

Emergency Preparedness of Secondary School Athletic Programs in Arizona

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Context: Schools that sponsor athletic programs have an obligation to provide a safe environment with appropriate policies for addressing emergencies.

Objective: To describe the emergency preparedness of secondary schools in Arizona specific to emergency action plans (EAPs), cardiac arrest, concussion, and heat illness.

Design: Cross-sectional study.

Setting: Online survey.

Patients or Other Participants: Athletic directors from 143 Arizona secondary schools (response rate = 54%).

Intervention(s): A 6-section survey that included questions related to athletic trainer (AT) access, EAPs, automated external defibrillators (AEDs), concussion, heat illness, and other policies.

Main Outcome Measure(s): Descriptive statistics were reported. Comparisons of responses between schools with and without AT access were conducted with Mann-Whitney *U* tests.

Results: Most respondents (81%, *n* = 116) indicated their school had access to an AT, and 95% (*n* = 125) of respondents

reported their school had a written EAP. The AEDs were available at most (93%, *n* = 121) schools. All respondents were familiar with the interscholastic concussion policy, and 98% (*n* = 123) indicated they had a school-specific policy. Almost all respondents (99%, *n* = 121) reported being familiar with the state heat-illness policy. Environmental measures were taken before practices at 48% (*n* = 60) of schools. Schools with access to an AT were more likely to have an EAP, venue-specific EAPs, physician approval of EAP, AEDs, heat illness policies, and cold-water immersion tubs and to take environmental measures.

Conclusions: Whereas the majority of schools reported AT access, not all schools had adequate EAPs in place. Schools would benefit from educational opportunities regarding best practices and policy development to improve emergency preparedness.

Key Words: emergency action plans, concussions, heat illness, automated external defibrillator, athletic trainer

Key Points

- Secondary schools with access to athletic trainers had better emergency preparedness in all areas except concussion.
- Emergency action plans and automated external defibrillators were present in almost all schools.
- Schools would benefit from educational opportunities regarding best practices and policy development to improve emergency preparedness.

The social, emotional, and health benefits of secondary school athletic programs are well established.^{1,2} As such, approximately 7.8 million US student-athletes participate in secondary school sports each year.³ Although high school sports participation is associated with many benefits, morbidity and mortality are possible complications and are often due to cardiac arrest, heat illness, or head injury.^{4,5} The National Center for Catastrophic Sport Injury Research⁶ reported 62 catastrophic injuries among high school athletes between 2013 and 2014, with 8 related to traumatic brain injury, 7 related to the heat, and 30 related to cardiac conditions.

Due to the potentially catastrophic and fatal consequences of these injuries, many position statements and best-practice documents^{4,5,7-11} have been developed to guide health care providers and school districts in appropriately preparing for, evaluating, and managing patients with these injuries and conditions. Specific to the secondary school setting, the “Appropriate Medical Care for Secondary School-Aged Athletes” statement⁸ suggested the need for

an athletic health care team that includes on-site medical personnel, such as an athletic trainer (AT). Similarly, the Inter-Association Task Force for Preventing Sudden Death in Secondary School Athletic Programs⁷ identified emergency action plans (EAPs), automated external defibrillators (AEDs), and AT services as key health and safety considerations for secondary schools.

However, recent data indicated that whereas 70% of secondary schools had access to AT services, only 37% of schools had access to a full-time AT.¹² Therefore, secondary schools are often challenged to provide a safe sporting environment without a full-time on-site athletic health care provider. To aid state interscholastic associations in understanding best practices in sports medicine management, the National Athletic Trainers' Association (NATA), American Medical Society for Sports Medicine, and National Federation of State High School Associations (NFHS) organized the first “Collaborative Solutions for Safety in Sport” meeting in March 2015. Representatives from each state athletic-association member (executive

director and sports medicine advisory committee chairs) attended a 2-day meeting to address sport safety in secondary schools. A call to action was developed to address the primary causes of sport-related death and catastrophic injury in secondary school sports: head injury, heat illness, and cardiac arrest.¹³

Some attempts have been made to determine the readiness of secondary schools regarding head injury,^{14,15} heat illness,¹⁶ and cardiac arrest¹⁷⁻²¹; however, these have typically focused on preparedness for only 1 condition. To date, only 1 group²² has studied multiple areas of emergency planning, including written EAPs, AT presence, availability of emergency equipment, communication, and guidelines for inclement weather and prevention of exertional heat illness.

Although the “Collaborative Solutions for Safety in Sport” meeting was a start, and many resources are available to secondary schools regarding emergency preparedness and injury-specific management, little is known about the actual implementation of best practices for comprehensive emergency preparedness among secondary schools. Therefore, the purpose of our study was to describe the emergency preparedness of secondary schools in Arizona specific to EAPs, concussion, heat illness, and cardiac arrest.

METHODS

Participants

The survey was e-mailed by the Arizona Interscholastic Association (AIA) office to the athletic director and his or her administrative assistant at all AIA member schools; a total of 265 schools were reached. The AIA member schools are classified into 6 athletic divisions, based primarily on student enrollment, and we recruited all schools to participate. The study was deemed exempt by the university’s institutional review board.

Instrumentation

A 52-item survey was developed by the AIA Sports Medicine Advisory Committee. The survey consisted of 6 sections that included questions related to AT access, EAPs, AEDs, concussion, heat illness, and other policies and was modeled after the “Collaborative Solutions for Safety in Sport” agenda. Sports Medicine Advisory Committee members drafted the initial wording of questions, which were then reviewed by the entire committee. The Sports Medicine Advisory Committee included physicians, ATs, physical therapists, chiropractors, naturopaths, and neuropsychologists, all with expertise in adolescent health or sports medicine (or both). After revision and restructuring of the questions, the instrument was reviewed by the AIA Executive Committee for readability, comprehension, and clarity. The AIA Executive Committee included athletic directors from member institutions representing all AIA divisions and thus was representative of our target sample.

Procedures

Participants were solicited via e-mail by the AIA office. An initial e-mail was sent, with a follow-up reminder sent

approximately 2 weeks later. The online survey was available to respondents for 1 month.

Statistical Analysis

Descriptive statistics (percentages, frequencies) were reported for each question on the survey. Separate Mann-Whitney *U* tests ($P < .05$) were used to identify group differences between schools with or without AT access in the presence of EAPs, venue-specific EAPs, physician approval of EAPs, AEDs, concussion guidelines, heat-illness guidelines, environmental weather measures, treatment plans for heat illness, and access to a cold-water immersion tub.

RESULTS

Response Rate

The e-mail with the survey link was opened by 236 individuals, and 143 accessed the survey, for a response rate of 54%. The majority of respondents ($n = 117$; 26 missing) were from schools in urban areas with city population sizes of greater than 200 000 residents (53.8%, $n = 63$), followed by towns with fewer than 50 000 residents (29.1%, $n = 34$), 100 000 to 199 999 residents (10.3%, $n = 12$), and 50 000 to 99 999 residents (7.7%, $n = 9$). Due to the logic in the survey, not all respondents answered each question. Therefore, the frequency (n) and percentage of responses for each question are provided, along with the number of missing responses.

Access to ATs

Eighty-one percent of respondents ($n = 116/143$) indicated that their school had access to a licensed AT, with 78% ($n = 90/116$) reporting that the AT was employed by the school or district and 22% ($n = 26/116$) reporting that the AT was employed by an outside clinic or hospital. A total of 80% ($n = 91/114$; 2 missing) of the ATs were employed full time and 20% ($n = 23/114$; 2 missing) part time.

Of those schools that did not have access to an AT, 38% ($n = 10/26$; 1 missing) of respondents indicated that the school had access to other medical providers for practices. With respect to game coverage, 73% of respondents ($n = 19/26$; 1 missing) stated they did have access to other medical providers, as outlined in Figure 1. The coverage provided by those providers is described in Table 1. We found it interesting that no respondent indicated that girls’ soccer games had coverage from another medical provider.

Emergency Action Plans

Ninety-five percent of respondents ($n = 125/132$; 11 missing) reported that the school had a written EAP. Seventy-one percent of respondents ($n = 89/125$) noted that the school had a written EAP for each venue where the school’s teams practiced and competed. In only 27% of schools ($n = 29/109$; 16 missing) was the EAP described as being approved and formally signed by the physician. Group differences were found between schools with and without access to an AT for the presence of an EAP ($U = 1051.0$, $P = .005$), presence of venue-specific EAPs ($U =$

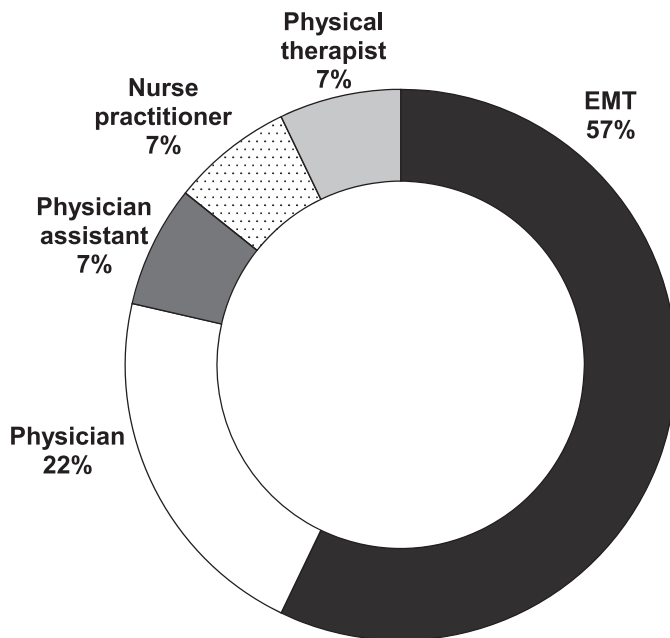


Figure 1. Respondents' access to other medical providers for coverage of games (n = 10). Abbreviation: EMT, emergency medical technician.

646.0, $P < .001$), and physician signature on the EAP ($U = 549.0$, $P = .005$). In schools with AT access, 97.2% ($n = 104/107$; 9 missing) had written EAPs compared with 82.6% ($n = 19/23$; 4 missing) in those without access. Similarly, 78.2% ($n = 79/101$; 15 missing) of schools with AT access had venue-specific EAPs, whereas only 36.4% ($n = 8/22$; 5 missing) of schools without access to an AT reported venue-specific EAPs. Physicians signed off on EAPs in 32.2% ($n = 29/90$; 26 missing) of schools with AT access, and no schools ($n = 0/27$) without AT access reported physician approval of EAPs. Responses for the frequency of EAP review are provided in Figure 2. Only 32% of respondents ($n = 38/120$; 23 missing) indicated that the EAP was practiced annually at each venue with the critical personnel. For those who did practice annually at each venue, Table 2 outlines the personnel involved with the review and practice.

With respect to hospitals, of respondents 56% ($n = 64/115$; 28 missing) indicated that the EAP designated a receiving hospital. Eighty-nine percent of respondents ($n = 78$) stated that they had spine boards available at the school, and 63% ($n = 55$) noted the school had airway rescue devices. Ninety-eight percent ($n = 122/124$; 19 missing)

Table 1. Sporting Events Covered by Other Medical Providers (n = 8; 18 missing)

| Distance | No. (%) |
|-------------------------|---------|
| Football games | 8 (100) |
| Boys' basketball games | 6 (75) |
| Girls' basketball games | 6 (75) |
| Football practices | 2 (25) |
| Wrestling matches | 2 (25) |
| Boys' soccer games | 1 (13) |
| Baseball games | 1 (13) |
| Volleyball | 1 (13) |
| Cheer | 1 (13) |
| Girls' soccer games | 0 (0) |

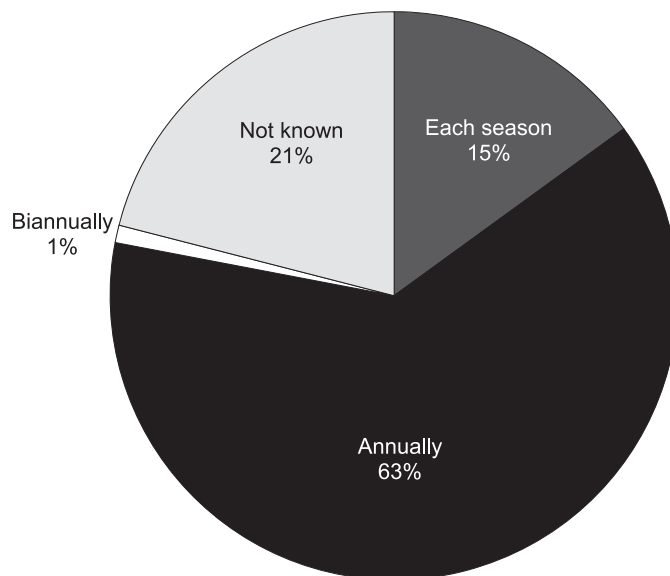


Figure 2. Frequency of emergency action plan review (n = 136; 7 missing).

noted that local emergency medical services (EMS) were familiar with the school, athletic director, and venue to allow for efficient response. Table 3 reflects the frequencies and percentages of responses for the distance from the closest EMS location to the school. Table 4 presents the frequencies and percentages of respondents indicating the response time of EMS to the school.

Automated External Defibrillators

Ninety-three percent of respondents ($n = 121/130$; 13 missing) reported that their school had an AED. Schools with access to an AT were more likely ($U = 867.0$, $P < .001$) to have access to an AED (87.9%, $n = 102/116$) than schools without AT access (68.0%, $n = 17/25$; 2 missing). The numbers of AEDs at the schools, as provided by the athletic directors of schools with AEDs, are listed in Table 5 ($n = 95$). The majority of AEDs at the secondary schools were portable (47%, $n = 55/117$; 26 missing) or both fixed and portable (47%, $n = 55/117$; 26 missing), with only 6% ($n = 7/117$; 26 missing) being fixed. The AEDs were noted to be within close proximity (within 3–5 minutes of the facility) to 92.9% ($\pm 13.9\%$) of venues. Athletic directors reported that 88.8% $\pm 29.9\%$ of ATs were cardiopulmonary resuscitation (CPR)/AED certified, with 86.9% $\pm 22.1\%$ of coaches and 64.4% $\pm 27.8\%$ of administrators being certified.

Table 2. Personnel Involved in the Emergency Action Plan Annual Review and Practice (n = 38; 23 Missing)

| Distance | No. (%) |
|----------------------------|---------|
| School administrator | 37 (97) |
| Athletic trainer | 36 (95) |
| Coach | 32 (84) |
| Emergency medical services | 17 (45) |
| Team physician | 14 (37) |
| External medical provider | 2 (5) |
| Other ^a | 6 (16) |

^a Those reporting *other* named the security personnel, custodial staff, and school staff as being involved in the practice.

Table 3. Responses for the Distance from the Closest Emergency Medical Services Location to the School (n = 129; 14 Missing)

| Distance, mi (km) | No. (%) |
|-------------------|-----------|
| <1 (<1.6) | 20 (15.5) |
| 1 (1.6) | 20 (15.5) |
| 2–5 (3.2–8.0) | 71 (55.0) |
| 6–10 (9.7–16.1) | 13 (10.1) |
| 11–15 (17.7–24.1) | 4 (3.1) |
| 16–20 (25.8–32.2) | 0 (0) |
| >20 (>32.2) | 1 (1.0) |

Concussion

All respondents (100%, n = 128/128; 15 missing) were familiar with the AIA concussion policy, and 98% (n = 123/125; 28 missing) indicated they had concussion guidelines in place at their schools. The presence of a concussion guideline at the school did not depend on whether the school had access to an AT ($U = 111.5, P = .254$), with 98.0% (n = 99/101; 15 missing) of schools with AT access and 95.6% (n = 22/23; 4 missing) of school without AT access having a school guideline. Most respondents (71%, n = 71/100; 43 missing) noted that their concussion policy had school board approval.

The responses regarding preseason concussion-education requirements for various stakeholders are shown in Table 6, and Figure 3 displays the responses regarding education programs for various stakeholder groups.

Sixty-eight percent of athletic directors (n = 79/116; 27 missing) indicated that their school had a designated concussion medical expert affiliated with the school. Responses regarding the credential of that expert were *physician* (67.1%, n = 53/79), *licensed AT* (67.1%, n = 53/79), *physician assistant* (12.7%, n = 10/79), and *nurse practitioner* (5.1%, n = 4/79).

Respondents were asked about their school's concussion guidelines and whether they included various aspects of concussion management. The responses regarding removal from play, return to play, and return to the classroom are summarized in Table 7. With respect to concussion testing, 83.5% of respondents (n = 101/121; 22 missing) indicated their schools offered baseline concussion testing, with the frequency of assessment type provided in Table 8. Fifty-three percent of respondents (n = 9/17; 3 missing) who did not offer in-school concussion testing referred families to external sources for baseline and postinjury testing. These athletes were referred to primary care physicians, Indian Health Services, or neurologists

Heat Illness

Almost all athletic directors (99.2%, n = 121/122; 21 missing) reported they were familiar with the AIA heat

Table 4. Respondents' Indications of the Response Time for Emergency Medical Services to the School (n = 131; 12 Missing)

| Response Time, min | No. (%) |
|--------------------|-----------|
| <1 | 0 (0) |
| 1 | 3 (2.3) |
| 2–5 | 82 (62.6) |
| 6–10 | 34 (26.0) |
| 11–15 | 8 (6.1) |
| 16–20 | 3 (2.3) |
| >20 | 1 (<1) |

Table 5. Numbers of Automated External Defibrillators at Schools as Reported by the Athletic Directors (n = 95)

| Automated External Defibrillators, No. | No. (%) |
|--|-----------|
| 1 | 15 (15.8) |
| 2 | 42 (44.2) |
| 3 | 18 (18.9) |
| 4 | 8 (8.4) |
| 5 | 7 (7.4) |
| 8 | 1 (1.1) |

illness policy, with 44.7% (n = 51/114; 29 missing) indicating that their school or district had additional policies to deal with heat-related conditions. Differences were noted ($U = 496.0, P < .001$) between schools based on AT access: 54.4% (n = 49/90; 26 missing) with access and 4.5% (n = 22/27; 5 missing) without AT access had additional heat-illness policies. Fifty-eight percent of schools (n = 60/104; 39 missing) took environmental measures before practices (Figure 4). Schools with AT access (67.1%, n = 57/85; 31 missing) more often took environmental measures ($U = 337.0, P < .001$) than schools without AT access (11.1%, n = 2/18; 9 missing).

Sixty-six percent of respondents (n = 73/111, 32 missing) indicated their school or district had an educational component for athletes, parents, and coaches on heat-related concerns; 83.9% (n = 94/112; 31 missing) had a treatment plan for managing heat illness, and 70.1% (n = 82/117; 26 missing) reported that their school had access to a cold-water immersion tub. Differences were noted ($U = 323.5, P < .001$): more schools with ATs (94.6%, n = 87/92; 24 missing) had a heat-illness treatment plan compared with those without (31.6%, n = 6/19; 8 missing). Similarly, more ($U = 644.0, P < .001$) schools with ATs (78.3%, n = 72/92; 24 missing) had access to a cold-water immersion tub than those without AT access (39.1%, n = 9/23; 4 missing). The methods used to assess core temperature are identified in Figure 5.

Other Policies

Questions were asked regarding whether each school had in place additional policies above the AIA or NFHS guidelines for lightning, dietary supplements, anabolic-adrenergic steroids, and disordered eating. The frequencies and percentages of respondents who indicated they do have additional school-specific policies are presented in Table 9. Moreover, athletic directors also reported that they had other policies in place, including those related to hazing (n = 1), random student drug testing (n = 2), alcohol and tobacco (n = 4), weight loss (n = 1), and cervical spine injuries (n = 1).

Table 6. Stakeholders Required to Have Preseason Concussion Education

| Stakeholder Group | No. | Total Responses | Percentage |
|-------------------------|-----|-----------------|------------|
| Students | 117 | 120 | 97.5 |
| Parents | 77 | 108 | 71.3 |
| Coaches | 118 | 120 | 98.3 |
| Staff or administration | 85 | 111 | 76.6 |

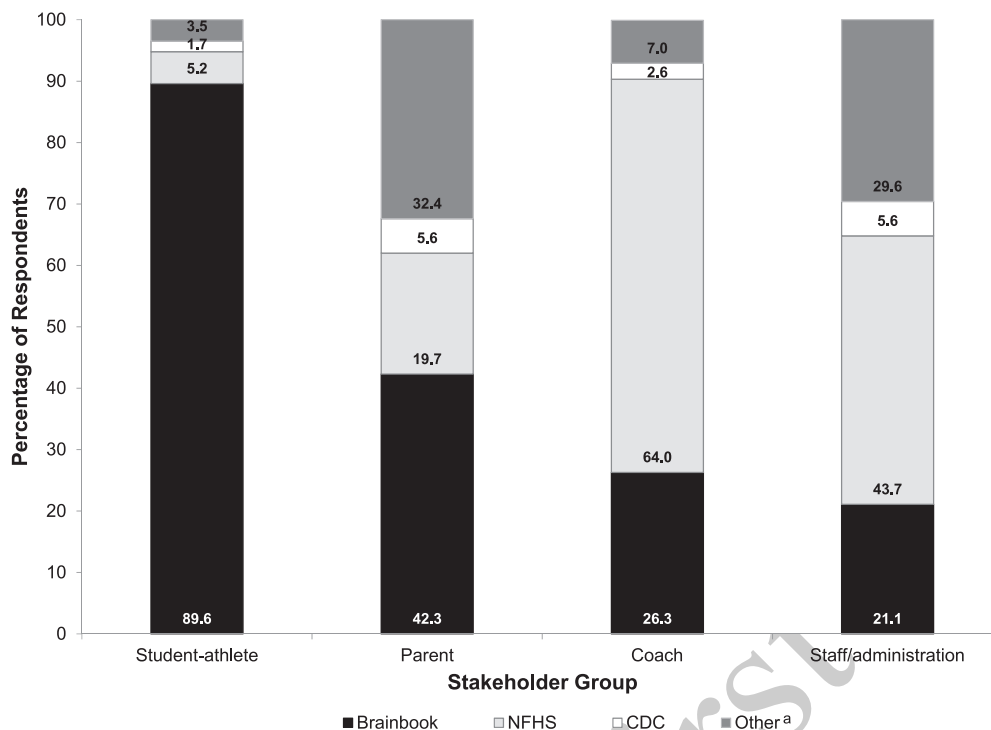


Figure 3. Educational programs used for student-athletes, parents, coaches, and staff/administration. ^a Responses in the *other* category included live meetings, self-developed educational sheets, athletic trainer presentations, the Arizona Interscholastic Association statement on concussions, informed consent video and a multi-modal approach, school-developed information, or a preseason coach meeting. Abbreviations: CDC, Centers for Disease Control and Prevention; NFHS, National Federation of State High School Associations.

DISCUSSION

The responses to this survey suggest that the majority of Arizona secondary schools had access to an AT and that schools with ATs were more likely to have specific policies, procedures, and equipment in place to prepare for emergencies resulting from sports. However, even with ATs, many schools demonstrated room for improvement, particularly in the areas of venue-specific EAPs, review and practice of EAPs, inclusion of return-to-school aspects of concussion management, baseline testing, environmental measures, availability of cold-water immersion tubs, and core temperature measurement.

Access to ATs

Athletic trainers have the knowledge and ability to develop and implement policies related to emergency preparedness.^{23,24} Several medical organizations have recognized ATs as key providers of athletics health care, and others have noted the importance of ATs on the concussion management team^{4,25} and as key on-site members of athletics health care teams.⁸

Nationally, it is estimated that nearly 70% of secondary schools have access to athletic training services.¹² Specific to Arizona, a national study¹² showed that 65% of responding public secondary schools noted they had access to an AT, with 43% reporting full-time access, 19% part-time access, 1% per diem access, and 6% access through a hospital or clinic. Our findings demonstrated greater access to ATs than reported in that study¹²: 81% of respondents described access, with 78% of ATs employed by the school or district and 80% employed in a full-time position. The differences between the studies may be the result of our survey being distributed to all AIA members, including private and charter schools, which are numerous in Arizona. In addition, it is plausible that nonrespondents to the survey were at schools without AT access, which may have resulted in an overestimate of access.

Access to athletic training services is important for the immediate recognition and evaluation of emergent conditions and the establishment of policies and procedures related to emergency preparedness. Comparing schools with and without access to athletic training services, we found that a higher number of schools with AT access had

Table 7. Components of School-Based Concussion Policies

| Guideline Component | No. | Total | |
|---------------------------------|-----|-----------|------------|
| | | Responses | Percentage |
| Removal from play | 126 | 126 | 100 |
| Graded, stepwise return to play | 117 | 121 | 96.7 |
| Return to classroom | 93 | 110 | 84.5 |

Table 8. Concussion Assessment Tools Used in Practice as Reported by Respondents (n = 101; 42 Missing)

| Assessment | No. (%) |
|-----------------------------|-----------|
| Computerized neurocognitive | 94 (93.1) |
| Balance | 43 (42.5) |
| Sideline | 66 (65.3) |
| Vision | 47 (46.5) |
| Other | 5 (5.0) |

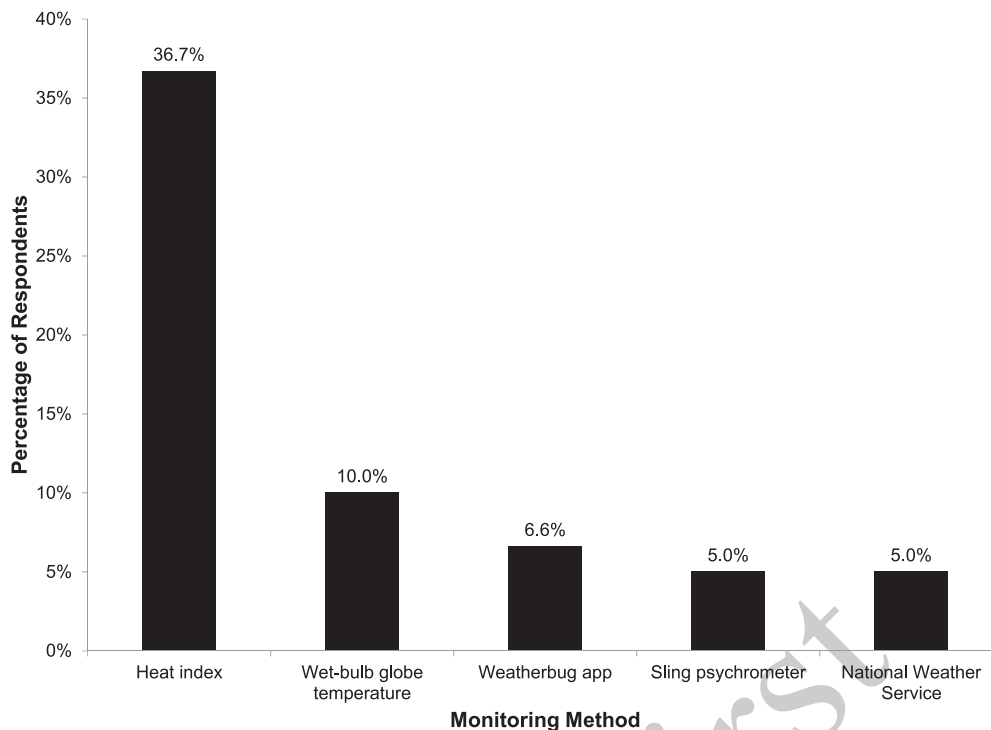


Figure 4. Frequency of methods used to assess environmental measures (n = 60).

EAPs, venue-specific EAPs, physician signatures on the EAPs, access to AEDs, additional heat-illness policies, and access to cold-water immersion tubs and took environmental measures. In fact, the only area in which no differences existed between schools with and without AT access was the presence of concussion guidelines. This is not surprising because concussion is the only area of emergency preparedness that is mandated by Arizona state law.

Emergency Action Plans

Our finding that 95% of athletic directors reported having an EAP was higher than previously reported in surveys of athletic directors, which indicated that approximately 55% of schools in Vermont,¹⁸ Ohio,²⁰ and North Carolina¹⁷ had EAPs in place. Our results also suggest a higher percentage of schools with EAPs than in previous surveys of ATs, perhaps demonstrating the results of targeted efforts to educate health care providers and schools to develop EAPs. Olympia et al²² observed that 70% of schools with ATs had EAPs, whereas another group¹⁶ reported that 84% of ATs stated they had an EAP specific to heat illness at their school. This is an important finding because one would expect surveys of ATs to include a greater percentage of respondents reporting an established EAP, given that it is considered a primary responsibility of the AT to ensure implementation of best practices for sports medicine management.⁹ Our result of a higher percentage of athletic directors noting the presence of a written EAP suggests that high schools within Arizona tended to be in compliance with recommendations on having an EAP,²⁶ and the athletic directors seemed to be involved in the development and implementation modeling published best practices.

Furthermore, our findings suggest that in addition to a higher percentage of schools having EAPs, nearly three-fourths of athletic directors indicated that they had venue-

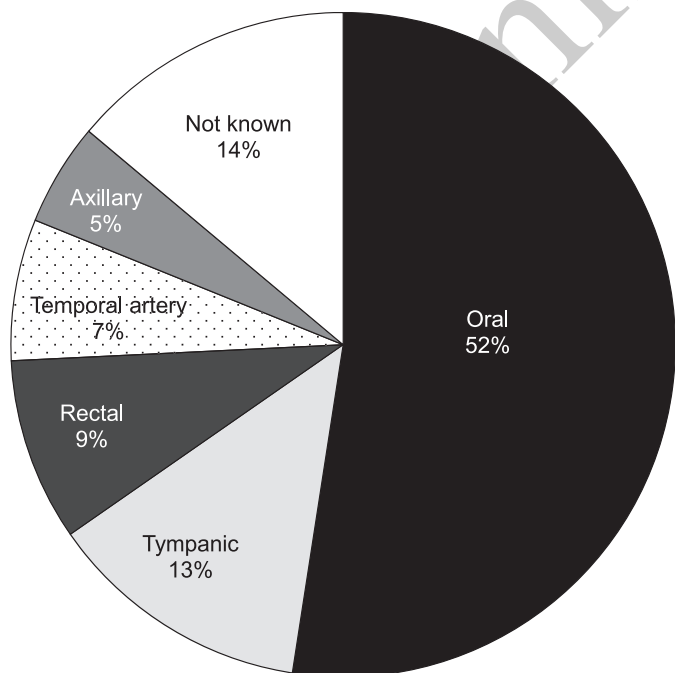


Figure 5. Frequency of methods used to assess core body temperature (n = 101; 42 missing).

Table 9. Additional Polices Noted by Respondents

| Policy | Frequency | Total | |
|------------------------------|-----------|-----------|------------|
| | | Responses | Percentage |
| Lightning | 80 | 125 | 64.0 |
| Dietary supplements | 35 | 114 | 30.7 |
| Anabolic-androgenic steroids | 55 | 116 | 47.4 |
| Disordered eating | 24 | 106 | 22.6 |

specific EAPs and reviewed the EAPs on at least an annual basis. However, only 32% of respondents commented that the EAP was practiced annually at each venue, which is similar to data from a national survey of ATs (26%)²² and a survey of Ohio athletic directors²⁰ but higher than previously reported in another study (18.3%).¹⁷ The lack of formal EAP practice is concerning, given that all medical-organization recommendations highlight the need to rehearse the EAP at each venue at least annually^{5,10} to ensure that all personnel are familiar with the plan and their roles in it. Athletic directors should be cognizant of the review and rehearsal of the EAP at their institution. It is interesting that only about one-quarter of our respondents indicated that a physician signed off on the EAP, which could be one means of approving it. This is a small number, considering that the best practice for sports medicine programs is to have the EAP approved by the team physician and supported by the school administration.⁹

Best practices for the development and implementation of EAPs suggest that all organizations that sponsor athletics should have a written, venue-specific EAP developed in consultation with emergency medical services.¹⁰ The EAP should identify the involved personnel, equipment needed, communication mechanisms, and documentation processes. Moreover, the EAP should indicate to which hospital(s) patients will be transferred. The EAP should be reviewed and practiced on an annual basis and be approved by the team or directing physician.^{5,9,10} The majority of our respondents tended to be in compliance with the recommendations to have written, venue-specific EAPs and to ensure that emergency medical services staff were familiar with the school personnel and venue(s), but fewer athletic directors noted that the EAP was practiced annually, included designated receiving hospitals, or was signed off by a physician. Therefore, educational efforts should be directed toward these areas of EAP implementation to improve overall emergency preparedness.

Automated External Defibrillators

The availability of AEDs is a key component of any EAP^{5,7-10} and predicts other aspects of emergency preparedness.¹⁹ Toresdahl et al¹⁹ researched AEDs as markers of emergency preparedness in high schools via data submitted to the National Registry for AED Use in Sports. Schools with 1 or more AEDs were more likely to have EAPs, consult EMS to develop the EAP, and review the EAPs annually, whereas those implementing an AED program were more likely to have a comprehensive emergency response plan for sudden cardiac arrest.

The responses from athletic directors in our study indicated that more than 90% of schools had access to an AED and more than 80% had access to at least 2 devices. These numbers are higher than the 54% to 81% in prior studies^{17-19,22} of AEDs in secondary schools. It is not surprising that more schools have access to AEDs today, given that the availability has increased and the cost has decreased, making it more feasible for schools to purchase them.

Although access to an AED is important, defibrillation using an AED within 3 to 5 minutes of the individual's collapse has been identified as a key aspect in preventing sudden cardiac death.⁵ Our respondents indicated that 92%

of venues had AEDs within a 3- to 5-minute response time, which was better than in another study¹⁷ that identified 54% of venues as having access to an AED within a 1- to 5-minute walk. Because the most important predictor of survival after a cardiac event is the time from the event until defibrillation,²⁶ these findings are encouraging. The availability of AEDs at or near athletic venues is important: One group²⁰ noted that 80% of reported sudden cardiac-arrest episodes in Ohio high schools that required AED use occurred at or near an athletic facility.

However, the availability and accessibility of the AED must be coupled with individuals trained to use it. Our respondents indicated that close to 90% of ATs and coaches and 65% of school administrators were certified in AED use. These numbers should be interpreted cautiously because the Board of Certification and Arizona Athletic Training Statute require CPR and AED certification for ATs holding certification or licensure; therefore, one would expect our respondents to have stated that all ATs were trained. Regardless, this is another area that can be improved by training all coaches and school administrators in CPR and AED use.

Concussion

Of all the aspects of emergency preparedness, sport-related concussion has been given the most attention in the past several years, with the passage of laws in all states and the District of Columbia between 2009 and 2014.²⁷ However, little evidence of the effectiveness of these legislative and policy initiatives at the high school level has been produced.^{28,29} It is apparent that the law and state association policy have affected high schools because concussion policy awareness and school guidelines were nearly universal and no differences existed between schools with and those without access to an AT. All respondents were aware of the AIA policy, and almost all had a written concussion policy in place at their schools, demonstrating greater compliance than reported in other national and state-specific studies.^{14,30} Those policies all contained a removal-from-play component, whereas most included a stepwise return-to-play progression, as recommended by the AIA. Close to 85% of schools had policies that addressed return to school, a value that was higher than the 44% reported in a nationwide study³⁰ of ATs.

With respect to concussion education, almost all of the surveyed athletic directors indicated that students and coaches completed preseason education, with fewer requiring education of parents or staff or administration. Furthermore, respondents varied in their descriptions of the type of education required for each stakeholder group, although most stated they used Barrow Brainbook (www.barrowneuro.org) for athletes and the National Federation of State High School Association's training for coaches (nfhslearn.com/courses/61151/concussion-in-sports). It is interesting that the state law requires education and the AIA policy not only requires athlete and coach education but mandates specific programs that were not identified by all athletic director respondents. For example, Barrow Brainbook is a mandated online athlete-education program requires both program completion and passing of a posttest to be eligible to participate in interscholastic athletics in Arizona.³¹ Similarly, AIA policy requires coaches to

complete the National Federation of State High School Association's concussion course. These discrepancies suggest room for improvement in the understanding and implementation of required concussion education among athletic directors.

Concussion preparedness should also include appropriate assessments and management processes built into the policy. Current recommendations⁴ suggest a multifaceted approach to assessment that incorporates baseline and postinjury testing. Eighty-three percent of our respondents indicated that they administered baseline testing, with 93% of those using computerized neurocognitive testing and, more specifically, ImPACT. These numbers are higher than those reported in other studies^{14,32} and may reflect opportunities provided to high schools in Arizona through the Barrow Concussion Network, a statewide initiative that supplies concussion education, assessment tool licenses, and virtual concussion-specialist consultation services.³¹ However, fewer respondents acknowledged the use of balance or oculomotor testing as a component of the baseline or postinjury assessment battery, identifying another area for further education and clinical practice implementation to improve concussion preparedness in Arizona high schools.

Heat Illness

Heat-related illness is a significant concern in all states, but especially in Arizona where fall preseason practices often begin in early August and average temperatures can range between 105° to 110°. Therefore, the AIA has paid specific attention to this concern by developing policies for heat acclimatization and the management of heat illness. It is not surprising that almost all athletic directors were familiar with the AIA heat-illness policy and almost half had additional policies for heat-related conditions in place at their schools. However, less than half of all schools and two-thirds of schools with AT access reported that environmental measures were taken before practice, which deviates from other studies¹⁶ and best practices.⁹ These findings are worrisome, especially because heat-related illnesses are 100% preventable if proper precautions are in place, including environmental monitoring and immediate management of suspected heat illness.⁵

With respect to the management of heat illness, 70% of surveyed athletic directors reported that their school had access to a cold-water immersion tub, which was greater than the 45% reported in another study¹⁶; however, in schools without AT access, less than 40% of respondents indicated they had access to a cold-water immersion tub. Emergency preparedness can be improved in those schools through the addition of a protocol that includes cold-water immersion, which has been identified as the criterion standard and the fastest and most effective cooling modality.⁵

The measurement of core body temperature can be a controversial topic in the secondary school setting, given that the criterion standard of rectal temperature⁵ is not always feasible. The majority of our respondents indicated that oral temperatures were measured, with less than 10% indicating their schools followed the best practice of measuring rectal temperatures. Continued discussion regarding best practices and implementation strategies needs

to occur to ensure appropriate management of athletes with heat illness.

LIMITATIONS AND FUTURE DIRECTIONS

This study was not without limitations. We intentionally studied only secondary schools within Arizona, and therefore, these findings may not be generalizable to other states where the state laws, policies, and athletic training practice acts may emphasize different areas of emergency preparedness. Whereas a 54% response rate is encouraging for survey research, there may have been an inherent bias in the 46% of athletic directors who did not respond. With the disproportionately high number of schools reporting access to an AT compared with prior studies, it is possible that the nonresponding schools did not have access to an AT or did not have adequate policies in place regarding emergency preparedness. However, many of these health and safety policies have been emphasized in the past several years, as reflected by the passage of concussion laws in all states,²⁸ publication of consensus and position statements, and efforts by professional leagues to promote safety initiatives. Regardless, these data provide a starting point for information on policies and procedures among Arizona high schools in numerous areas of emergency preparedness from which additional educational efforts can be developed to improve implementation.

Whereas the focus of our study was national concerns noted in the 2015 "Collaborative Solutions for Safety in Sport" meeting—specifically, head injury, heat illness, and cardiac arrest—other important areas of policy deserve future study. Athletic directors at a number of schools indicated additional health-related policies of equal value, including cervical spine injuries, inclement weather, alcohol use, hazing, and drug testing. Although the national policies and procedures may be improved, we have the opportunity to expand the scope of these efforts to include topics that affect athletes and nonathletes at the state level.

CONCLUSIONS

Our findings suggest that whereas the majority of schools reported access to an AT, not all schools had adequate policies in place to ensure a safe sporting environment. Mandates through laws and policies that address other areas of emergency preparedness may promote better adoption at the school level, as we identified for concussions. In addition, some responses demonstrated the need for better communication between athletic directors and ATs or interscholastic associations in areas such as AT AED certification, mandated athlete concussion education, and concussion-assessment tool availability. Secondary schools would benefit from additional educational opportunities regarding best practices and policy development to improve emergency preparedness.

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