

# High School Athletic Directors Report Poor Compliance With Concussion Reporting and Medical Clearance in Massachusetts



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**Purpose:** To assess statewide prevalence of medical access, concussion reporting, and concussion clearance rates of high school athletic departments in Massachusetts after the implementation of state-wide concussion legislation. **Methods:** A random sample of 50 athletic directors (ADs) from Massachusetts high schools with an enrollment of >150 students was selected. A 10-minute electronic survey about access to athletic trainers and physicians, and concussion reporting and clearance practices was administered. Responses were anonymous. **Results:** The response rate was 80% (n = 40). In total, 90% of respondents were male. Median age and experience of respondents was 52 years old and 10 years, respectively. The median school size was 637 students, represented from all Massachusetts geographic athletic districts. ADs disclosed that on average, 12% (95% confidence interval 7%-20%) of concussions go unreported at their schools. In total, 16% of respondents reported that at least 1 in 4 of concussed athletes at their school returned to play without appropriate medical clearance, and 5% of ADs reported that not all of their coaches had undergone any form of concussion training. Overall, 55% of high schools do not have access to a full-time athletic trainer and 50% do not have a team physician; 20% have affiliations with an orthopaedic surgeon and 8% with a neurologist. **Conclusions:** Despite new regulations in Massachusetts, high school ADs report concussion reporting and clearance that are less than 100%. Less than one half of all Massachusetts high schools report access to a full-time athletic trainer or formal relationship with a school physician. **Clinical Relevance:** Investigating compliance with Massachusetts school athletics safety regulations could help identify a need for reform of policies designed to help schools keep student athletes safer in situations where a concussion may have occurred.

In 2006, 13-year-old Zachary Lystedt sustained permanent brain damage after returning to play in the same football game that he sustained a concussion.<sup>1</sup> Since then, nearly every state has passed concussion legislation requiring standardized reporting and clearance practices for high school athletes.<sup>2</sup>

Diagnosing and managing concussions is challenging because they present with a wide range of clinical signs and symptoms<sup>3</sup> and are often neither recognized by athletes nor observed by coaches or athletic trainers.<sup>2,4</sup> Premature return to play can have permanent consequences,<sup>3,5,6</sup> and even high school-aged athletes can develop chronic traumatic encephalopathy with repetitive injuries.<sup>7</sup> Preventing inappropriate return to play while symptomatic is essential to prevent long-term concussion sequelae. Evidence suggests that a second impact while an athlete is incompletely recovered from a concussion carries the added risk of increased likelihood of fatal or highly morbid injuries, and that concussive effects may be prolonged when not removed immediately from play, adding further importance to proper clearance before return to play.<sup>6,8</sup> From 2005 to 2015, there were a total of 28 traumatic brain and spinal cord injury deaths in high school and college football: 18% were preceded by an earlier concussion.<sup>9</sup>

Despite these risks, many high school athletes do not report their injuries or do not understand the health

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**Table 1.** Athletic Director and High School Characteristics in Massachusetts, 2017 (n = 40)

	%	Median	25th, 75th Percentile
Athletic director			
Age, y		52	45, 61
Sex			
Male	90%		
Experience, y		10	6, 17
Number of head coaches		26	21, 33
School			
Number of students		637	466, 1084
Type			
Public	85%		
Private	15%		

consequences of premature return to play.<sup>3,10</sup> Many high school athletes continue to play with concussive symptoms.<sup>4,11,12</sup> Only a minority seek medical help.<sup>11</sup>

High school athletes in particular have protracted recovery times compared with other populations, a situation exacerbated when coaches, athletic trainers, and other sports medicine professionals do not properly follow guidelines for concussion assessment and management.<sup>13</sup> Such guidelines are highlighted by the American Academy of Neurology, which recommends that doctors who clear athletes for return to sports should be specifically trained in managing and accessing sports-related concussions.<sup>14</sup>

Since 2011, 44 states have enacted legislation focused on concussions in youth sports.<sup>15</sup> In 2010, Massachusetts passed An Act Relative to Safety Regulations for School Athletic Programs (2010 Mass Session Law Chapter 166, 19 July 2010), mandating that by 2011, all coaches undergo concussion training, all concussions be reported to the state athletic conference, and all athletes who are concussed receive medical clearance before returning to play by a medical practitioner trained in concussion management.<sup>16</sup> The law did not specifically describe how the mandates were to be carried out but rather delegated responsibility of oversight, including auditing and punishment for failure to comply, to the Massachusetts Department of Public Health Division of Violence and Injury Prevention. While the Massachusetts Department of Public Health has studied concussion incidence and removal from play via surveys of high school students,<sup>11</sup> there is limited research regarding school injury reporting practices, rates of medical clearance before return to play, rates of concussion awareness training for high school coaches, or athlete access to medical professionals.

The purpose of this study was to assess statewide prevalence of medical access, concussion reporting, and concussion clearance rates of high school athletic departments in Massachusetts after the implementation of state-wide concussion legislation. We hypothesized that there would be imperfect compliance to the Massachusetts school athletics safety regulations, which, if true would

imply a need for reform of policies designed to help schools comply with such regulations.

## Methods

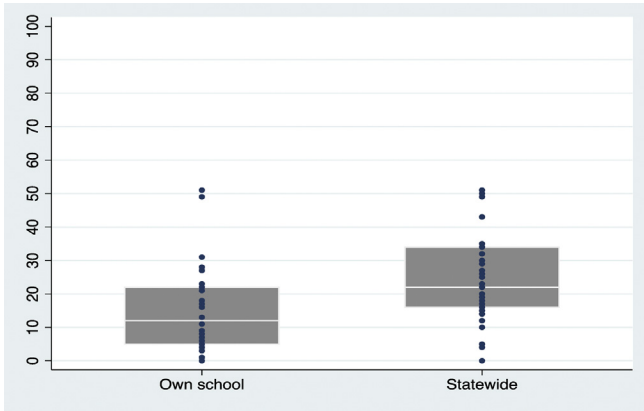
We acquired a list of all schools that participated in the Massachusetts Interscholastic Athletic Association in 2016 to 2017 from the Massachusetts Department of Education. All schools with a total enrollment greater than 150 students in grades 9 to 12 were included in the sampling frame. Stata, version 14 (StataCorp, College Station, TX) was used to select a random sample of 50 eligible high schools.

A 10-minute self-administered survey was developed and administered to a separate group of 10 high school athletic directors (ADs) before administration to the random sample. This survey included information about school access to athletic trainers and physicians, concussion training for coaches, injury and concussion reporting practices, and injury and concussion clearance practices. The survey asked ADs about practices at their own schools. The survey also asked athletic directors about their perception of practices at other schools statewide, in an effort to eliminate social desirability bias, which may lead ADs to under-report their own lack of compliance.

To maximize the survey response rate, a mixed-methods approach with e-mail and phone calls as described in prior other survey methods was used.<sup>17</sup> Surveys were first sent electronically to all 50 ADs, and followed with phone calls explaining the purpose of the survey and providing opportunities to answer any clarifying questions. Surveys were collected during a 4-month response window during the 2016-2017

**Table 2.** High School Access to Trainers/Physicians, and Training History for Coaches, as Reported by Massachusetts High School Athletic Directors, 2017 (n = 40)

	Frequency	%
School access to trainers		
Good access		
Multiple full-time trainers	2	5
Single full-time trainer	16	40
Poor access		
Part-time trainer	11	28
Per-diem trainer	3	7
No access to trainers	8	20
Formal affiliation with physician		
Yes		
General pediatrician/primary care physician	13	33
Orthopaedic surgeon	8	20
Neurologist or neuro-psychiatrist	3	8
No	20	50
Coaches' training history		
Not all coaches have received general safety or first aid training	7	18
Not all coaches have received formal concussion training	2	5



**Fig 1.** Massachusetts athletic director report of the percentage of concussions unreported in 2017, at their own school and statewide (n = 38: dots represent individual responses; boxes represent 25th, 50th, and 75th percentiles).

high school academic year. The survey was administered electronically using SurveyMonkey, Inc. (San Mateo, CA). All responses were anonymous.

We calculated proportions, means, medians, and confidence intervals (CIs) as appropriate. The study was approved by the Tufts University institutional research board (exempt from institutional research board review under exemption 45 CFR 46.101(b)(2); no. 12290). We conducted all statistical analysis using Stata, version 14 (StataCorp) with a 2-sided alpha level of 0.05.

**Results**

The response rate for our survey was 80%. Two respondents initiated the survey but did not finish. Respondent demographics are shown in Table 1. Almost all ADs were male (90%). The median age of respondents was 52 (interquartile range [IQR] 45, 61). Their median experience as AD was 10 years (IQR 6, 17).

The median school had 637 students in grades 9-12. In Massachusetts, there are 8 geographic athletic districts, and each district had at least 2 respondents. Of our respondents, 85% worked for public schools and 15% for private schools.

More than one half of high schools (55%) reported poor access to athletic trainers (Table 2). Similarly, 50% of high schools did not have a formal affiliation with a physician. Only 20% of high schools reported affiliations with an orthopaedic surgeon and only 8% of high schools reported affiliations with a neurologist.

The median number of head coaches at the respondent schools was 26 (IQR 21, 33). In total, 18% of ADs in Massachusetts reported that not all of their coaches had taken a first aid course (95% CI 8.3%-23.0%). In total, 5% of ADs reported that not all of their coaches had undergone any form of concussion training (95% CI 1%-17%). Only 2 of the 40 ADs reported that all of their coaches underwent a formal, in-person concussion training course.

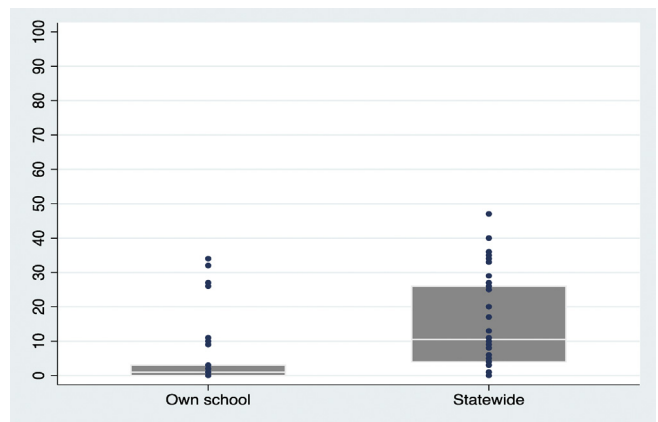
The median AD reported that 12% of concussions went unreported at their own schools (95% CI 7%-20%) and 16% of ADs reported that at least 1 of every 4 concussions went unreported (Fig 1). In regard to return-to-play clearance, the median AD reported that only 1% of concussed athletes return to play before appropriate medical clearance (95% CI 0%-1%). However, there was considerable variability in response, as 13% (5/38) of ADs admitted that at least 1 of 4 athletes who were concussed returned to play before obtaining appropriate medical clearance at their own schools (Fig 2).

When asked about their perceptions of concussion reporting throughout the state, ADs estimated greater rates of unreported concussions and greater rates of return-to-play without proper medical clearance for all injuries and concussions specifically (Table 3). Of note, 16% of ADs believe that at least one half of concussions go unreported statewide, and 32% of ADs believed that at least 1 of every 4 athletes who were concussed in Massachusetts did not receive appropriate medical clearance before returning to play.

**Discussion**

Despite a 2011 Massachusetts legislation mandating training, reporting, and medical clearance for concussions, our study demonstrates that high school ADs believe concussion reporting and clearance are less than 100%. In addition, less than one half of all Massachusetts high schools report access to a full-time athletic trainer or formal relationship with a school physician.

This 2011 Massachusetts legislation specifically mandates that all athletes who suffer a head injury during practice or competition must be removed from play and may not return until they have received medical clearance from an athletic trainer, nurse practitioner,



**Fig 2.** Massachusetts athletic director report of the percentage of concussed athletes returning to play before receiving appropriate medical clearance in 2017, at their own school and statewide (n = 38: dots represent individual responses; boxes represent 25th, 50th, and 75th percentiles).

**Table 3.** Athletic Director Report of Unreported Injuries, Unreported Concussions, and Insufficient Medical Clearance Postinjury, at Own School and Statewide (n = 38, Massachusetts, 2017)

	Median (95% CI)	Min	Max	25th, 75th Percentiles
Percent of concussions not reported				
At athletic director's own school	12 (7-20)	0	51	5, 22
Statewide	22 (17-30)	0	51	16, 34
Percent of time medical clearance was not obtained before allowing athletes to return to play after sustaining any type of injury				
At athletic director's own school	1 (0-4)	0	49	0, 6
Statewide	20 (9-27)	0	51	9, 33
Percent of time medical clearance was not obtained before allowing athlete to return to play after sustaining a concussion				
At athletic director's own school	1 (0-1)	0	34	0, 3
Statewide	11 (7-20)	0	47	4, 26

CI, confidence interval.

physician assistant, or physician.<sup>16,18</sup> Further, coaches are required to report all head injuries to their AD and school nurse within 24 hours, and ADs are responsible for reporting annual statistics to the Department of Public Health.<sup>18</sup> Our data suggest imperfect compliance for improvement in all realms, with ADs reporting that 12% of concussions go unreported at their schools. This may be due in part due to lack of awareness among coaches, as ADs also reported a lack of concussion training for all coaches.

Previous research has investigated the number of athletes who sought medical care after sustaining a concussion,<sup>11</sup> but there is limited research regarding the percent who received medical clearance before returning to play. With random selection and a high response rate, we were able to estimate the number of athletes who were concussed statewide who did not receive medical clearance before returning to play.

In the 2016-2017 season, nearly 230,000 unique high school athletes participated in the Massachusetts Interscholastic Athletic Association.<sup>19</sup> Using a cumulative incidence of 14% per season, as reported in a 2015 survey of Massachusetts public school students,<sup>11</sup> we estimate that there were approximately 32,000 high school athletes who sustained a concussion within 2016-2017 academic year. Our research suggests that of those possible 32,000 concussed athletes, potentially 320 did not receive medical clearance before returning to play.

Our concussion reporting findings are consistent with 2013-2014 data from the Massachusetts Department of Public Health, showing that of the more than 700 schools required to submit concussion reporting data, more than 200 schools did not submit reports. An additional 142 schools reported no head injuries for the entire year.<sup>8,19</sup>

The implications of continued play with concussive symptoms have been well documented, with second-impact syndrome and repetitive prolonged concussive effects potentially causing highly morbid and even fatal

events.<sup>6,8</sup> We suggest that opportunities exist to improve health care access and education in an effort to remedy the poor diagnosis, reporting, and management of high school concussions. We believe that access to care remains the most significant barrier to appropriate head injury evaluation and management. Our data demonstrated that the majority of high schools have poor access to athletic trainers and team physicians. More than one half of high school athletic departments lack formal relationships with physicians and do not have full-time athletic trainers. Improving access should be a main focus of future interventions.

### Limitations

Our study has inherent limitations associated with a survey study. Our data rely on the self-report of ADs, who may, knowingly or unknowingly, incorrectly recall the concussion reporting and clearance data for their school. Social desirability bias suggests that they would likely overstate rates of clearance and reporting, given that anything less than 100% is not in compliance with the law. Therefore, our reported data are likely a "best-case" scenario, and the true practices are perhaps bleaker than reported here, as reflected by the higher statewide estimates based on AD perception.

Another limitation of this study was lack of validation of the survey. Although attempts were made to increase face validity with an initial trial survey, appropriate survey validation remained a challenge. Because it is impossible to objectively measure the number of unreported concussions, there is no sample to which to compare AD estimates to validate our survey.

We were unable to recruit all ADs in our sample, introducing potential response bias. However, if a school were adhering perfectly to the regulations, it is likely their ADs would be more motivated to respond, further suggesting that our data are overestimates of rates of clearance and reporting. Future research should investigate current practices in other states. Researchers



should also examine which school-level factors are associated with better access, reporting and clearance.

Finally, we recognize that this study represents opinions and beliefs of ADs. It is impossible to quantify the exact number of concussions in the state of Massachusetts, and the number that are unreported or do not seek medical attention. However, we demonstrated that ADs are reporting difficulties complying to the Massachusetts head injury legislation. Further study is needed to understand where these difficulties lie, and how athletic departments and high schools can be better supported to address the healthcare needs of their athletes.

### Conclusions

Despite new regulations in Massachusetts, high school ADs report concussion reporting and clearance that are less than 100%. Less than one half of all Massachusetts high schools report access to a full-time athletic trainer or formal relationship with a school physician.

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