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Exertional Heat-Stroke Management Practices and Intentions Among Secondary School Football Athletic Trainers

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Context: Athletic trainers (ATs) are educated and trained in appropriate exertional heat-stroke (EHS) management strategies, yet disparities may exist between intended and actual uses in clinical practice.

Objective: To examine the intended and actual uses of EHS management strategies among those who did and those who did not treat patients with suspected cases of EHS during the 2017 high school (HS) American football preseason.

Design: Cross-sectional study.

Setting: Online questionnaire.

Patients or Other Participants: A total of 1016 ATs who oversaw patient care during the 2017 HS American football preseason.

Main Outcome Measure(s): Responding HS ATs recorded whether they had or had not managed patients with suspected EHS events during the 2017 HS American football preseason. Those who had managed patients with suspected cases of EHS reported the management strategies used; those who had not managed such patients described their intended management strategies. For each management strategy, *z* tests compared the proportions of actual use among ATs who managed patients with suspected EHS with the proportions of intended use among ATs who did not manage such patients.

Results: Overall, 124 (12.2%) ATs treated patients with suspected EHS cases during the 2017 HS American football preseason. Generally, the proportions of intended use of management strategies among ATs who did not treat patients with suspected EHS were higher than the actual use of those strategies among ATs who did. For example, ATs who did treat patients with suspected EHS were more likely than those who did not treat such patients to intend to take rectal temperature (19.6% versus 3.2%, $P < .001$) and immerse the athlete in ice water (90.1% versus 51.6%, $P < .001$).

Conclusions: Inconsistencies occurred between intended and actual use of EHS management strategies. The standard of care for managing patients with suspected cases of EHS was not consistently used in clinical practice, although ATs who did not treat EHS stated they intended to use these management strategies more frequently. Future researchers should identify factors that preclude ATs from using the standard of care when treating patients with suspected cases of EHS.

Key Words: exertional heat illness, emergency care, high school sports

Key Points

- Only 3.2% of surveyed athletic trainers caring for patients with suspected cases of exertional heat stroke reported taking rectal temperatures.
- Standard-of-care practices for managing exertional heat stroke were not consistently implemented in clinical practice.

Exertional heat stroke (EHS) is a life-threatening condition that is widely considered to be a public health concern.[1] Characterized as central nervous system dysfunction or cognitive impairment in conjunction with a core body temperature greater than 40.0°C,[1,2] EHS results from strenuous exercise, oftentimes when performed in a hot environment. Authors[3] have suggested that EHS and other exertional heat illness (EHI) events occur most frequently during preseason American football practices (which typically occur in late July and August), particularly after 1 to 2 hours of physical activity. Yeargin et al[3] found that the rate of EHI for high school (HS) American football players during the preseason was 1.47 per 10 000 athlete-exposures, compared with 0.15 per 10 000 athlete-exposures during the regular season. Factors associated with an increased risk of EHI are a combination of elevated ambient temperature, use of protective equipment, and lack of acclimatization.[4]

As the primary care providers for many athletes at the HS level, athletic trainers (ATs) must be prepared to manage cases of EHS, particularly during the American football preseason. Best-practice guidelines that outline the standard of care for the prevention, recognition, and treatment of EHS have been published,[1,5,6] including the National Athletic Trainers' Association (NATA) position statement on exertional heat illnesses.[2] All ATs are expected to know, understand, and implement these best practices in their clinical care. Thus, in 2011, the Commission on Accreditation of Athletic Training Education released an update to the accreditation standards and educational competencies requiring athletic training education programs to deliver instruction and hands-on training related to the standard of care and best practices for EHS prevention, recognition, assessment, and management.[7]

Given the increased risk of long-term morbidity and mortality when body temperature exceeds the critical threshold for cell damage (40.83°C), prompt recognition and care are imperative.[8] Current standards of care for EHS dictate that (1) an accurate assessment of internal body temperature and (2) aggressive whole-body cooling are needed to successfully treat patients with EHS. To assess internal body temperature in exercising individuals, rectal thermometry is the most accurate and feasible method.[9–12] Once EHS is confirmed (rectal temperature >40.5°C with obvious central nervous system dysfunction), rapid, whole-body cooling using cold-water immersion (CWI) until internal body temperature (ie, rectal temperature) reaches 38.9°C is recommended before the patient is transported for higher-level medical care.[2] Researchers[13,14] have demonstrated that adequate rates of cooling (0.2°C/min) can occur with CWI, even while wearing protective equipment.

When faced with suspected cases of EHS, ATs should use standard-of-care practices for EHS management and care.[2,15] However, investigators[16] found a low level of adherence to evidence-based standard-of-care practices for EHS management in HS American football players. Although not all suspected cases of EHS are ultimately diagnosed as EHS (potentially explaining the lower actual use of appropriate management strategies), our understanding of why these standard-of-care practices are not widely implemented remains limited. Although previous work on this topic exists,[9,16,17] tactics must be used to encourage wider implementation of standard-of-care EHS management strategies. Yet it is important to first update the literature to better understand the disconnect between the intended and actual use of potential management strategies used to treat patients with suspected cases of EHS, particularly regarding standard-of-care practices. Accordingly, the purpose of our study was to provide such an update by comparing the actual use of management strategies by ATs who treated patients with suspected cases of EHS during the 2017 HS American football preseason with the intended use of these management strategies by ATs who did not treat such patients during this time period.

METHODS

We used a cross-sectional survey design that was modeled after a similar study[17] conducted to assess implementation of EHI-prevention strategies in high school American football players. The population of interest was HS ATs in the United States. The study was approved by the institutional review board at the University of North Carolina at Chapel Hill.

Study Sample and Recruitment

Data were collected from ATs during the 2017–2018 academic year. For inclusion in this study, ATs were required to (1) have a valid email address; (2) be NATA affiliated; (3) have elected to receive questionnaires via the NATA membership list; and (4) be employed in the HS setting with responsibility for providing medical care to the school's American football program during the 2017 preseason.

Overall, 7278 ATs were invited to participate in the study by an email invitation from the research team. The email included information about the study as well as a link to the online questionnaire. Nonrespondents received up to 8 biweekly email reminders during the 4-month data-collection period between December 2017 and March 2018. The NATA membership list did not specifically identify ATs working with HS American football programs. As a result, ATs responding to the questionnaire were asked a screening question regarding their work with an HS American football program during the 2017 season. Those reporting that they had worked with either a public or private HS American football team were allowed to complete the questionnaire (n = 1023); those who did not were informed they did not meet the inclusion criteria for the study, and the questionnaire was ended (n = 92). Of the 1023 respondents who completed the questionnaire, 1016 provided complete responses for the items of concern for these analyses.

Questionnaire Instrument

We modeled the study questionnaire after an instrument developed for a previous study[17] that reviewed the NATA Inter-Association Task Force preseason heat-acclimatization guidelines.[2] The original questionnaire was pilot tested in a convenience sample of 11 ATs who provided care to HS athletes.[17] Our questionnaire was pilot tested in a different convenience sample of 5 ATs who provided care to HS athletes. After the pilot testing, minor adjustments were made to the instrument to improve clarity and comprehension. The questionnaire was distributed via the online Qualtrics platform (Provo, UT).

Demographic information regarding the ATs and their schools was collected. Respondents were asked to indicate whether they had treated patients with suspected cases of EHS during the 2017 HS American football preseason (see Table 1 for specific questions). Athletic trainers who indicated that they had treated a patient with a suspected case of EHS were then asked about management strategies they used. This list of strategies consisted of 12 items,

Table 1. Key Questions Used in Questionnaire[a]

1) During the 2017 football pre-season practices, how many athletes were examined or treated for suspected exertional heat stroke?
Response options:
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or more

2) If respondent answered at least 1 suspected exertional heat stroke:	*2) If respondent answered no suspected exertional heat strokes:*
• What was done for the athlete(s) that was examined or treated for suspected exertional heat stroke?	• What would have been done for athlete(s) that were examined or treated for suspected exertional heat stroke?

Response options for both questions (check all that apply):
Take temperature; Immerse athlete in ice water; Call for EMS; Call for clinical back up (ie, physician); Use wet towels; Cool athlete with fan; Utilize portable air conditioning unit; Move athlete to shaded area; Remove athlete's football equipment; Remove athlete's clothing; Move athlete indoors into air conditioning

3) If respondent answered "Take temperature":

• What is the most common way that athletes' temperatures were taken?	• What would be the most common way that athletes' temperatures were taken?

Response options for both questions (check all that apply):
Thermometer in mouth; Thermometer in/on other external body site (eg, armpit, forehead); Internal heat sensors (eg, gastrointestinal temperature via ingestible thermometers; Rectal thermometer; Don't know; Prefer not to answer

Abbreviation: EMS, emergency medical services.
[a] Instrument is reproduced in its original format.

including standard-of-care practices (eg, removal of protective equipment, CWI, and use of a rectal thermometer), additional cooling strategies to cool athletes (eg, moving the athlete to an air-conditioned or shaded environment), and additional medical care resources. Athletic trainers who reported that they did not treat a patient with a suspected case of EHS during the 2017 HS American football preseason were presented with the same list of strategies and asked to select those they would have used for management had they been presented with a suspected case. The question sets for the AT groups were similar in nature to ensure comparability of responses.

Statistical Analysis

We examined ATs' demographics and HS characteristics using frequencies and percentages. High school characteristics also included the US census region and heat-safety region,[18] both of which were determined on the basis of the HS zip codes provided by the ATs. The heat-safety regions were based on warm-season wet-bulb globe temperatures (WBGTs) from 1991 through 2005, accounted for multiple environmental variables across and within states (including temperature, humidity, wind, and radiant heating), and were grouped by extreme (90th-percentile) daily maximum WBGT. Mild region 1 (WBGTs $\leq$ 30°C) consisted of the Pacific Coast, New England, and the northern tier of the US; moderate region 2 (WBGTs from 30.1°C–32.2°C) extended in an arc from the interior Northwest through Nevada and portions of the Midwest, Ohio Valley, and Northeast; hot region 3 (WBGTs $\geq$ 32.3°C) contained much of the southeastern quadrant of the US, along with portions of the Southwest and the Central Valley of California.[18] Descriptive characteristics were analyzed for the pooled sample of ATs and then separately for ATs who had and those who had not managed a patient with suspected EHS during the 2017 preseason.

Chi-square tests were calculated to compare distributions of AT demographics and HS characteristics between ATs who had and those who had not managed a patient with suspected EHS in the 2017 preseason. We used z tests for proportions to compare the differential proportions of actual and intended uses between the 2 subsamples of surveyed ATs for each management strategy. Statistical significance was evaluated at the .05 level; analyses were conducted with SAS (version 9.4; SAS Institute Inc, Cary, NC).

RESULTS

Of the 1016 ATs included in the analyses, most were women (55.1%) and aged <40 years (65.9%), and they had <10 years of athletic training experience (50.9%; Table 2). Of these ATs, 124 (12.2%) ATs reported treating patients with suspected cases of EHS during the 2017 HS football preseason. The largest proportion of ATs who indicated managing patients with suspected cases of EHS were from HSs in heat safety region 3 (49.2%) and had been practicing for 0 to 9 years (54.5%).

Only 1 demographic difference was found between the ATs who had treated patients with suspected cases of EHS during the 2017 HS football preseason and the ATs who did not. A higher proportion of the former had spent fewer years at their respective schools ($P < .001$). No other differences in HS level characteristics were present.

The EHS management strategy most often reported by both groups (as having been used or intended for use) was removal of football equipment (treated: 97.6%; did not treat: 98.5%; Table 3). Other EHS management strategies commonly used by ATs who had treated patients with suspected EHS were wet ice towels (87.9%), moving the athlete out of the sun and into a shaded area (87.9%), and moving the athlete indoors to an air-conditioned space (71.9%). Despite being a standard-of-care strategy, taking rectal temperature was the least prevalently endorsed EHS management strategy (3.2%) among ATs who treated patients with suspected. Instead, 46.7% (n = 58) of ATs who treated patients with suspected cases of EHS reported taking the athlete's temperature via alternative sites, such as other external body sites (eg, armpit, forehead).

Table 2. **Demographics of Surveyed Athletic Trainers (ATs) and Their High Schools**

Characteristic	Treated Patients With Suspected Exertional Heat Stroke? No. (%)		*P* Value[a]	Overall Sample (n = 1016), No. (%)
	Yes (n = 124)	No (n = 892)		
ATs				
Gender			.681	
Female	65 (53.3)	484 (55.3)		552 (55.0)
Male	57 (46.7)	392 (44.3)		452 (45.0)
Missing	2	16		18
Age, y			.367	
<30	53 (43.1)	332 (37.5)		387 (38.2)
30–39	34 (27.6)	245 (27.8)		281 (27.7)
40–49	16 (13.0)	170 (19.2)		188 (18.5)
≥50	20 (16.3)	138 (15.6)		158 (15.6)
Missing	1	7		8
Years of experience as AT			.545	
0–4	40 (32.5)	237 (26.7)		279 (27.4)
5–9	27 (22.0)	211 (23.8)		238 (23.4)
10–19	27 (22.0)	195 (22.0)		225(22.1)
≥20	29 (23.6)	245 (27.6)		275 (27.0)
Missing	1	4		5
Years at current high school as AT			**.001**	
0–2	55 (44.4)	271 (30.5)		329 (32.3)
3–4	29 (23.4)	163 (18.4)		192 (18.9)
5–9	14 (11.3)	168 (18.9)		183 (18.0)
≥10	26 (21.0)	286 (32.2)		314 (30.8)
Missing	0	4		4
School characteristics				
Region			.380	
Midwest	25 (20.2)	225 (25.2)		250 (24.4)
Northeast	23 (18.6)	186 (20.9)		210 (20.5)
South	53 (42.7)	315 (35.3)		371 (36.3)
West	23 (18.6)	166 (18.6)		192 (18.8)
Heat-safety region[b]			.378	
1	28 (23.0)	240 (27.6)		269 (26.9)
2	34 (27.9)	258 (29.6)		293 (29.3)
3	60 (49.2)	373 (42.8)		438 (43.8)
School size (2017 school year)			.199	
<500	15 (12.4)	169 (19.3)		183 (18.4)
500–999	30 (24.8)	216 (24.9)		247 (24.8)
1000–1999	44 (36.4)	308 (35.4)		355 (35.6)
≥2000	32 (26.5)	177 (20.4)		212 (21.3)
Missing	3	23		26
Student-athletes, No. (2017 school year)			.692	
<250	26 (21.7)	166 (19.5)		192 (19.4)
250–499	47 (39.2)	362 (42.5)		411 (42.0)
500–749	30 (25.0)	183 (21.5)		217 (22.2)
≥750	17 (14.2)	140 (16.5)		158 (16.2)
Missing	4	45		46
2017 football preseason squad size			.914	
<40	23 (18.7)	181 (20.5)		205 (20.3)
40–59	35 (28.5)	232 (26.3)		269 (26.6)
60–79	24 (19.5)	185 (21.0)		211 (20.9)
≥80	41 (33.3)	284 (32.2)		327 (32.3)
Missing	1	10		11

[a] *P* values reported from χ^2 test for proportions evaluating differential AT demographics and high school characteristics between ATs who treated patients with suspected EHS in the 2017 preseason and those who did not. Bolded value was significant at the $\alpha = .05$ level.
[b] Heat-safety regions are based on safety thresholds outlined by Grundstein et al.[18]

Of the 12 EHS management strategies assessed, we noted significant differential proportions for 9 (Table 3). In these instances, lower proportions of actual use were described by ATs who treated patients with suspected EHS versus the intended use among ATs who had not treated such patients. With regard to standard-of-care practices for EHS management, the percentages of actual use were lower than the percentages of intended use for CWI (51.6% versus 90.1%, respectively; $z = -11.38$; $P < .001$) and taking rectal temperature (3.2% versus 19.6%, respectively; $z = -4.49$; $P < .001$).

DISCUSSION

During the 2017 preseason, we found that both the actual and intended uses of standard-of-care practices for EHS

Table 3. Management Strategies for Patients With Suspected Exertional Heat Stroke (EHS) That Were or Would Have Been Used by Athletic Trainers (ATs) During the 2017 High School American Football Preseason

	Treated Patients With Suspected EHS? No. (%)			
EHS Management Strategy	Yes (n = 124)	No (n = 892)	*z* Score[a]	*P* Value[b]
Standard-of-care practices				
Removed athlete's football equipment	121 (97.6)	879 (98.5)	−0.75	.45
Immersed athlete in ice water	64 (51.6)	804 (90.1)	**−11.38**	**<.001**
Took rectal temperature[c]	4 (3.2)	175 (19.6)	**−4.49**	**<.001**
Additional steps to cool athlete's temperature				
Moved athlete to shaded area	109 (87.9)	841 (94.3)	**−2.71**	**.007**
Used wet ice towels	109 (87.9)	770 (86.3)	0.49	.62
Moved athlete indoors into air conditioning	89 (71.8)	714 (80.0)	**−2.10**	**.04**
Removed athlete's clothing	69 (55.6)	692 (77.6)	**−5.29**	**<.001**
Cooled athlete with fan	38 (30.6)	362 (40.6)	**−2.14**	**.03**
Used portable air conditioning unit	6 (4.8)	90 (10.1)	−1.89	.06
Obtained additional medical care resources				
Called for emergency medical services	19 (15.3)	848 (95.1)	**−23.55**	**<.001**
Called for clinical backup (ie, physician)	7 (5.6)	175 (19.6)	**−3.81**	**<.001**

[a] Reflects *z* scores for proportions evaluating use or intended use of management strategies by ATs who treated patients with suspected cases of EHS and those who did not, respectively. Bolded values were significant at the $\alpha = .05$ level.
[b] *P* values reported from z test for proportions evaluating use or intended use of management strategies by ATs who treated patients with suspected cases of EHS and those who did not. Bolded values were significant at the $\alpha = .05$ level.
[c] An additional 46.7% of ATs who treated patients with suspected EHS reported taking temperature by other means or via alternative sites, such as other external body sites (eg, armpit, forehead) or using internal heat sensors (eg, gastrointestinal temperature via ingestible thermometer). Bolded *z* score and *P* value indicate differences in the use and intended use of the various management strategies.

management (such as use of rectal thermometer and CWI) were low; the 1 exception was removal of protective (football) equipment, for which both the actual and intended uses were high. It is important to recognize that these results are based on patients with suspected cases of EHS, some of whom may not have had the condition. Nevertheless, these data are critical in helping us to identify areas in need of improvement related to managing patients with suspected EHS. Considering the education that ATs receive on managing EHS, we must acknowledge barriers that might deter ATs from properly implementing these standard-of-care practices. Therefore, we advocate additional research to elucidate the barriers ATs face when trying to implement standard-of-care practices and identify factors and strategies to increase appropriate implementation.

Distributions of Suspected Cases of EHS

Patients with suspected cases of EHS were located in all 3 heat-safety regions and all 4 US census regions. Although we might assume that EHI is only a concern in certain parts of the US due to the various climates, our results highlight that ATs across the US must be prepared to manage patients with possible EHS.[19] Nearly half of the ATs who had treated patients with suspected EHS during the 2017 preseason had been practicing for less than 10 years. These ATs were likely to have been enrolled in educational programs that were required to comply with the most recent set of Commission on Accreditation of Athletic Training Education standards. This training should have included standard education and hands-on practice surrounding the recognition (ie, assessment of body temperature via rectal thermometry) and management (ie, rapid cooling via CWI) of EHS. This information is included in the educational standards, yet clearly some limitations exist to implementation in all programs. This may have resulted in clinicians being insufficiently prepared to implement standard-of-care practices after transitioning to clinical practice when caring for patients with suspected EHS or in clinicians being provided with but choosing not to use their equipment and knowledge. Such information is important to ATs, regardless of their experience level, years of service, or location of practice within the US. As a result, we recommend the development and use of continuing education opportunities on this topic to help ensure that all ATs are aware of standard-of-care practices. Whereas such continuing education opportunities may already be available, the creation of new EHS-specific opportunities at the national, district, and state levels will allow all ATs to be brought up to date on the most current standard-of-care practices. In addition, hands-on, laboratory-based continuing education opportunities for EHS will provide ATs with practical experience in recognizing and managing patients with EHS.

Body Temperature Assessment

The use of rectal temperature for diagnosing EHS[1,2,5,6,15] has been extensively studied and supported within the scientific and medical literature.[10–12,20–24] However, the use of this strategy was notably low among ATs who reported treating patients with suspected cases of EHS in the 2017 preseason (3.2%). The intended use of rectal thermometers was also low among ATs who did not treat such patients (19.6%). Mazerolle et al[9] indicated that possible barriers surrounding this standard-of-care management strategy included a perceived lack of patient privacy, lack of confidence in skills, lack of understanding that rectal temperature differs from temperatures taken at other locations, and legal concerns related to state, local, and school district regulations. Furthermore, lack of access to supplies, such as a rectal thermometer, and training to use the device have also been considered barriers. These same barriers may have contributed to the lack of use of this strategy among our sample.

It is important to recognize that both the Board of Certification[25] and the NATA Code of Ethics[26] require ATs to provide care that protects patients from undue harm by means of methods outlined by professional statements and best practices.[2] As a result, assessing rectal temperature is critical to the proper diagnosis and care of patients with suspected EHS.[10,11,22,24] Although other means are available for measuring core body temperature (ie, ingestible gastrointestinal pill or esophageal probe), they are not always practical or feasible for use at the high school level. In those wearing football equipment, differences were demonstrated among temporal, axillary, oral, and tympanic temperatures versus rectal temperature.[27] In addition, the accurate assessment of core body temperature is critical for promptly diagnosing and developing an immediate plan of care for patients with suspected cases of EHS. It is vital that the general public has an understanding of rectal thermometer use as the standard of care for identifying and managing patients with suspected EHS. Athletic trainers and researchers should also educate school and district administrators to help school systems obtain the proper supplies and emphasize the importance of an emergency action plan. Rehearsal of the emergency action plan with all who would be involved in a medical emergency will help to ensure that athletes are provided with the best possible care. Moreover, ATs learn about EHS to fulfill the competency that is required in accredited programs, but site-specific practice can help to increase familiarity with and confidence in the skills. These strategies, coupled with more widespread continuing education offerings on topics such as rectal thermometer use and caring for patients with suspected EHS, will help ATs improve their competency and confidence in EHS management.

Cold-Water Immersion

Cold-water immersion is the standard-of-care management strategy for quickly lowering body temperature in a patient with EHS[2]; in treating patients with suspected EHS, the body should be cooled to <39°C within 30 minutes of collapse. Researchers[28] have suggested that CWI produces a cooling rate of approximately 0.22°C/min in an average-sized body, which is well above the 0.155°C/min threshold deemed optimal. Other authors[29] observed that cooling rates of CWI varied according to body size, noting that it took considerably longer to cool a larger football player (0.156°C/min) than a smaller cross-country runner (0.255°C/min). Although all of these cooling rates are close to or above the optimal threshold, larger athletes may require more time to cool using CWI. This becomes a particularly relevant consideration if core body temperature is not being actively monitored with a rectal thermometer. Among ATs in our sample who reported treating patients with suspected cases of EHS in the 2017 preseason, the prevalence of CWI was low (51.6%). However, we observed a higher prevalence of intention to use this strategy among ATs who did not treat such patients (90.1%). The reason for the difference between the actual and intended uses of this strategy is unknown; practice location (indoor versus outdoor or the location on the school campus) and the availability of resources may be at least partially responsible for the low prevalence of actual use. Whereas tanks specifically for CWI are commercially available, water troughs, kiddie pools, and bags of ice and water can serve as effective, more readily available, and often cost-efficient alternatives for implementing this treatment. Alternatively, tarp-assisted cooling, a portable method of CWI that uses a tarp or other impermeable and flexible material filled with ice and water, can be easily and quickly used to treat patients with EHS.[20,21] Precooling of athletes using CWI has also been effective in delaying the onset of increased core body temperatures and does not affect CWI's subsequent cooling rate in the case of EHS.[30] Ultimately, ATs are responsible for ensuring that the appropriate resources are available during preseason American football practices to provide athletes the best care possible. Still, continued research can contribute to a better understanding of which factors may affect an AT's ability to properly implement this standard-of-care management strategy.

Removal of Protective Equipment

Nearly all ATs sampled indicated that they used (97.6%) or intended to use (98.5%) removal of protective (football) equipment for managing patients with suspected cases of EHS. This standard-of-care management strategy is easy and quick to implement. Cold-water immersion may be just as effective without removal of football padding,[13,14] yet removing protective equipment permits optimal cooling because the body surface area exposed to the cooling modality is maximized. However, if the patient is combative or exhibiting aggressive behavior, initiating cooling with protective equipment on and then removing it during the cooling process may allow for a more rapid temperature reduction.

Emergency Medical Services

At the HS level, summoning advanced medical personnel and transporting patients with EHS to the hospital is critical to recovery. High schools are not properly equipped to manage and monitor an athlete after cooling and, therefore, athletes must be cooled first and transported afterward. Based on our findings, it appears that emergency medical services (EMS) were not always called while patients with suspected EHS were being treated. Furthermore, we observed differential prevalences of actual and intended uses of EMS, with intended use (95.1%) greater among ATs who did not treat patients with suspected EHS. The lower prevalence of actual use (15.3%) among ATs who treated patients with suspected EHS may be attributable to those patients not actually being diagnosed with EHS and the summoning of EMS being deemed unnecessary. Nevertheless, given the low level of use of rectal thermometers, such decisions may have been based on improper temperature measurements.

In other settings, such as at the professional and collegiate levels when a practicing physician is on site during the initial presentation and management of patients with suspected EHS, patients who remain asymptomatic 1-hour postcooling do not require transport by EMS. Still, ATs and on-site physicians can choose to transport after cooling should they deem it necessary. This is based on the recommendations put forth in the NATA position statement

Table 4. Management Strategies for Patients With Suspected Exertional Heat Stroke (EHS) That Were Used or Would Have Been Used by Athletic Trainers (ATs) During the 2017 and 2011 High School Football Preseasons, No. (%)

	2017 Preseason		2011 Preseason[22]	
	Treated Patients With Suspected EHS?			
EHS Management Strategy	Yes (n = 124)	No (n = 892)	Yes (n = 225)	No (n = 886)
Removed athlete's football equipment	121 (97.6)	879 (98.5)	221 (98.2)	880 (99.3)
Immersed athlete in ice water	64 (51.6)	804 (90.1)	117 (52.0)	702 (79.2)
Took rectal temperature	4 (3.2)	175 (19.6)	2 (0.9)	68 (7.7)
Called for emergency medical services	19 (15.3)	848 (95.1)	66 (29.3)	845 (95.4)

on exertional heat illnesses.[2] Physicians are rarely present on the sidelines of HS practices, so transport should always occur after cooling to facilitate the best possible outcome. In addition, EMS agencies are frequently not equipped with the appropriate means to cool a patient during transport or continuously and accurately monitor internal body temperature. Athletic trainers play a critical role in cooling the patient; it is imperative that cooling occur before transport and temperatures are reported to EMS. Encouraging HS ATs to summon EMS and transport patients after cooling can ensure the best possible outcomes.

Comparison With Data From the 2011 Preseason

Intended use of standard-of-care practices improved when data from the 2017 HS football preseason were compared with data from the 2011 HS football preseason (Table 4).[16] Intended uses of CWI and rectal thermometer increased. Furthermore, actual use of rectal thermometers by those ATs who treated patients with suspected cases of EHS increased slightly. Slight increases in intended and actual uses of these management strategies over time may suggest that some progress has been made in overcoming barriers to use. In contrast, actual use of EMS by those ATs who treated patients with suspected cases of EHS decreased from 2011 to 2017. As previously noted, this may be due to patients with suspected cases of EHS not actually being diagnosed with EHS. Also, if more physicians were on site during the 2017 preseason, then transport might have not been as necessary (although still encouraged) if patients remained asymptomatic 1-hour postcooling.[2] Regardless of whether actual and intended use increased or decreased, continued efforts to increase compliance with best practices are recommended.

Limitations

We relied on a convenience sample, and our findings may not be generalizable to all ATs who worked with HS American football players or to nonrespondents. Furthermore, as with any survey-based research, the study may be prone to general information biases such as recall and social-desirability bias. Patients who were suspected of having EHS may have not been ultimately diagnosed with EHS, which may explain the lower actual use of appropriate management strategies. In addition, we were unable to distinguish previous experience managing patients with suspected EHS before the 2017 preseason.

CONCLUSIONS

Our results suggest that many ATs were not using or did not intend to use current standard-of-care strategies for managing patients with suspected cases of EHS. Intended use was generally higher than actual use, but our findings indicate that barriers might inhibit proper implementation and need to be identified and mitigated. Policy, institutional, and organizational support should be provided to ATs in an effort to permit easier access and implementation of these standards. Also, ATs should have access to extensive classroom education, continuing education opportunities, and hands-on practice regarding these standards. Once ATs are confident and comfortable with the standard-of-care practices for recognizing and treating patients with suspected EHS, they can educate and inform other sports organization stakeholders (eg, coaches, parents, administrators, athletes) on the importance of using the standard-of-care strategies. Future researchers should look more specifically at the barriers that inhibit proper implementation of best practices and assess ways those at the institutional and organizational levels can support ATs in implementing such strategies.

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