center for Injury Research and Policy's High School RIO. (See table 1 for descriptions of the databases.)

Table 1: Characteristics of Concussion Occurrence Databases

Database	Managing organization	Information characteristics		
		Data gathered	Sources used to identify injuries	Methods used to collect data
National Center for Catastrophic Sports Injury Research (NCCSI) database	University of North Carolina at Chapel Hill	Injury information about cases of catastrophic injuries in high school and college athletes, including concussions with serious complications	Media reports obtained through Internet searches and questionnaires sent to state high school associations to identify catastrophic injuries	Researchers review published accounts and contact the school, coach, doctor, and family of the injured athlete
National Electronic Injury Surveillance System (NEISS)	Consumer Product Safety Commission (CPSC)	Information on injuries related to a consumer product for all patients—including those diagnosed with a concussion—treated in emergency departments ^a	Random national sample of approximately 100 hospitals with 24-hour emergency services, stratified by size	Hospital staff conduct chart reviews and assign a code for the type of injury the patient sustained and a code based on the product or activity associated with the injury, if applicable
National High School Sports Related Injury Surveillance Study (High School RIO)	Center for Injury Research and Policy, Nationwide Children’s Hospital, Columbus, Ohio	Participation and injury information, including concussion, for 20 high school sports	Random national sample of 100 high schools with certified athletic trainers ^b who have volunteered to participate, stratified by geographic location and size	Athletic trainers report information online weekly

Source: GAO analysis of NCCSI, CPSC, and Center for Injury and Research Policy database operations documents.

^aIn addition, since 2000 CDC has provided funding through an interagency agreement with CPSC to expand NEISS to collect information from about two-thirds of the hospitals in the sample on all types and causes of nonfatal injuries, including those not related to consumer products, for all patients treated in their emergency rooms.

^bCertified athletic trainers are health care professionals who have a bachelor’s or master’s degree in and are board certified in athletic training.

According to experts and federal officials, while none of the databases can provide a national estimate of the occurrence of concussion in high school sports, two of them provide national estimates of the occurrence of concussion for the populations they study. High School RIO provides national estimates of the occurrence of concussion in 20 sports for high schools with certified athletic trainers,⁶ based on its sample of 100 high

⁶E.E. Yard and R.D. Comstock, “Compliance With Return to Play Guidelines Following Concussion in US High School Athletes, 2005-2008,” *Brain Injury*, vol. 23, no. 11 (2009).

schools with certified athletic trainers.⁷ Because it collects data on participation in the sports it studies, High School RIO also calculates injury rates by sport and by sex. NEISS provides national estimates of the occurrence of concussion treated in hospital emergency departments, based on its random national sample of approximately 100 hospitals with 24-hour emergency services.⁸ The third database, NCCSI, provides information on cases of concussion with serious complications, but it cannot provide national estimates of occurrence of all concussions.

According to experts and federal officials, High School RIO and NEISS have certain strengths. The information collected by High School RIO is timely, as athletic trainers in the sample schools report data on a weekly basis. According to CPSC officials, the information collected by NEISS is also timely, in that hospitals in the sample report information on a daily basis and NEISS receives approximately half of the data within 4 days of the patient's being seen in the emergency department. In addition, both High School RIO and NEISS collect information in ways—such as through certified athletic trainers and through review of medical charts, respectively—that experts report to produce more reliable information than other methods.

Experts and federal officials have noted that notwithstanding these strengths, the national estimates provided by High School RIO and NEISS may be underestimates of the overall national occurrence of concussion in high school sports. For example, High School RIO gathers information only on concussions that are reported to or observed by a certified athletic trainer, but, according to officials from an athletic trainers' association, athletes may be reluctant to report symptoms of possible concussions to athletic trainers to avoid being removed from play. In addition, the athletic trainers cannot be present at all practices and games and the coaches and parents who are present may not recognize the signs or symptoms of a concussion, resulting in an underestimate of the actual number of

⁷Certified athletic trainers are health care professionals who have a bachelor's or master's degree in and are board certified in athletic training. The National Athletic Trainers' Association estimates that approximately 42 percent of high schools have access to a certified athletic trainer. Schools may have a full-time certified athletic trainer on staff, share a trainer with other schools, or receive the services of a trainer who volunteers on a part-time basis.

⁸J. Gilchrist, K.E. Thomas, M. Wald, and J. Langlois, "Nonfatal Traumatic Brain Injuries From Sports and Recreation Activities—United States, 2001-2005," *Morbidity and Mortality Weekly Report*, vol. 56, no. 29 (2007).

concussions in the schools studied. Further, some athletes may consult their family physician about signs and symptoms of a possible concussion without reporting it to the athletic trainer. These concussions would not be included in the database. In addition, because High School RIO collects information on only 20 sports, its data cannot be used to estimate the occurrence of concussion in all sports. Similarly, NEISS gathers information only on concussions in patients who are treated in emergency departments, but not all athletes with a concussion go to an emergency department for treatment. Furthermore, the medical charts that are reviewed by hospital staff for NEISS may not always indicate detailed circumstances of the concussion, and therefore the staff may miss some concussions that were sustained during athletic participation.

Experts and federal officials identified additional features of the databases that may lead to further uncertainty and thus preclude the use of the data to provide comprehensive national estimates of concussion in high school sports. For example, High School RIO does not collect data from schools that do not have certified athletic trainers, and researchers do not know how the occurrence and reporting of concussion in schools with athletic trainers differ from schools without athletic trainers or what effect any difference would have on estimates of occurrence. In addition, according to CPSC officials, NEISS cannot always indicate whether a concussion was sustained during participation in a sport or simply involved sports equipment. For example, NEISS would count a concussion sustained by a person who was hit on the head with a baseball bat as a sports-related concussion, regardless of whether or not the injury was incurred during a baseball game or practice.

The Primary Federal Program Directed Specifically at Preventing Concussion in High School Sports Is CDC's Heads Up: Concussion

CDC's Heads Up: Concussion in High School Sports is the primary federal program directed specifically at preventing concussion in high school sports. The program, which is one of CDC's educational initiatives, is intended to provide educational materials for coaches, athletic trainers, athletic directors, parents, and athletes to prevent concussion.⁹ The Heads Up: Concussion in High School Sports tool kit includes a concussion guide for coaches with information on signs and symptoms and strategies for preventing concussions, a coach's quick-reference wallet card, a coach's clipboard sticker with concussion facts and space for emergency medical contacts, two fact sheets—one for parents and one for athletes—in English and Spanish, an educational DVD, posters for school gymnasiums, and a disc that contains additional resources. According to CDC officials, the Heads Up: Concussion in High School Sports materials were developed by a panel of experts from CDC and outside the federal government.

CDC rolled out the Heads Up: Concussion in High School Sports program in September 2005 to coincide with the beginning of the school year. As part of the agency's promotional activities for its national roll-out, CDC developed press kits and other promotional materials, and to promote the program, it partnered with 14 public and private organizations, including Education, physician associations, and other organizations that conduct work in high school athletics or sports medicine. CDC also conducted a targeted media campaign consisting of e-mails and telephone calls to local, regional, and national media outlets, regional and national newspapers, and general and specialty magazines. In addition, the Surgeon General served as a key spokesperson and participated in radio interviews with program officials.¹⁰ CDC estimates that it distributed 20,000 tool kits within the first 3 months of the program and reached 6 million listeners and readers through the targeted media campaign.¹¹ Agency officials

⁹CDC officials told us that the agency developed the Heads Up: Concussion in High School Sports program to follow up on its Heads Up: Brain Injury in Your Practice program, which CDC released in 2002 for primary care physicians.

¹⁰The Surgeon General, whose office is in the Office of the Secretary of HHS, has responsibilities for public health education and promotion, including the promotion of special departmental health initiatives, among other duties.

¹¹CDC conducted an evaluation of the Heads Up: Concussion in High School Sports initiative in 2008, in which the agency surveyed eligible high school coaches who received the tool kit from September 2005 to July 2006. More than one-third of responding coaches reported that they learned something new about concussions from the tool kit, and half of responding coaches noted that the tool kit made them view concussions more seriously.

estimate that CDC distributed more than 300,000 Heads Up: Concussion in High School Sports materials overall by the end of December 2009.¹²

CDC has continued to update and expand its Heads Up: Concussion in High School Sports materials. CDC plans to release updated Heads Up: Concussion in High School Sports materials in spring 2010 to coincide with the release of free online training for high school coaches developed by CDC and NFHS, which will include downloadable Heads Up: Concussion materials and an educational video. CDC has also continued to expand its Heads Up programs to target broader audiences.¹³ In addition, CDC officials told us that the agency created sports-specific materials in conjunction with the national governing bodies for youth and high school football, lacrosse, and ice hockey¹⁴ based on the Heads Up: Concussion in High School Sports and other materials. The sports-specific materials include prevention and safety information related to each sport and its equipment. The agency plans to continue developing specific materials for additional sports.

Other federal agencies administer programs related to concussion, but most of these programs are not directed specifically at the prevention of concussion in high school sports. CPSC carries out initiatives that include developing educational materials such as brochures and fact sheets. These initiatives are not targeted exclusively at high school sports, but are directed more broadly at sports and recreation safety for youth and adults. For example, CPSC developed a brochure on which helmets to wear for a variety of activities, such as football, baseball, and bicycling, to prevent head injuries, including concussion. HRSA and NIH administer grant programs related to concussion and brain injury from all causes and for all age groups. HRSA grants focus on high-risk groups including youth ages 15-19, and NIH grants have supported some research on concussion in

¹²CDC also makes the materials available for download on its Web site.

¹³In 2007, CDC launched the Heads Up: Concussion in Youth Sports program to provide educational prevention materials for coaches of youth athletes ages 5 through 18 participating in organized and unorganized sports. In March 2010, CDC released the Heads Up to Clinicians program to provide emergency department health professionals with information on the management of brain injuries in adults. In addition, CDC is planning to release in spring 2010 its Heads Up to Schools: Know Your Concussion ABCs program for grades K through 12 school professionals—such as school nurses, counselors, and administrators—and parents.

¹⁴These governing bodies may also provide support, skill development, and education to college or adult amateur athletes.

high school sports. However, neither agency administers programs specifically for the prevention of concussion in high school sports. According to department officials, Education does not administer any programs related to the prevention of concussion.

Concussion Education and Return-to-Play Requirements Are the Focus of Key State Laws, but Exact Requirements Differ

The three key state laws regarding the management of concussion that were identified by federal officials and experts all include requirements related to concussion education and athletes' return to play. (See table 2.) The education components of the key state laws—those of Oregon, Texas, and Washington¹⁵—vary in terms of targeted group and frequency of training. The return-to-play requirements of the key state laws vary with respect to the conditions under which the requirements apply and the personnel who may authorize return to play.

¹⁵2009 Or. Laws, ch. 661; 2007 Tex. Sess. Law. Serv., ch. 1296 (West); and 2009 Wash. Sess. Laws, ch. 475. Other states may have laws or may be considering legislation related to concussion incurred in high school sports.

Table 2: Components of Key State Laws Regarding the Management of Concussion Incurred in High School Sports

Components	State (Year enacted)		
	Oregon (2009) ^a	Texas (2007) ^b	Washington (2009) ^c
Education requirements			
Schools covered	School districts ^d	Public schools and any other schools subject to University Interscholastic League (UIL) rules ^e	School districts ^f
Targeted group(s)	Coaches	Coaches, trainers, physicians who assist with activities, sponsors of extracurricular activities, and athletes ^g	Coaches, athletes, and parents
Content	Recognizing symptoms of concussion and knowing how to seek medical treatment	Recognizing symptoms of potentially catastrophic sports injuries, including concussion ^h	Understanding the nature and risk of concussion and head injury, including the risk of continuing to play after a concussion or head injury
Frequency	Annual	Not specified, but an annual safety drill is required. A UIL official reported that UIL requires education for coaches and students annually	Not specified for coaches; athletes and parents must sign an information sheet annually
Return-to-play requirements			
Conditions under which return-to-play requirements apply following injuries	Presence of signs, symptoms, and behaviors consistent with concussion following an observed or suspected blow to the head or body or diagnosis of concussion	Loss of consciousness for any reason	Suspicion of concussion
Removal from play	Athlete removed from any event or training on day of injury	Athlete removed from play on day of injury. According to a UIL official, these decisions are made by personnel designated by the school, typically a coach or athletic trainer	Athlete removed from play at the time of injury. According to the Washington Interscholastic Athletic Association (WIAA), removal is the responsibility of the coach
Return-to-play requirements	Athlete may return to play no sooner than the day after the athlete sustained the blow to the head or body and only after the athlete (1) no longer exhibits signs, symptoms, or behaviors that are consistent with concussion; and (2) receives a medical release from a health care professional	Athlete may not (1) return to the practice or competition during which the athlete became unconscious, or (2) participate in any extracurricular athletic activity until the athlete receives written authorization from a physician	Athlete may not return to play until the athlete is evaluated by and receives written clearance to return to play from a licensed health care provider trained in the evaluation and management of concussion

Components	State (Year enacted)		
	Oregon (2009) ^a	Texas (2007) ^b	Washington (2009) ^c
Sanctions			
Possible sanctions for failure to comply with law	The law does not provide sanctions	The law provides that schools shall be subject to a range of penalties determined by UIL. According to UIL, penalties range from reprimand to disqualification and can affect individuals, such as a coach, or the school	The law does not provide sanctions. WIAA rules state that students cannot participate in competitive district athletics without having a signed concussion information sheet on file with the school district

Source: GAO analysis of key state laws and relevant implementation guidelines.

^a2009 Or. Laws, ch. 661. The law does not specify a particular association or other entity to assist in implementation. The law first applies to the 2010-2011 school year.

^b2007 Tex. Sess. Law. Serv., ch. 1296 (West). The Texas Commissioner of Education adopted the Extracurricular Activity Safety Training Program of UIL as the safety training program to be provided under this law. Implementation guidelines for this program are provided by UIL.

^c2009 Wash. Sess. Laws, ch. 475. Implementation guidelines are developed by school districts in concert with the Washington Interscholastic Activities Association (WIAA).

^dAccording to an official from the Oregon Department of Education, this term does not apply to private schools.

^eUIL is a voluntary-membership, nonprofit organization created by the University of Texas at Austin to provide leadership and guidance to public school debate and athletic teachers. According to a UIL official, the league has 1,300 member schools, all but 2 of which are public schools.

^fThe Washington State Superintendent of Public Instruction has issued a memo indicating that, while the law does not mention private schools directly, WIAA directs all member schools to follow the new requirements. WIAA has 800 public and private member high schools and junior high or middle schools, approximately 10 percent of which are private schools, according to a WIAA official.

^gThe Texas law also requires directors of school marching bands to complete the education program.

^hAmong other potentially catastrophic sports injuries that the law mentions are heatstroke and cardiac arrest.

All three state laws include requirements for education on concussion, but they vary in the groups targeted and the content and frequency of the education. The educational requirements of the Oregon law are targeted at coaches. In addition to coaches, the Texas law specifies that additional persons—such as athletic trainers, sponsors of extracurricular athletic activities, physicians who assist with activities, and athletes—also must complete an education program.¹⁶ The Washington law is the only one that requires that parents, in addition to coaches and athletes, receive education. The Oregon law is unique in that it requires that coaches receive education on concussion symptoms annually. The Texas and

¹⁶The Texas law requires education on the recognition of a broad range of potentially catastrophic injuries, including but not limited to concussion.

Washington laws are silent on how often coaches should complete such an education program.¹⁷

The Washington law is the only state law we examined that requires school districts to work with a state athletic organization to develop guidelines, forms, and educational materials. School districts in Washington worked with the Washington Interscholastic Activities Association (WIAA) to develop a document, which athletes and parents must sign annually, that contains information on the risks of concussion and on how to recognize the signs and symptoms of concussion.¹⁸ By signing the document, parents and athletes are acknowledging their understanding that the athlete will be removed from play or practice by the coach if he or she is suspected of having a concussion. WIAA also developed fact sheets and an educational video for coaches that describe the signs and symptoms of concussion and propose a management strategy for coaches to follow. Much of the information distributed by WIAA is modeled after CDC's Heads Up: Concussion materials.

The Texas law requires the Commissioner of Education to develop and adopt a safety training program, and the Texas Commissioner of Education adopted the extracurricular athletic activity safety training program provided by the University Interscholastic League (UIL).¹⁹ The UIL training manual includes a section on recognizing the signs of concussion and one on reducing head and neck injuries. The latter section states that an athlete with signs of head or neck trauma should receive immediate medical attention and not be allowed to return to play or practice without permission from proper medical authorities. UIL has also developed a parent information manual that includes a section on

¹⁷According to a WIAA official, the association is incorporating concussion education into a cardiopulmonary resuscitation (CPR) course that coaches are required to take every other year. The official told us that WIAA mandated that in 2010 all coaches take the CPR course with the concussion information, regardless of whether they are current on their CPR training.

¹⁸WIAA is a private, nonprofit organization and rule-making body formed in 1905 to create equitable playing conditions between high school teams in Washington. The association has approximately 800 member high schools and middle schools, both public and private.

¹⁹UIL is a voluntary-membership, nonprofit organization created by the University of Texas at Austin to provide leadership and guidance to public school debate and athletic teachers. The purpose of UIL is to organize and properly supervise contests. UIL provides services to its member schools in the organization and administration of regional and state championships in 14 sports.

concussion signs and management. In addition, UIL has contracted with the Brain Injury Association of America to provide to schools and coaches 25,000 palm cards for the management of sports-related concussion, which outline the protocol that every school must follow when dealing with possible head injuries that occur in practice or play of all UIL activities.²⁰

The Oregon law requires that the State Board of Education establish rules regarding the required concussion education for coaches. An official from the Oregon Department of Education told us that these rules have not yet been established, as the law first applies to the 2010-2011 school year.

The return-to-play requirements of the key state laws vary with respect to the conditions under which the requirements apply. The return-to-play requirements of the Texas law apply only to athletes with injuries that result in a loss of consciousness and therefore exclude many concussions. In contrast, the return-to-play requirements of the Oregon and Washington laws apply to athletes with symptoms of or suspicion of concussion.

While each state law requires that an athlete removed from play receive written permission from a health care professional before returning to play, the laws vary in the types of health professionals who can provide such permission. The Texas law requires clearance from a physician, and the Oregon law requires clearance from a health care professional. The Washington law requires that an athlete suspected of having a concussion be evaluated and cleared to return to play by a health professional specifically trained in the evaluation and management of concussion. WIAA's Web site indicates that such professionals include medical doctors, doctors of osteopathy, advanced registered nurse practitioners, physicians' assistants, and licensed certified athletic trainers. According to the WIAA Web site, the organization is considering whether other licensed health care providers have sufficient training to qualify them to authorize return to play. The Oregon law is the only one of the three we reviewed that specifically prohibits an athlete removed from play or practice from returning to play or practice on the same day.

²⁰UIL policy states that failure to comply with UIL rules can result in a variety of sanctions ranging from reprimand to disqualification from UIL activities and competitions.

Voluntary Nationwide Guidelines for Managing Concussion Incurred in High School Sports All Recommend Assessing Concussion on an Individual Basis, with Gradual Return to Play

Federal officials and experts we spoke with identified five sets of voluntary nationwide guidelines that address the management of concussion in sports.²¹ (See table 3.) One set specifically targets high school sports, while the other four contain broad recommendations for the management of concussion in athletes of all ages.²² All five sets of guidelines contain similar recommendations for assessing concussion and managing the athlete, including making return-to-play decisions. For example, all sets of guidelines recommend that an athlete suspected of sustaining a concussion should be monitored closely on the sidelines following the injury and his or her cognitive function assessed at regular intervals for signs and symptoms of deterioration—such as fluctuating levels of consciousness, balance problems, headaches, or nausea. All sets of guidelines also recommend returning an athlete to play on a gradual basis, tailored to the individual athlete’s recovery and based on the athlete’s signs and symptoms and the results of various concussion assessment tools, such as tests of memory, cognition, balance, and physical exertion. The set of guidelines that specifically targets high school sports, which was developed by NFHS, recommends a gradual increase in mental activity appropriate to high school students, such as attending an abbreviated school day and engaging in short periods of reading. If the athlete remains symptom-free, this is to be followed by a gradual increase in low-impact physical activity once the athlete has returned to a full school day. In addition, this set of guidelines recommends that high school athletes playing high-risk or collision sports or having a history of previous concussions should undergo tests of cognition, memory, and balance prior to the start of season to serve as a baseline in case an injury occurs.

²¹The American Academy of Pediatrics published an additional set of guidelines for the management of concussion among children. However, an official from this association told us that the guidelines, which were published in 1999, are no longer in use, and that the association was in the process of developing a clinical report on sports-related concussion.

²²These sets of guidelines were all developed by organizations that conduct work in the area of high school athletics or sports medicine; officials and experts did not identify any guidelines developed by federal agencies.

Table 3: Concussion Management Guidelines

Title	Source	Publication year	Intended end user	Focus on high school sports
Concussions (Mild Traumatic Brain Injury) and the Team Physician: A Consensus Statement ^a	American Academy of Family Physicians, the American Academy of Orthopaedic Surgeons, the American College of Sports Medicine, the American Medical Society for Sports Medicine, the American Orthopaedic Society for Sports Medicine, the American Osteopathic Academy of Sports Medicine	2006	Team physicians	No; contains broad recommendations for all athletes ^b
Consensus Statement on Concussion in Sport, 3rd Annual International Conference on Concussion in Sport ^c	International and domestic experts, including those from the International Olympic Committee and experts affiliated with the American College of Sports Medicine and the National Athletic Trainers' Association	2009	Physicians, therapists, certified athletic trainers, health professionals, coaches, and others involved in the care of athletes	No, but includes special considerations for young athletes ^d
National Athletic Trainers' Association Position Statement: Management of Sport-Related Concussion ^e	National Athletic Trainers' Association	2004	Certified athletic trainers and sports medicine professionals (physicians and medical personnel caring for athletes)	No, but includes special considerations for young athletes ^d
Practice Parameter: The Management of Concussion in Sports ^f	American Academy of Neurology	1997	Neurologists	No; contains broad recommendations for all athletes
Sports Medicine Handbook, Concussion chapter ^g	National Federation of State High School Associations	2008	School administrators, coaches, and high school sports medicine staff	Yes

Source: GAO analysis of guidelines.

^aS.A. Herring, J.A. Bergfeld, A. Boland, L.A. Boyajian-O'Neil, R.C. Cantu, E. Hershman, P. Indelicato, R. Jaffe, W.B. Kibler, D.B. McKeag, R. Pally, and M. Putukian, "Concussion (Mild Traumatic Brain Injury) and the Team Physician: A Consensus Statement," *Medicine & Science in Sports & Exercise*, vol. 38, no. 2 (2006).

^bAccording to the lead author, the consensus statement is primarily intended to guide the management of concussion in the amateur or high school athlete, rather than the college, elite, or professional athlete.

^cP. McCrory, W. Meeuwisse, K. Johnston, J. Dvorak, M. Aubry, M. Molloy, and R. Cantu, "Consensus Statement on Concussion in Sport, 3rd International Conference on Concussion in Sport Held in Zurich, November 2008," *Clinical Journal of Sport Medicine*, vol. 19, no. 3 (2009).

^dThis set of guidelines recommends managing young athletes more conservatively than adults but does not provide any more specific recommendations.

^eK.M. Guskiewicz, S.L. Bruce, R.C. Cantu, M.S. Ferrara, J.P. Kelly, M. McCrea, M. Putukian, and T.C. Valovich McLeod, "National Athletic Trainers' Association Position Statement: Management of Sport-Related Concussion," *Journal of Athletic Training*, vol. 39, no. 3 (2004).

¹American Academy of Neurology, Quality Standards Subcommittee, *Practice Parameter: The Management of Concussion in Sports Summary Statement* (St. Paul, Minn., 1997). According to officials, the association is currently in the process of updating the practice parameter and anticipates publishing it in spring 2011.

⁹National Federation of State High School Associations, "Concussion," *Sports Medicine Handbook*, Third Edition (Indianapolis, Ind., 2008).

Officials from three of the organizations that developed guidelines told us that their members received information about the guidelines in a variety of ways. For example, NFHS officials told us that the association sent its set of guidelines to its member high schools upon publication and planned to include information on the management of concussion in its sports rule books, which it publishes every year for 17 sports, beginning with the 2010-2011 school year. Officials from the American College of Sports Medicine and the National Athletic Trainers' Association told us that concussion management is a frequent topic of discussion at their meetings and that their guidelines were also published in each organization's respective journal.

Mr. Chairman, this concludes my prepared statement. I would be happy to answer any questions that you or other members of the committee may have.

GAO Contact and Staff Acknowledgments

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