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High Schools' Adoption of Evidence-Based Practices for the Management of Exertional Heat Stroke

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Context: Exertional heat stroke (EHS) deaths can be prevented by adhering to best practices.

Objective: To investigate high schools' adoption of policies and procedures for recognizing and treating patients with EHS and the factors influencing the adoption of a comprehensive policy.

Design: Cross-sectional study.

Setting: Online questionnaire.

Patients or Other Participants: Athletic trainers (ATs) practicing in the high school (HS) setting.

Main Outcome Measure(s): Using the National Athletic Trainers' Association position statement on exertional heat illness, we developed an online questionnaire and distributed it to ATs to ascertain their schools' current written policies for using rectal temperature and cold-water immersion. The precaution adoption process model allowed for responses to be presented across the various health behavior stages (*unaware if have the policy*, *unaware of the need for the policy*, *unengaged*, *undecided*, *decided not to act*, *decided to act*, *acting*, and *maintaining*). Additional questions addressed perceptions of facilitators and barriers. Data are presented as proportions.

Results: A total of 531 ATs completed the questionnaire. Overall, 16.9% (n = 62) reported adoption of all components for the proper recognition and treatment of EHS. The component with the highest adoption level was "cool first, transport second"; 74.1% (n = 110) of ATs described acting on or maintaining the policy. The most variability in the precaution adoption process model responses was for a rectal temperature policy; 28.7% (n = 103) of ATs stated they decided not to act and 20.1% (n = 72) stated they maintained the policy. The most frequently cited facilitator of and barrier to obtaining rectal temperature were a mandate from the state HS athletics association (n = 274, 51.5%) and resistance to or apprehension of parents or legal guardians (n = 311, 58.5%), respectively.

Conclusions: Athletic trainers in the HS setting appeared to be struggling to adopt a comprehensive EHS strategy, with rectal temperature continuing as the biggest challenge. Tailored strategies based on health behavior, facilitators, and barriers may aid in changing this paradigm.

Key Words: policies and procedures, adoption, health behavior, tailored interventions

Key Points

- Overall, 17% of athletic trainers reported adopting all 4 policy components for the diagnosis and management of patients with exertional heat stroke, whereas 48% described adopting all 3 cold-water immersion policies.
- The most often cited facilitator of a rectal temperature policy was a mandate from the state high school athletics association, whereas the most frequently cited barrier was resistance or apprehension from parents.
- The facilitator reported most commonly for a cold-water immersion policy was having a medical professional onsite, whereas the barrier described most often was financial limitations.

Exertional heat illness (EHI) represents a constellation of medical conditions in which heat exposure plays a key role.[1] Data from the past decade have indicated that the rate of EHI in high school (HS) athletes ranges from 0.12 to 0.13/10 000 athlete-exposures.[2,3] The proper management and care of patients with exertional heat stroke (EHS), the only fatal EHI, has been examined extensively in the scientific literature for decades. Synthesis of the current standards of care is provided in numerous position and consensus statements[4–8] and other supporting literature specific to the HS setting.[9] Belval et al[6] introduced a paradigm on the prehospital care of EHS consisting of 4 steps: (1) rapid recognition, (2) rapid assessment, (3) rapid cooling, and (4) rapid advanced care. In short, recognition of altered mental status and confirmation of extreme hyperthermia (>40.5°C) using rectal thermometry to diagnose EHS, followed by onsite whole-body, cold-water immersion (CWI) within 30 minutes of collapse ensures survival.[4,10] Evidence suggests that, when all steps of this paradigm are followed, the survival rate of EHS is 100%,[10] whereas a lapse in any 1 step can prove fatal.[11]

The use of evidence-based best practices in the development, implementation, and adoption of comprehen-

sive health and safety policies for HS athletics allows for proactive planning and preparation to mitigate the EHI risk. Despite the data that suggested implementing health and safety policies at the state level reduced risk,[12] examination of the compliance of local adoption of these health and safety policies at the HS level has not been comprehensive.[13–15] At the HS level, only 3.2% of athletic trainers (ATs) who reported treating a patient with suspected EHS took a rectal temperature,[16] though it is unclear if this was the AT's written policy or if it was operational but not written. Although best practices may be operational at an HS (eg, practicing the skill or best practice) and not written (eg, not inscribed in the policies and procedures handbook), it is imperative that all best practices be both operational and written. Failure to put policies and procedures in writing implies a lack of proactive consideration for managing catastrophic events such as EHS.

Why HSs are resistant to adopting and implementing EHS best practices is unclear. For emergency action plans (EAPs), access to an AT and a requirement from the school to have a policy in place appeared to be the greatest influencing factors for EAP adoption.[17–19] The most commonly reported barrier to EAP adoption was financial limitations, but this is an interesting finding given the zero cost of adopting an EAP.[17] Data related to facilitators and barriers may provide insight into influencing factors; however, these data fail to address decision-making processes. Health behavior models, such as the health belief model and the precaution adoption process model (PAPM), help researchers understand how individuals think through change.[20] For example, the health belief model has been used to identify that ATs who perceived more barriers, fewer perceived benefits, less seriousness of EHS, and less perceived susceptibility were less likely to obtain a rectal temperature.[21] However, the literature has not addressed the applicability of the PAPM to similar decision making regarding the adoption of EHS best practices.

The PAPM aims to identify one's readiness to act in adopting a behavior. Although typically for individual health decisions, the PAPM may have applicability for a clinician's decision-making process regarding adoption of the best practices to affect the health of others.[20,22,23] In the context of providing health care for those suffering from EHS, ATs directly influence the quality of care a patient will receive. Clinical decision-making tools are taught, yet the literature continues to accentuate ATs' lack of adoption of best practices in the care of patients with EHS.[13,16,18,21,24–26] The PAPM can provide a unique consideration for individual behavioral factors influencing ATs to make (or not make) these decisions. Specifically, the PAPM can identify if a person is unaware of the need for EHS management strategies (*unaware*), aware but not considering adopting EHS management strategies (*unengaged*), aware and considering adopting EHS management strategies (*undecided*), aware and decided not to adopt EHS management strategies (*decided not to act*), aware and decided to adopt EHS management strategies in the next 6 months (*decided to act*), recently adopted strategies (*acting*) or adopted strategies more than 6 months ago (*maintaining*; Table 1).[20,22] Through an increased appreciation of this process, we can create tailored interventions to one's health behavior, a technique that has demonstrated success in areas such as osteoporosis and colorectal screening.[27,28]

Table 1. Operational Definitions for the Precaution Adoption Process Model (PAPM)

Stage	Operational Definition
Unaware of need[a]	Does not know about the need for the policy
Unaware if have[a]	Does not know if their school has the policy
Unengaged	Aware of but not thinking about adopting the policy
Undecided	Aware of and considering adopting the policy
Decided not to adopt	Rejected the policy
Decided to act	Planning to adopt the policy within the next 6 mo
Acting	Follows all recommended guidelines but only within the past 6 mo
Maintaining	Continued use of the guidelines

[a] The original PAPM combines the unaware stages into simply *unaware*. For the purpose of this investigation, we acknowledge that individuals may be unaware if they have the policy or unaware of the need for the policy, thus modifying the original PAPM.

Athletic trainers were not likely to adhere to current best practices when treating a suspected case of EHS.[16,24] However, the extent to which comprehensive policies and procedures for the management of EHS are adopted by HSs is unknown. Therefore, the purpose of our study was to investigate the current adoption of policies and procedures for recognizing and treating patients with EHS. Secondarily, we aimed to assess the factors influencing the adoption of a comprehensive policy (eg, facilitators, barriers, social determinants of health).

METHODS

Using a cross-sectional questionnaire design, we evaluated the current level of EHS management strategies in HSs across the United States. A national sample of ATs was contacted to participate in this investigation in the fall of 2018 and the spring of 2019. The research study was classified as exempt by the University of Connecticut Institutional Review Board.

Participants

Athletic trainers were invited to participate via 2 methods. First, ATs who had completed the Athletic Training Locations and Services (ATLAS) project[29] were emailed invitations (fall = 3319; spring = 3187). Two e-mail reminders were sent to nonresponders at 2 and 4 weeks after the initial email distribution. In the fall of 2018 and the spring of 2019, a social media blast (Facebook, Twitter, Instagram) was released to invite ATs to participate. As with the emailed reminders, the primary author (S.E.S.M) reposted the social media blast at 2 weeks and 4 weeks after the initial post. However, it is impossible to know how often the social media blast was reshared by others and at what frequencies. Given the varied distribution rates and the unknown number of ATs who viewed the social media blast, a method used in questionnaire research, an overall response rate cannot be calculated. Responses from the emailed and social media distributions from ATs only were combined and reviewed for duplicate data (eg, completion of the questionnaire using the email link and a social media link). Duplicate data were identified when the response was from the same state, and zip code and listed the same sex and years in the profession among other variables. A

completed questionnaire consisted of (1) the AT's consent to participate, (2) the response from an AT working in the HS setting, and (3) answering of ≥80% of the items in the questionnaire. A total of 439 ATs started the survey in the fall 2018 and 439 in spring 2019; 100 and 114 responses did not meet the inclusion criteria (fall = 20, spring = 21) or did not complete ≥80% of the questionnaire (fall = 80, spring = 94) for fall and spring, respectively. This left a total of 417 complete responses for the fall 2018 and 324 for spring 2019 (total N = 741).

This study was part of a larger study aimed at observing policy change over time (fall to spring). As such, each AT was asked to provide a unique ID to anonymously match his or her responses. All matched responses (ie, ATs who took the survey at both time points) were removed from this analysis. A total of 105 individuals completed the survey in both the fall and the spring, leaving 312 unique observations in the fall and 219 in the spring (N = 531).

Questionnaire

The items in the online questionnaire were based on the NATA position statement on exertional heat illness[4] and distributed via Qualtrics (Provo, UT). Questions pertaining to demographics (age, sex, state, years in profession, years at school overall), EHS management policy, facilitators, and barriers were asked. For EHS management, ATs were asked to report their current written policies for the use of rectal temperature, having a CWI tub available within 5 minutes, the CWI setup (filled halfway with ice and water), and the use of "cool first, transport second." The questions about these policies were developed using a health behavior model, the PAPM, which can provide formidable information about the factors influencing an AT's ability to change policy.[20,23,27] The PAPM consists of 7 stages: unaware, undecided, considering, decided not to act, decided to act, acting, and maintaining.[20] For the purpose of this research, we divided the unaware stage into *unaware of the need for this policy* and *unaware if we have this policy* (Table 1). Athletic trainers were asked if their school had a written policy for preventing and treating patients with EHI (9a). An AT who selected *not adopting* for this item was not asked additional questions about policy components (eg, 9b to 9e). *Adoption* was defined as ATs who reporting acting on and maintaining a policy from the PAPM.[20] All other stages combined were defined as *not adopting*. For the facilitators and barriers questions, ATs were asked to choose all that applied regarding policies for the adoption of a rectal temperature policy and the setup and use of CWI. See the Appendix for the questionnaire.

The questionnaire was developed by the 6 authors, who are experts in the field of EHI and health behavior. To ascertain the relevance, importance, and clarity of the questions, we conducted a pilot test with 7 ATs who worked in the HS setting. Revisions of the questionnaire were based on feedback from the pilot test; 4 questions were revised for clarity.

Data Analysis

Policy data (PAPM stages and overall adoption) along with facilitators and barriers were summarized and are presented as proportions with 95% CIs. As our primary purpose was to identify the current adoption of guidelines for the recognition and treatments of patients with EHS, we aimed to evaluate the adoption of all components for a heat policy. We termed this the *comprehensive EHS management policy*, which included adoption of all 4 components.

We sought to determine if age or the number of students enrolled at the school between those with (eg, adopting) a policy and those without (eg, not adopting) differed. For the rectal temperature policy question (9b), a Welsh t test with 95% CIs was run to determine this difference due to the assumption of homogeneity of variances being violated, as assessed by the Levene test for equality of variances (age $P = .001$, students $P = .05$). For the CWI available onsite (9c), CWI setup (9d), and cool first, transport second (9e), an independent-samples t test with 95% CI was performed, as homogeneity of variances was present as assessed by the Levene test for equality of variances ($P > .05$). Finally, χ^2 tests of association were calculated between the years in the professional role (dichotomized as 0–10 years [56.4%] versus 11+ years [43.6%]) and years working in the current HS (dichotomized as 0–5 years [60.2%] and 6+ years [39.8%]). The dichotomization for professional role and years working in their current HS was based on a natural cut in the data. Statistical significance was determined as $P < .05$. All statistical analysis was carried out in SPSS (version 26; IBM Corp).

RESULTS

On average, respondents were aged 35 ± 9 years. Most of our respondents were from Texas (n = 59, 11.1%), Florida (n = 28, 5.3%), and North Carolina (n = 31, 5.8%). Overall, the majority of ATs in this sample had been working in the profession for 1 to 5 years (n = 169, 31.9%) and at their current HS for 1 to 5 years (n = 288, 54.2%).

Adoption of EHS Management Strategies

Nearly a third of ATs reported they did not have a written policy for EHS prevention or treatment (not adopting, n = 161, 30.32%, 95% CI = 26.44%, 34.43%). The most adopted policy component as cool first, transport second with 66.21% (n = 241, 95% CI = 61.10%, 71.06%) of ATs reporting acting or maintaining for this policy (Table 2). The most variability in the PAPM responses was in the question: "Does your school have a rectal temperature policy for the diagnosis of EHS?" (9b) with 28.69% (n = 103, 95% CI = 24.07%, 33.67%) of ATs reporting they decided not to act and 20.06% (n = 72, 95% CI = 16.04%, 24.58%) reporting maintaining (Table 3). When we evaluated the adoption of a comprehensive EHS management policy, 16.9% (n = 62, 95% CI = 13.20%, 21.13%) of ATs reported adopting all 4 components for the diagnosis and management of EHS (Figure). When assessing only the treatment of EHS, 47.1% (n = 173, 95% CI = 41.94%, 52.39%) reported adoption of all 3 CWI policies.

Differences in age between those with (32 ± 7 years) and those without (36 ± 10 years) a written rectal temperature policy existed ($t_{178.54} = 3.15$; 95% CI = 1.23%, 5.36%; $P = .002$). Similarly, age between those with (34 ± 9 years) and those without (37 ± 9 years) a cool first, transport second policy ($t_{359} = 2.31$; 95% CI = 0.412%, 5.044%; $P = .021$) varied. We observed no differences in AT age between those with and those without CWI available onsite ($P = .840$) or CWI setup ($P = .563$). Also, the number of students

Table 2. Proportion of Athletic Trainers Reporting Adoption of Each of the Written Policy Components by Time Point and Aggregate of Fall and Spring, % (n) [95% Confidence Interval]

Policy Component: *My school has policies and procedures on...*	Fall 2018 Time Point (n = 312)	Spring 2019 Time Point (n = 219)	Aggregate (Both Fall + Spring; n = 531)
9a. Exertional heat illness (prevention and treatment)	69.55 (217) [64.12, 74.61]	68.95 (151) [62.37, 75.01]	69.30 (368) [65.19, 73.20]
If participants answered adopting to 9a, they were shown questions 9b–9e.			
9b. Requires use of rectal temperature for diagnosis and evaluation of exertional heat illness	22.58 (49) [17.20, 28.73]	23.18 (35) [16.71, 30.73]	22.83 (84) [18.64, 27.46]
9c. Requires a cold-water immersion tub to be onsite (within 5 min of each venue)	61.29 (133) [54.46, 67.81]	64.24 (97) [56.04, 71.86]	62.50 (230) [57.33, 67.46]
9d. Requires a cold-water immersion tub to be set up (including filled with water, ice chests nearby) during warm weather activities	48.85 (106) [42.02, 55.71]	56.95 (86) [48.65, 64.97]	52.17 (192) [46.93, 57.38]
9e. Requires cooling onsite first, and then transport to the hospital (ie, "cool first, transport second")	75.12 (163) [68.81, 80.72]	72.85 (110) [65.02, 79.76]	74.18 (273) [69.39, 78.58]

did not vary between those with and those without the adoption of a rectal temperature policy ($P = .178$), CWI available onsite ($P = .489$), CWI setup ($P = .523$), or cool first, transport second (0.710). No differences between years in the profession and years in an HS with any of the policy variables were identified ($P > .05$).

Facilitators

The most commonly reported facilitators for obtaining rectal temperature were a mandate from the state HS athletics association (n = 270, 50.85%, 95% CI = 47.26%, 55.93%), state legislation (n = 270, 50.85%, 95% CI = 46.51%, 55.18%), support from someone in the authoritative position (n = 243, 45.76%, 95% CI = 41.47%, 50.11%), and seeing how others facilitate implementation of a policy (n = 228, 42.94%, 95% CI = 38.68%, 47.27%; Table 4). The most frequently described facilitators for the development of a policy to include CWI included having a medical professional (n = 273, 51.41%, 95% CI = 47.07%, 55.74%), support from someone in an authoritative position (n = 191, 46.70%, 95% CI = 42.40%, 51.05%), mandate from the state HS athletics association (n = 247, 46.54%, 95% CI = 42.21%, 50.86%), and state legislative mandate for policy (n = 209, 39.36%, 95% CI = 35.18%, 43.66%).

Barriers

The most often cited barriers for a rectal temperature policy were resistance or apprehension from parents or legal guardians (n = 311,58.57%, 95% CI = 54.25%, 62.79%), liability for using it (n = 282, 53.11%, 95% CI = 48.76%, 57.42%), resistance or apprehension from coaches (n = 228, 42.94%, 95% CI = 38.68%, 47.27%), and "I am not comfortable using a rectal thermometer" (n = 183, 34.46%, 95% CI = 30.42%, 38.68%; Table 5). The most commonly reported barriers for CWI were no barriers encountered (n = 266, 50.09%, 95% CI = 45.76%, 54.43%), financial limitations (n = 141, 26.55%, 95% CI = 22.84%, 30.53%), AT is not full time (n = 55, 10.36%, 95% CI = 7.90%, 13.27%), and resistance or apprehension from coaches (n =55, 10.36%, 95% CI = 7.90%, 13.27%).

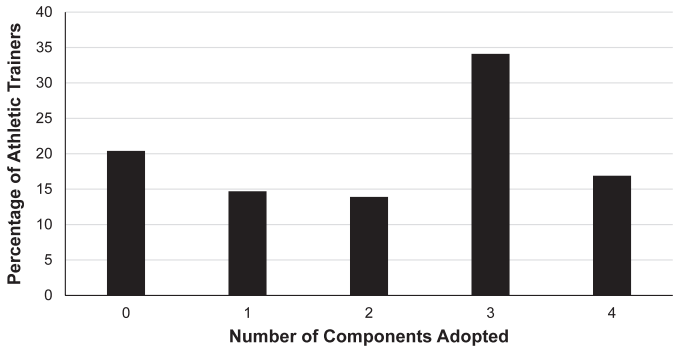

Figure. Number of exertional heat-stroke management policy components adopted (rectal temperature, cold-water immersion [CWI] available onsite, CWI set up, "cool first, transport second") as reported by athletic trainers (ATs; N = 367).

DISCUSSION

Exertional heat stroke remains 1 of the leading causes of sudden death in sport and physical activity, despite boasting a 100% survival rate when current evidence-based best practices are followed.[10] Given the concern and potentially catastrophic outcomes from EHS if best practices are not followed, we examined the compliance associated with the adoption and influencing factors of current best practices[4] in the form of written policies for the management of EHS in HS athletics. Our main findings were that 161 (44.1%) respondents did not have a written heat illness policy at the HS for which they were employed, and only 16.9% of those who did have a written policy adopted a comprehensive policy related to the diagnosis and treatment of EHS. Further, the PAPM identified the largest proportion of ATs reported deciding not to act to adopt a rectal temperature policy (28.69%), whereas a majority reported maintaining for using the cool first, transport second mantra (66.21%). Athletic trainers were most likely to endorse a mandate from either the state's HS athletics association or through state legislature as a policy facilitator. The most frequent barriers preventing the adoption of evidence-based heat policies focused on liability surrounding the management of patients with EHS, although this reasoning lacked evidence.

Despite rectal temperature being described as the current medical standard of care for the diagnosis of EHS,[4,6] only 22.83% of respondents indicated that this was included in their written policies and procedures for the management of EHS. However, nearly 1 in 3 ATs reported they decided not to act to have this policy. This finding in the present study complemented recent work by Nedimyer et al,[16] who observed that only 3.9% of ATs used this diagnostic

Table 3. Precaution Adoption Process Model Responses From Athletic Trainers Aggregated From Fall 2018 and Spring 2019 Time Points (n = 370) Within Each Policy Component, % (n) [95% CI]

Policy Component	Unaware We Needed	Unaware If We Have	Decided Not to Act	Unengaged	Undecided	Decided to Act	Acting	Maintaining
9b. Requires use of rectal temperature for diagnosis and evaluation of exertional heat illness (n = 359)	5.85 (21) [3.66, 8.80]	5.85 (21) [3.66, 8.80]	28.69 (103) [24.07, 33.67]	23.68 (85) [19.37, 28.42]	7.88 (28) [5.25, 11.07]	4.74 (17) [2.78, 7.47]	3.34 (12) [1.74, 5.77]	20.06 (72) [16.04, 24.58]
9c. Requires a cold-water immersion tub to be onsite (within 5 min of each venue; n = 364)	5.49 (20) [3.39, 8.36]	4.67 (17) [2.74, 7.37]	7.14 (26) [4.72, 10.29]	6.98 (25) [4.49, 9.97]	5.49 (20) [3.39, 8.36]	7.14 (26) [4.72, 10.29]	8.52 (31) [5.86, 11.87]	54.67 (199) [49.40, 59.87]
9d. Requires a cold-water immersion tub to be set up (including filled with water, ice chests nearby) during warm weather activities (n = 362)	5.80 (21) [3.63, 8.73]	5.52 (20) [3.41, 8.40]	9.67 (35) [6.83, 13.19]	10.50 (38) [7.54, 14.12	8.56 (31) [5.89, 11.93]	6.91 (25) [4.52, 10.03	7.18 (26) [4.75, 10.35]	45.86 (166) [40.64, 51.14]
9e. Requires cooling onsite first, and then transport to the hospital (also known as "cool first, transport second"; n = 364)	1.37 (5) [0.45, 3.18]	4.40 (16) [2.53, 7.04]	2.75 (10) [1.32, 4.99]	4.40 (16) [2.53, 7.04]	4.67 (17) [2.74, 7.37]	7.42 (27) [4.95, 10.61]	8.79 (32) [6.09, 12.18]	66.21 (241) [61.10, 71.06]

technique when examining a patient suspected of EHS. The difference between our results and those of Nedimyer et al[16] was that the latter asked clinicians to indicate if they had used rectal temperature for EHS diagnosis, whereas we asked if they had a written policy for the technique. Similarly, McLean et al[21] noted that when ATs perceived more barriers, fewer benefits, less perceived seriousness, and less perceived susceptibility, they were less likely to obtain a rectal temperature. Without accurately assessing this vital sign, health care providers are unable to appropriately differentiate EHS from other potentially life-threatening conditions (eg, exertional sickling, hypoglycemia, hyponatremia). The lack of a definitive diagnosis then limits the ability to initiate a proper and prompt course of treatment. Although the number of ATs who stated that they decided not to act may be concerning, it is unclear if they made this decision themselves (ie, the ATs decided they would not obtain rectal temperatures) or if the ATs lacked support (from the school administrator or supervisor) to include this item in the heat policy. Recently, McLean et al[21] found that 32% of ATs selected *agree* or *strongly agree* for the item indicating that the school's administration would not allow them to use rectal temperature. It is imperative for the AT, as the health care professional, to stand up for the standard of care and not allow nonmedically trained individuals to make decisions about the health care of athletes. From a legal standpoint, it is critical for the AT to make every attempt to educate others on the importance and liability regarding a clear diagnosis and treatment of a patient with EHS. Any efforts by the AT to include this policy that are met with resistance should be documented.

Adoption of evidence-based policies surrounding CWI for the treatment of EHS was greater than that for rectal temperature. Most respondents said they had a CWI tub onsite (63%), had the CWI tub setup (53%), and followed

Table 4. Facilitators to Implementation of a Rectal Temperature and Cold-Water Immersion Policy, % (n) [95% CI]

Rectal Temperature		Cold-Water Immersion	
Having medical professional(s) (ie, athletic trainer) at the school	35.78 (190) [31.70, 40.02]	Having medical professional(s) (ie, athletic trainer) at the school	51.41 (273) [47.07, 55.74]
State mandate from the high school athletics association	51.60 (274) [47.26, 55.93]	Support from someone in an authoritative position (coach, nurse, school leader, etc)	46.70 (248) [42.40, 51.05]
State legislation for mandate for policy	50.85 (270) [46.51, 55.18]	State mandate from the high school athletics association	46.54 (247) [42.21, 50.86]
Support from someone in an authoritative position (coach, nurse, school leader, etc)	45.76 (243) [41.47, 50.11]	State legislation for mandate for policy	39.36 (209) [35.18, 43.66
Seeing how other schools/programs facilitate implementing this policy	42.94 (228) [38.68, 47.27]	Seeing how other schools/programs facilitate implementing this policy	35.97 (191) [31.88, 40.22]
Education on how to perform the technique	41.05 (218) [36.84, 45.37]	Training	29.38 (156) [25.53, 33.45]
Training	39.55 (210) [35.36, 43.85]	Education on how to perform the technique	28.63 (152) [24.81, 32.68]
School stakeholders believing sport safety is important and buying into these policies	32.20 (171) [28.24, 36.36]	School stakeholders believing sport safety is important and buying into these policies	28.25 (150) [24.46, 32.29]
Model policy that can be adopted	30.13 (160) [26.25, 34.23]	Model policy that can be adopted	21.09 (112) [17.70, 24.81]
Nothing would make it easier; I will not take a rectal temperature	15.44 (82) [12.47, 18.80]	Nothing would make it easier	6.59 (35) [4.63, 9.05]
Nothing would make it easier	4.71 (25) [3.07, 6.87]		

Table 5. Barriers to Implementation of a Cold-Water Immersion and Rectal Temperature Policy, % (n) [95% CI][a]

Rectal Temperature		Cold-Water Immersion	
Resistance or apprehension from parents or legal guardians	58.57 (311) [54.25, 62.79]	No barriers encountered	50.09 (266) [45.76, 54.43]
Liability for using it	53.11 (282) [48.76, 57.42]	Financial limitations	26.55 (141) [22.84, 30.53]
Resistance or apprehension from coaches	42.94 (228) [38.68, 47.27]	Resistance or apprehension from head coaches to modify practices	10.36 (55) [7.90, 13.27]
I am not comfortable with using a rectal thermometer	34.46 (183) [30.42, 38.68]	My school's AT is not full time	10.36 (55) [7.90, 13.27]
My school would need more information, assistance, etc, in order to implement this	30.32 (161) [26.44, 34.43]	My school would need more information, assistance, etc in order to implement all of the heat modification guidelines	9.04 (48) [6.74, 11.81]
Financial limitations	19.40 (103) [16.12, 23.02]	My school does not have the time to train the coaches and school personnel on how to implement this policy	4.33 (23) [2.77, 6.43]
My school does not have the time to educate the parents or legal guardians on the reason for using this	10.92 (58) [8.40, 13.89]	It's not hot enough where I live; we have difficulty seeing the need for this	3.95 (21) [2.46, 5.98]
No barriers encountered	9.98 (53) [7.57, 12.85]	Liability	3.95 (21) [2.46, 5.98]
I am not sure how to use a rectal thermometer	8.29 (44) [6.08, 10.96]	Resistance or apprehension from parents or legal guardians to modify practices	3.58 (19) [2.17, 5.53]
My school does not have the time to educate the coaches and school personnel on the reason for using this	7.91 (42) [5.76, 10.54]	My school does not have the time to educate the parents or legal guardians on the importance of this policy	2.45 (13) [1.31, 4.15]
It's not hot enough where I live, we have difficulty seeing the need for this	7.91 (42) [5.76, 10.54]	We don't think this policy is as important as other topics	1.32 (7) [0.53, 2.70]
We don't think this policy is as important as others	6.03 (32) [4.16, 8.40]	We are located in a location that makes it difficult for EMS to get to us	0.75 (4) [0.21, 1.92]
My school's AT is not full time	4.71 (25) [3.07, 6.87]		
I am not sure when I would use a rectal thermometer	4.14 (22) [2.61, 6.21]		
My school does not have an AT	1.13 (6) [0.42, 2.44]		
We live in a location that makes it difficult for EMS to get to us	0.75 (4) [0.21, 1.92]		

Abbreviations: AT, athletic trainer; EMS, emergency medical services.

[a] Items are reproduced in their original format.

the cool first, transport second EHS treatment mantra (75%). Our results are consistent with those of Kerr et al,[14] who determined that 57.1% of ATs had an immersion tub prepared to treat patients with EHS onsite before the start of practice. Among our sample, 37% commented that they did not have a written policy for a CWI tub onsite for EHS treatment; we are unaware if they had a policy for an effective alternative body cooling method. Tarp-assisted cooling, an alternative body cooling modality that uses an impermeable tarp instead of a tub, is an effective means of rapidly cooling the body and may be a suitable option for settings where access to a tub is not feasible.[30,31]

Though small, the proportion of ATs who reported being unaware for the need for a policy (1.37% to 5.85%) or unaware if they had a policy (4.40% to 5.85%) was an interesting result. The need to obtain a rectal temperature and use CWI have been discussed in the literature and in athletic training educational programs for decades.[8,32] We found that younger ATs were more likely to have written policies in place for rectal temperature assessment and cool first, transport second than were older ATs. In 2011, the fifth edition of the *Education Competencies* was released,[33] which included updates requiring accredited athletic training programs to provide both didactic and hands-on education and training specific to the assessment of internal body temperature using rectal thermometry and treatment of EHS using CWI. These updates may have been a catalyst for the differences observed between younger and older ATs, as the younger respondents in our study may have been educated under the fifth edition of the competencies. However, we also identified no differences in the adoption of these policies based on the number of years in the profession. This information may offer a better indication of the possible influence of the AT's educational background on whether policies were adopted, mainly to evaluate the effectiveness of the change in competencies.[24–26,34] We are unable to speculate further on this, as we did not assess the extent to which these concepts were covered in each AT's educational program.

When designing interventions, it is imperative to identify what strategies or facilitators will help improve adoption. In this study, ATs cited state-level mandates, legislation, or both as positive facilitators in the adoption of EHS management policies. As state requirements have been shown to improve patient outcomes[12] and overall adoption,[14,35] this finding was not surprising. Furthermore, having the support of a person in an authoritative position (eg, athletics director, principal) assisted in ensuring that these policies were adopted locally. This result aligns with prior literature,[17] as ATs have described support from administration as a common facilitator for the adoption of EAPs. Given that athletics directors are often in charge of the logistics and operations of athletics, their support allows for comprehensive "buy in" from the other individuals involved with athletics. Although exceedingly uncommon in HSs, it may be worthwhile to evaluate the feasibility of a

Table 6. Suggested Strategies for Overcoming the Most Common Barriers to Implementing a Rectal Temperature and Cold-Water Immersion Policy Continued on Next Page

Rectal Temperature Barriers[a]	Suggested Strategies to Overcome
Resistance or apprehension from parents or legal guardians and My school does not have the time to educate the parents or legal guardians on the reason for using this	A consent-to-treat waiver signed by parents typically includes all catastrophic and noncatastrophic injury management. This waiver is often included on the preparticipation physical form. It is ineffective to assume clinicians can review each consent to treat to identify if parents agree to specific, individual management strategies. If the consent to treat has a separate section for individual emergency care procedures (eg, AED application for males and females, administration of epinephrine, etc), schools should consider describing rectal temperature on a supplemental page. Additional educational strategies may include a parent meeting, information page on a school website, and infographic distribution.
Liability for using it	The BOC, CAATE and NATA outline the professional responsibility of ATs to provide the standard of care. The current evidence-based recommendations include the use of these skills for the proper recognition and treatment of patients with EHS. The lack of a definitive diagnosis (ie, not obtaining a rectal temperature) will limit the clinician's ability to initiate a proper and prompt course of treatment. The risk of liability is greater from the failure to provide the standard of care for all injuries; injury caused by a failure to properly diagnose and treat EHS may be considered gross negligence.
Resistance or apprehension from coaches	Coaches or other nonhealth care providers should not perform rectal thermometry. Athletic trainers should aim to educate coaches on why the AT is obtaining rectal temperature and the potential consequences (eg, death, long-term disability) should a proper diagnosis not be determined.
I am not comfortable with using a rectal thermometer and I am not sure how to use a rectal thermometer	Clinicians should pursue educational opportunities to increase familiarity with this technique. These may include reaching out to local CAATE-accredited athletic training programs; attending state, district and national continuing education opportunities; and reaching out to experts in the field.
My school would need more information, assistance, etc in order to implement this and I am not sure when I would use a rectal thermometer	Review the NATA position statement on exertional heat illness (2015)[4] and the consensus statement on prehospital care of EHS (2018).[6] Seek authorization and educational templates such as those posted on the Korey Stringer Institute website (https://ksi.uconn.edu/).
Financial limitations	Rectal thermometers may be flexible thermistors or rigid instruments. Flexible thermistors often retail for up to $450. However, rigid thermometers such as those sold at local drug stores often retail for about $15. It is important to note that a rigid thermometer may have a maximum temperature (usually 106°F [41°C] or 108°F [42°C]). Clinicians may use this to confirm EHS (>40.5°C, 105°F) but need to be cognizant that the actual core temperature may be higher. Therefore, if using a rigid thermometer, recheck temperature every 5–8 minutes to confirm hyperthermia.
My school does not have the time to educate the coaches and school personnel on the reason for using this	Nonhealth care professionals should not perform this medical technique. However, it is important to ensure community "buy in." Educational strategies may include meetings, informational sessions, and infographics.
It's not hot enough where I live, we have difficulty seeing the need for this	Although the risk is higher in hotter, more humid environments, EHS can occur in any environment or locale. Athletes adapt to the environmental conditions in which they train. Thus, ATs must be prepared to treat and recognize patients with EHS if local conditions become more extreme than normal.
We don't think this policy is as important as others	One of the top 3 causes of sport-related death—sometimes in the top 2 (eg, in July and August), EHS is relative to our environment. For example, a hot day in Maine may be a comfortable day in Florida, yet the Maine athletes are at a greater risk because of the relative climate. As such, proactive planning for preventing and managing EHS should be a priority.
My school's AT is not full-time	Nonhealth care professionals should not take a rectal temperature. Athletic trainers should have written policies for when to use a rectal temperature (eg, when the AT is on scene) along with procedures for potentially identifying an EHI if a health care professional is not on scene. The EAP should outline which procedures to implement if an AT is not present.

Table 6. Continued From Previous Page

Cold-Water Immersion Barriers[a]	Suggested Strategies to Overcome
Financial limitations	Aggressive cooling can be achieved with CWI via a stock tank, kiddie pool, whirlpool, or tarp (TACO method). Booster clubs, foundations, and other sport safety organizations may be able to donate funds.
Resistance or apprehension from head coaches to modify practices and Resistance or apprehension from head coaches to modify practices	The use of CWI does not require practices to be modified. Educational efforts should be implemented to inform coaches and parents of when CWI should be used.
My school's AT is not full-time	Education on the recognition and treatment of EHS is imperative whether the AT is present or not. Annual training on how coaches can recognize heat stress, activate the EAP, and cool the athlete with CWI while waiting for EMS will assist coaches and other school staff in how to implement lifesaving steps when a health care provider is not present.
My school would need more information, assistance, etc in order to implement all of the heat modification guidelines and My school does not have the time to train the coaches and school personnel on how to implement this policy and My school does not have the time to educate the parents or legal guardians on the importance of this policy	Athletic departments should hold an annual sport safety training with all coaches and athletic staff to review important lifesaving procedures, such as CPR and AED training, EHS management, and other potentially life-threatening conditions as well as to review and rehearse the EAP. An AT (full time or part time) could be hired to assist with implementing these policies.
It's not hot enough where I live, we have difficulty seeing the need for this	Although EHS occurs most often in warmer climates, it can occur anywhere. Environmental heat is 1 risk factor; however, lack of heat acclimatization, exercise intensity, metabolic heat production and storage, and factors that impede body heat loss (eg, equipment, excess clothing) can increase the risk of EHS. Having CWI ready, particularly when more risk factors are present, can help save a life.
Liability	In treating EHS, CWI is the criterion standard. When EHS is promptly recognized and the patient is cooled aggressively via CWI, survival is 100%. A patient with EHS patient should be cooled on site before transport, especially when rectal temperature confirms the diagnosis.
We don't think this policy is as important as other topics	The successful treatment of EHS can mean the difference between life and death. Although EHS may be more prevalent in warmer climates, the risk increases whenever intrinsic and extrinsic factors that can lead to EHS exist. Having CWI readily available is the standard of care in the event of EHS.

Abbreviations: AED, automated external defibrillator; AT, athletic trainer; BOC, board of certification; CPR, cardiopulmonary resuscitation; CAATE, Commission on Accreditation of Athletic Training; CWI, cold-water immersion; EAP, emergency action plan; EHS, exertional heat stroke; NATA, National Athletic Trainers' Association; TACO, tarp-assisted cooling.

[a] Items are reproduced in their original format.

medical model in the HS setting to facilitate administrator support from an individual (eg, district medical director) with a health care background rather than one with no medical expertise.

With our findings showing that only 16.9% of ATs adopted all 4 policies for the assessment and treatment of EHS, a concerted effort must be undertaken to address this in HS athletics. The failure of ATs to adopt evidence-based policies for the assessment and treatment of patients with EHS may be related to the barriers revealed in our dataset. Potential strategies to overcome the common barriers we reported can be found in Table 6. Regarding obtaining rectal temperature, ATs primarily described resistance from parents or legal guardians (58.57%) and coaches (42.94%), potential legal liabilities for performing this diagnostic measure on minors (53.11), as well as their personal comfort level in performing this psychomotor skill (34.46%). However, to our knowledge, these are perceived barriers, and no literature indicates that coaches and parents would not support evidence-based policies that lead to survival from EHS. Although not as prevalent, barriers to the use of CWI centered on financial implications and apprehension from the coaching staff. It is important to emphasize that, as mentioned earlier with respect to coaches and parents, barriers related to financial limitations and coaches' apprehension are also not evidence based; we are aware of no published literature that supports these barriers as influencing the ability to adopt comprehensive EHS policies. The most concerning barrier was the perception of the potential legal liabilities, as these evidence-based recommendations have been in the literature for nearly 20 years and were included in athletic training education programs for more than 8 years. Given the efforts in the athletic training profession to practice evidence-based medicine, it is concerning that more ATs have not adopted best-practice recommendations. We are unaware of any instance in which an AT acting within the scope of practice and providing medical care consistent with current medical evidence was the subject of litigation.

A notable strength of this study was that it allows us to begin to better understand the current adoption of EHS management strategies in a nationally representative sample using a health behavior model. However, our investigation was not without limitations. We decided to evaluate adoption rather than implementation; therefore, we cannot infer the implementation or operation of these polices. Dunbar-Gaynor et al[36] identified differences between written and operational policies. As such, ATs in

this sample may have reported their school did not have a written policy, but they may have been performing that technique. Conversely, the AT may have indicated the presence of a written policy, but the policy may not have been in operation. Future researchers should further evaluate a school's written and operational policies and procedures via an onsite visit. Also, the ATs in this sample were asked to describe their school's written policies rather than provide their own perceptions of the written policies. As such, rather than ascertaining interpersonal health behavior, our data may have reflected the intrapersonal or organizational level of health behavior. Future authors should explore the differences in health behavior and readiness to act across the socioecological framework. With the development of tailored community-based interventions directed at one's readiness to act, we can better address individual concerns and motivations, thereby enhancing best-practices adoption.

In conclusion, many ATs were not likely to adopt all the evidence-based policies and procedures for the proper management and care of patients with EHS in the HS setting. Without having current evidence-based standards of care for EHS in place, participating student-athletes remain at risk. Further exploration of the actual implementation of EHS management strategies and facilitators and barriers is warranted to develop adaptive intervention strategies for improving patient care.

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Appendix. Questionnaire

1. Do you currently work in a secondary school?
- ○ Yes
- ○ No

2. What is your current role or position at your high school?
- ○ Principal/Headmaster
- ○ Athletic Director
- ○ Head Coach
- ○ Assistant Coach
- ○ Nurse
- ○ Athletic Trainer
- ○ Parent of a Student- Athlete
- ○ Student-Athlete

General Information

3. What is your school's five digit zip code?

4. Age: _____

5. What type of school do you work at?
- ○ Public
- ○ Private
- ○ Charter
- ○ Magnet

6. How many students are enrolled at your high school? _____

7. How many years have you served in your role at your school?
- ○ Less than 1 year
- ○ 1-5 years
- ○ 6-10 years
- ○ 11-15 years
- ○ 15 or more years

8. How many years have you worked in your profession?
- ○ Less than 1 year
- ○ 1-5 years
- ○ 6-10 years
- ○ 11-15 years
- ○ 15 or more years

9. For each component, please select the category that best describes your high school's current written policies and procedures. My school has policies and procedures on...

10. Which, if any, of the following do you foresee OR which, if any, of the following did you encounter as barriers to your school's ability to implement the requirement of a cold water immersion tub on-site, set up for the treatment of exertional heat stroke? Check all that apply.
- ○ Resistance or apprehension from head coaches to modify practices
- ○ Resistance or apprehension from parents or legal guardians to modify practices
- ○ Financial limitations
- ○ My school does not have the time to train the coaches and school personnel on how to implement this policy
- ○ My school does not have the time to educate the parents or legal guardians on the importance of this policy
- ○ My school would need more information, assistance, etc. in order to implement all of the heat modification guidelines
- ○ My school does not have an AT
- ○ My school's AT is not full-time

- ○ It's not hot enough where I live, we have difficulty seeing the need for this
- ○ We are located in a location that makes it difficult for EMS to get to us
- ○ Liability
- ○ We don't think this policy is as important as other topics
- ○ No barriers encountered
- ○ Other: _____

11. Which, if any, of the following do you foresee OR which, if any of the following did you encounter as <u>barriers</u> to your school's ability to implement utilization of <u>rectal temperature</u> for diagnosis and treatment of exertional heat stroke? <u>Check all that apply.</u>

- ○ Resistance or apprehension from coaches
- ○ Resistance or apprehension from parents or legal guardians
- ○ Financial limitations
- ○ My school does not have the time to educate the coaches and school personnel on the reason for using this
- ○ My school does not have the time to educate the parents or legal guardians on the reason for using this
- ○ My school would need more information, assistance, etc. in order to implement this
- ○ My school does not have an AT
- ○ My school's AT is not full-time
- ○ It's not hot enough where I live, we have difficulty seeing the need for this
- ○ We live in a location that makes it difficult for EMS to get to us
- ○ Liability for using it
- ○ I am not comfortable with using a rectal thermometer
- ○ I am not sure how to use a rectal thermometer
- ○ I am not sure when I would use a rectal thermometer
- ○ We don't think this policy is as important as others
- ○ No barriers encountered
- ○ Other: _____

12. Select all of the following that you feel would make it <u>easier</u> OR did make it easier to adopt a policy to use <u>cold water immersion</u> to treat exertional heat stroke.

- ○ Having medical professional(s) (i.e. athletic trainer) at the school
- ○ Support from someone in an authoritative position (coach, nurse, school leader, etc.)
- ○ Seeing how other schools/programs facilitate implementing this policy
- ○ Nothing would make it easier
- ○ State mandate from the high school athletics association
- ○ State legislation for mandate for policy
- ○ School stakeholders believing sport safety is important and buying into these policies
- ○ Education on how to perform the technique
- ○ Training
- ○ Model policy that can be adopted
- ○ Other: _____

13. Select all of the following that you feel would make it <u>easier</u> OR did make it easier to adopt a policy to use <u>rectal temperature</u> to diagnose exertional heat stroke.

- ○ Having medical professional(s) (i.e. athletic trainer) at the school
- ○ Support from someone in an authoritative position (coach, nurse, school leader, etc.)
- ○ Seeing how other schools/programs facilitate implementing this policy
- ○ Nothing would make it easier
- ○ State mandate from the high school athletics association
- ○ State legislation for mandate for policy
- ○ School stakeholders believing sport safety is important and buying into these policies
- ○ Education on how to perform the technique
- ○ Training
- ○ Model policy that can be adopted
- ○ Nothing would make it easier, I will not take a rectal temperature
- ○ Other: _____

	My high school was **not aware** we needed to have this written policy	**I do not know** if my high school has this written policy	My high school is aware of this but has **not considered** creating this written policy	My high school is aware of this and is **considering** creating this written policy	My high school is aware of this policy, but has **decided not to** have this written policy	My high school is aware of this and **planning to create** this written policy within the next 6 months	My high school created this written policy **in the past 6 months**	My high school has had this written policy **for longer than 6 months**
9a. Exertional Heat Illness (prevention and treatment)	○	○	○	○	○	○	○	O
9b. Requires use of r**ectal temperature** for diagnosis and evaluation of exertional heat illness	○	○	○	○	○	○	○	○
9c. Requires a cold-water immersion tub to be **on-site** (within 5 minutes of each venue)	○	○	○	○	○	○	○	○
9d. Requires a cold-water immersion tub **to be set up** (including: filled with water, ice chests near by) during warm weather activities	○	○	○	○	○	○	○	○
9e. Requires cooling onsite first, and then transport to the hospital (also known as "**cool first, transport second**")	○	○	○	○	○	○	○	○