

## Emergency Action Planning in School-Based Athletics: A Systematic Review

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### ABSTRACT

**Introduction.** A significant number of preventable catastrophic injuries occur in secondary school athletics. Compliance to Emergency Action Plan (EAP) recommendations is not well documented. The purpose of this systematic review was to identify compliance to EAP recommendations, access to an athletic trainer (AT) and automated external defibrillator (AED), and current legislative mandates in school-based athletics.

**Methods.** Electronic databases were searched to identify articles that met criteria for inclusion. Studies in English that focused on adoption, implementation, or compliance with EAPs or other national guidelines pertaining to athlete health were eligible for inclusion. Quality and validity were examined in each article and data were grouped based on outcome measures.

**Results.** Of 12,906 studies, 21 met the criteria for inclusion and full text review. Nine studies demonstrated EAP adoption rates ranging from 55% - 100%. Five studies found that EAPs were rehearsed and reviewed annually in 18.2% - 91.6% of schools that have an EAP. At total of 9.9% of schools were compliant with all 12 National Athletic Trainers Association (NATA) EAP guidelines. A total of 2.5% - 27.5% of schools followed NATA exertional heat illness guidelines and 50% - 81% of schools had access to an athletic trainer. In addition, 61% - 94.4% of schools had an AED available at their athletic venues. Four of 51 state high school athletic association member schools were required to meet best practice standards for EAP implementation, 7 of 51 for AED access, 8 of 51 for heat acclimation, and 3 of 51 for concussion management.

**Conclusions.** There was a wide range of EAP adoption and a low rate of compliance to EAP guidelines in U.S. schools. Barriers to EAP adoption and compliance were not well documented and additional research should aim to identify impeding and facilitating factors.

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### INTRODUCTION

In 2019, nearly 8 million adolescents participated in school-related sporting activities according to the 2018 - 19 High School Athletics Participation Survey conducted by the National Federation of State High School Associations.<sup>1</sup> From 2011 to 2014, the Centers for Disease Control and Prevention reported nearly 5.6 million injuries related to sport or recreation among persons aged 5 - 24.<sup>2</sup> Although the majority of injuries were not life threatening, there were a significant amount of catastrophic and fatal injuries. During the 2017 - 2018 academic year,

99 catastrophic injuries, defined as fatalities, permanent disability injuries, serious injuries (fractured neck or serious head injury) even though the athlete has a full recovery, temporary or transient paralysis, heat stroke due to exercise, or sudden cardiac arrest or sudden cardiac or severe cardiac disruption, occurred in high school and college athletes.<sup>3</sup> Of these, 85 events occurred during or due to sport-related activities, and 66 of 85 sport-related catastrophic injuries were at the high school level.

Implementing emergency action plans (EAPs) likely mitigates athletes' risk of sudden death or catastrophic injury. Professional organizations have published guidelines on emergency preparedness and state high school athletic associations (SHSAA) have issued policies of their own, based on those professional guidelines. Specifically, the National Athletic Trainers' Association (NATA) has published 13 consensus statements endorsed by over 26 organizations on various aspects of emergency health and safety, and sports medicine best practices in collaboration with various inter-association task forces. Most notably, NATA has published a position statement on emergency planning in athletics detailing the 12 best practice guidelines athletic organizations should follow (Table 1).

The American Heart Association (AHA), Sideline Preparedness Collaboration (AAFP, AAOS, ACSM, AMSSM, AOSSM, AOASM), and National Collegiate Athletic Association (NCAA) have published similar documents that align closely with NATA consensus statements.<sup>4-9</sup> It is agreed widely that sports related injuries and medical emergencies are best prevented by implementing and rehearsing a venue specific EAP.<sup>4-9</sup> The goal of this review was to analyze the adoption and compliance of EAP recommendations, access to an athletic trainer (AT) and automated external defibrillator (AED), and current legislative mandates in school based athletics. In addition, we aimed to identify ways to improve compliance to evidence-based guidelines, like those that have been created by the Sideline Preparedness Collaboration, NCAA, AHA, and NATA.

### METHODS

A systematic review of the literature was conducted on March 12, 2020, using PubMed, Embase, MEDLINE, Cochrane, CINAHL, and Google Scholar with the following string: Emergency preparedness OR Emergency action plan OR School-based athletics OR Sport injury and illness OR exertional heat illness in sports. After removal of duplicates, articles were screened by abstract and title using our predetermined inclusion and exclusion criteria. Studies were included if the article was written in the English language and focused on adoption and/or compliance with EAPs or other national guidelines pertaining to athlete health. Studies were excluded if they not written in the English language, focused solely on epidemiology in school-based athletics, or did not evaluate adoption or compliance with an EAP or national guideline. The full text of the articles was obtained and evaluated if eligibility could not be assessed from the first screening. Of note, one study included in our results was only available as an abstract.

Article selection was performed by an orthopedic sports medicine fellow (W.M.). In the case of uncertainty regarding inclusion of an article, discrepancies were solved by an experienced sports medicine physician (J.D.). An electronic database search was supplemented by manual search of the reference list of the selected articles.

**Table 1. National Athletic Trainers' Association position statement: Best practice recommendations.<sup>4</sup>**

1	Each institution or organization that sponsors athletic activities must have a written emergency plan. The emergency plan should be comprehensive and practical, yet flexible enough to adapt to any emergency situation.
2	Emergency plans must be written documents and should be distributed to certified athletic trainers, team and attending physicians, athletic training students, institutional and organizational safety personnel, institutional and organizational administrators, and coaches. The emergency plan should be developed in consultation with local emergency medical services personnel.
3	An emergency plan for athletics identifies the personnel involved in carrying out the emergency plan and outlines the qualifications of those executing the plan. Sports medicine professionals, officials, and coaches should be trained in automatic external defibrillation, cardiopulmonary resuscitation, first aid, and prevention of disease transmission.
4	The emergency plan should specify the equipment needed to carry out the tasks required in the event of an emergency. In addition, the emergency plan should outline the location of the emergency equipment. Further, the equipment available should be appropriate to the level of training of the personnel involved.
5	Establishment of a clear mechanism for communication to appropriate emergency care service providers and identification of the mode of transportation for the injured participant are critical elements of an emergency plan.
6	The emergency plan should be specific to the activity venue. That is, each activity site should have a defined emergency plan that is derived from the overall institutional or organizational policies on emergency planning.
7	Emergency plans should incorporate the emergency care facilities to which the injured individual will be taken. Emergency receiving facilities should be notified in advance of scheduled events and contests. Personnel from the emergency receiving facilities should be included in the development of the emergency plan for the institution or organization.
8	The emergency plan specifies the necessary documentation supporting the implementation and evaluation of the emergency plan. This documentation should identify responsibility for documenting actions taken during the emergency, evaluation of the emergency response, and institutional personnel training.
9	The emergency plan should be reviewed and rehearsed annually, although more frequent review and rehearsal may be necessary. The results of these reviews and rehearsals should be documented and should indicate whether the emergency plan was modified, with further documentation reflecting how the plan was changed.
10	All personnel involved with the organization and sponsorship of athletic activities share a professional responsibility to provide for the emergency care of an injured person, including the development and implementation of an emergency plan.
11	All personnel involved with the organization and sponsorship of athletic activities share a legal duty to develop, implement, and evaluate an emergency plan for all sponsored athletic activities.
12	The emergency plan should be reviewed by the administration and legal counsel of the sponsoring organization or institution.

An electronic form for data extraction was created to analyze the results of the selected articles. Data relating to EAP adoption, compliance with EAP guidelines, access to an AT, access to an AED, or compliance with state mandated guidelines were extracted. Data were grouped into broad categories to account for the wide variety of survey questions in each article. Data were only grouped together if the articles were measuring the same outcome. One limitation of this comparison was the fact that study populations varied between coaches, athletic trainers, and other school staff. We recognized the notable differences between these stakeholders and the fact that this could affect the reliability of comparisons.

### RESULTS

A total of 12,906 articles were identified in the initial database search. After duplicates were removed, abstracts were screened for relevance to EAPs based on title and brief summary of abstract. This left 26 articles that were screened using inclusion/exclusion criteria. Five articles were excluded after full text review, these studies focused on epidemiological data. A total of 21 articles remained for full text review, see Figure 1.

Nine studies aimed to identify if schools had adopted a formal EAP and demonstrated EAP adoption rates ranging from 55% - 100% (Figure 2).<sup>10-18</sup>

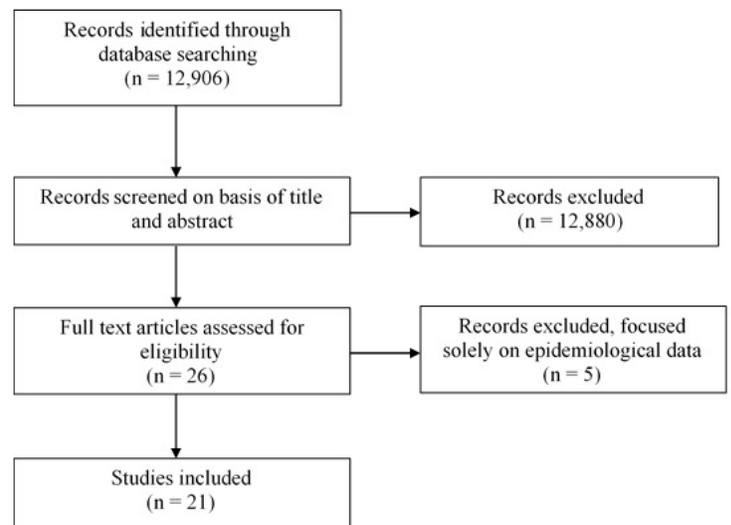


Figure 1. Flow diagram for study selection.

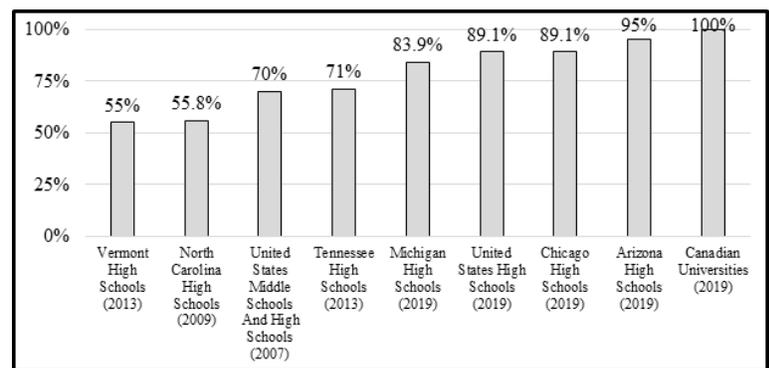


Figure 2. Percentage of schools with a written EAP.<sup>10-18</sup>

One study identified 38% of high schools always having an EAP, while 36% have never had an EAP in place.<sup>19</sup> Five studies found that EAPs were rehearsed and reviewed at least annually in 18.2% - 91.6% of schools that have an EAP.<sup>11,13,15,17,18</sup> Scarneo et al.<sup>16</sup> identified that only 9.9% of schools were compliant with all 12 NATA guidelines, while Meredith et al.<sup>12</sup> found that only 4% of schools were compliant with all three guidelines set forth by the AHA. Two studies identified that 2.5% - 27.5% of schools complied with all Exertional Heat Illness (EHI) guidelines set forth by the NATA.<sup>20,21</sup>

Two studies identified that only 50% - 81% of schools had access to an AT.<sup>11,21</sup> Olympia et al.<sup>13</sup> found that 34% of schools have an AT at all athletic events, while Jones et al.<sup>10</sup> found that only 4.6% of schools had an AT available for medical problems at practices. Nine studies found that 48% - 98% of schools had an AED on campus.<sup>10-12,16-19,23,24</sup> Tennessee had the lowest rate at 48%, while West Virginia high schools had the highest rate of 98% among the states included in the studies.<sup>12,19</sup> Four studies found that 61% - 94.4% of schools had an AED available at all athletic venues.<sup>13-15,19</sup> In 2017, Johnson et al.<sup>22</sup> found that only 56% of Oregon high schools had an AED available for early defibrillation (within four minutes) at all athletic venues. Meredith et al.<sup>12</sup> found that of the 21 sudden cardiac arrest events that occurred in the previous five years in Tennessee high schools, an AED was not available in 10 (48%) and in four cases (19%) the AED was present, but not opened.

A benchmark study was performed in 2018 to identify the extent to which SHSAs and other state regulations mandate their respective member schools to create health and safety guidelines that align with current best practices.<sup>25</sup> This study showed that only 4 of 51 SHSAA member schools were required to meet best practice standards for EAP adoption, 7 of 51 for AED access, 8 of 51 for heat acclimatization, and 3 of 51 for concussion management.

## DISCUSSION

The results of this systematic review supported the hypothesis that there is low EAP adoption (55% - 100%) and compliance (9.9% when using NATA guidelines) with EAP guidelines in schools. This review also identified poor access to ATs (50% - 81%) and AEDs (48% - 98%). Schools with access to ATs were associated with higher rates of EAP adoption and compliance, as well as better access to AEDs and early defibrillation.<sup>11,22</sup> Schools with AEDs were more likely to follow EAP guidelines than those without.<sup>18,24</sup> The EAP adoption rate of schools with at least one AED was 86.5% compared to 47.4% of schools with no AED.<sup>24</sup> This association could indicate that barriers to AED access may be similar to EAP adoption and compliance barriers.

The three most common barriers to AED access were lack of funding, medical-legal reasons (i.e., fear of liability), and lack of certified medical personnel or access to certified medical personnel.<sup>12,17-19,23,24</sup> AED access is important, but it is also important to have an EAP in place and to have staff trained in first aid and CPR. The barriers to EAP adoption have not been studied, but could include lack of funding, certified medical personnel, appropriate facilities, and continuing education.<sup>19</sup>

Further studies are needed to identify factors that facilitate and impede EAP adoption and compliance, including discussion with ATs, coaches, and other stakeholders. Finally, only 8% of states mandated EAP adoption, 14% mandated AED access, 16% mandated

heat acclimation guidelines, and 6% mandated concussion management guidelines.<sup>25</sup> Illinois, Kentucky, Missouri, and North Carolina required all 10 EAP recommendations between SHSAA bylaws and state legislation. The remaining 47 of 51 SHSAs do not make the EAP recommended guidelines mandatory for participating schools, and there have been a limited number of studies evaluating compliance with the emergency-preparedness best practices.<sup>4,5,9,26</sup> Although states rarely have EAP mandates, Kerr and colleagues<sup>20,21</sup> identified that states with mandated guidelines had better adoption of EHI guidelines than those without. Kerr et al.<sup>27</sup> found that SHSAA mandated heat acclimation guidelines were associated with a 55% reduction in EHI incidence.

Sports related injuries and medical emergencies are best prevented by implementing and rehearsing a venue specific EAP.<sup>4-9</sup> The NATA, AHA, and Sideline Preparedness Collaboration have set forth guidelines and recommendations that athletic organizations should follow to align with sports medicine best practices.

The NATA in conjunction with the Sideline Preparedness Collaboration and the Inter-Association Task Forces advocate for the implementation of EAPs at any institution that sponsors athletic activities.<sup>4,5</sup> These recommendations included having an EAP placed in writing, and that they be distributed to all appropriate personnel, ensured they are incorporated with local emergency medical services, and rehearsed at least annually.<sup>4</sup> The NATA detailed their recommendations for effective EAP implementation in a 12 point explanation and provided evidence-based reasoning to its position statement. This position statement emphasized the importance of implementing EAPs in preventing catastrophic injury and death, and showed that implementation requires three steps: committing an EAP to writing, educating those involved in the plan, and rehearsing the plan.

Most notable of the 13 consensus statements published by NATA are the best practice recommendations for the prevention of sudden cardiac arrest in secondary school athletics programs, and the document on emergency health and safety.<sup>6,7</sup> The former provided detailed information on EAPs, AT services, conditioning sessions, brain and neck injuries, exertional heat stroke, sudden cardiac arrest, and exertional sickling. It emphasized that most deaths in secondary school athletics are avoidable by providing appropriate prevention, recognition, and treatment strategies. This guide also recognized that supervisors of secondary school athletics programs would benefit from AT services to meet the increasing requirements of health policies and mandates.<sup>6</sup> The latter provided the strength of recommendation and level of evidence to each of the policies and guidelines they recommended. This document served as a guide for national governing bodies for youth sports.<sup>7</sup> These consensus statements and an updated list of endorsing organizations can be found at <https://www.nata.org/news-publications/pressroom/statements/consensus>.

The Sideline Preparedness Collaboration advocated understanding and practicing specific prevention measures for sports related injury/illness and provided guidelines to help team physicians implement

these prevention strategies.<sup>5</sup> In agreement with the NATA and the Sideline Preparedness Collaborations' stance on EAP implementation, the NCAA released its Inter-Association Recommendations in July 2019.<sup>8</sup> These recommendations emphasized that at a minimum, EAPs should be developed for head and neck injury, cardiac arrest, heat illness and heat stroke, exertional rhabdomyolysis, exertional collapse associated with sickle cell trait, any exertional or non-exertional collapse, asthma, diabetic emergency, and mental health emergency. The NCAA also emphasized that EAPs should be consistent with their concussion safety protocol checklist.<sup>8</sup> Overall, most deaths in sports are deemed preventable and the Inter-Association Task Forces' charge was to meet this expectation.<sup>6-8</sup>

The AHA is a leader among these organizations in advocating for the importance of AED availability.<sup>9</sup> Their stance is predicated on AED availability being crucial in the response to sudden cardiac arrest as neurological outcomes are compromised by every minute without appropriate treatment. Although the AHA recommended that state laws and regulations require schools to have a cardiac emergency response plan, including the availability of an AED, only seventeen out of fifty states (34%) had some legislation that require AED installation in schools.<sup>9,20</sup> In addition, only one state required AED installation in all public grade schools, private schools, and colleges.<sup>26</sup>

## CONCLUSIONS

Emergency Action Planning is an important preventative measure for high schools to take to protect their athletes from sports related injuries and illness. The results of this study showed that there is a wide range of EAP adoption across U.S. high schools and a low rate of EAP compliance with NATA/AHA guidelines. In addition, there is poor access to athletic trainers and AEDs in high schools, which may hinder EAP implementation and compliance. One common barrier to AED access was due to costs; to address this, states may need to allocate more funding to high schools to allow them to be fully compliant with AHA recommendations. There also seems to be low percentage of states mandating best practice recommendations for the prevention of the leading causes of sudden death and concussion management. Advocating for the implementation of state mandates may improve high school EAP compliance which would improve prevention of sports related injury or illness in high school athletics as well as improvement in outcomes of sudden cardiac arrest in high schools. In conclusion, given the widely accepted recommendations by multiple respected organizations, EAP for sport related injury and illness should be a top priority for all athletic organizations to ensure the utmost safety of our athletes.

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