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ORIGINAL RESEARCH

Promoting Best Practices Regarding Exertional Heat Stroke: A Perspective from the Team Physician

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Context: Knowing the team physician's perspective regarding the use of evidence-based practice (EBP) for treatment of exertional heat stroke (EHS) may help increase the number of athletic trainers (ATs) implementing best practices and avoiding the use of improper assessment tools and treatment methods.

Objective: To ascertain team physicians' perspectives regarding the AT's use of rectal temperature (T_{re}) and cold-water immersion (CWI) for recognition and treatment of EHS.

Design: Exploratory study using semi-structured focus groups and follow-up telephone interviews.

Setting: American College of Sports Medicine Annual meeting.

Patients or Other Participants: Thirteen family or internal medicine specialists who were currently serving as the team physician for a college/university or secondary school participated. The mean age was 44 ± 4 with 10 ± 8 years of sports medicine specific experience. Of these, 7 participated in a focus group and 5 completed a telephone interview.

Data Collection and Analysis: Data analysis included open coding procedures by a 3-member research team. Credibility was established by member checks and multiple analyst triangulations.

Results: Two major themes emerged regarding how ATs could be encouraged to use T_{re} assessment and CWI in clinical practice: 1) *pre-certification* and 2) *post-certification*. Pre-certification included two lower level themes: a) *real-life experience* and b) *skill set mandate*. The post-certification theme included one lower theme: *professional development.*

Conclusion: Physicians, in recognition of the dichotomy between best and actual practices, believe that ATs must receive both formal skill training in a structured learning environment and field experience using these methods, and remain current through annual professional development seminars and courses.

Key Words: Continuing education, best practices, exertional heat stroke

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Promoting Best Practices Regarding Exertional Heat Stroke: A Perspective from the Team Physician

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The rising number of young, seemingly healthy individuals who have died as result of sport participation has recently thrust the issue of sudden death in sports into the media spotlight. Although sudden cardiac death is the overall leading cause of death in sport, exertional heat stroke (EHS) is usually the leading cause of death during the hot and humid preseason months of July and August, as well as one of the top 3 leading causes of death in sport, regardless of the time of year.[1] While it is not always plausible to prevent sudden cardiac death, EHS is entirely treatable.[2,3]

Early detection, accurate diagnosis, and immediate rapid cooling can improve survival rates for EHS victims. Experts in thermal physiology have encouraged the use of rectal temperature (T_{re}) assessment to quickly and accurately diagnose EHS when the core body temperature rises above 105°F (40.5°C).[2-4] Once the condition has been diagnosed, cold-water immersion (CWI) is the gold standard treatment.[2-3,5] Both the National Athletic Trainers' Association (NATA)[2] and the American College of Sports Medicine (ACSM)[3] endorse the implementation of T_{re} measurements and cooling via CWI because multiple studies and systematic reviews have supported their use and efficacy.[4-7]

Despite the existing NATA and ACSM recommendations, many athletic trainers (ATs) are reluctant to implement T_{re} and CWI into their practice.[8,10] Many plausible explanations include misconceptions regarding effectiveness and cost, lack of formalized skill training, and discomfort or reduced confidence implementing both procedures.[8-9] Although most trepidations lie with the use of T_{re}, only half of all ATs utilize CWI as a cooling modality.[8] Recognizing that sudden deaths due to EHS still occur, many scholars have begun investigating the disconnect between patient care and recommended practices. Athletic training educators,[10] clinicians,[8-9] and athletic training students[11] have all identified limited educational training, practicality, liability, and limited resources as reasons why they do not utilize T_{re} and CWI.

Because ATs work closely with a team physician to provide optimal care for their athletes, it is important to understand the supervising physician's perspective when developing policies and procedures regarding this care. Hypothetically, if the team physician endorses the use of T_{re} and CWI for evaluation and treatment of EHS, the AT may be more inclined to implement those practices. Furthermore, the AT must ethically and legally follow the policies established by the team physician as they practice clinically under their supervision. Therefore, the purpose of this study was to gain team physicians' insights on how to encourage ATs to use T_{re} assessment and CWI when presented with a potential case of EHS. It was also important to ascertain whether the team physicians supported using T_{re} and CWI before determining what strategies could been implemented to help promote their use among ATs.

METHODS

In this exploratory study, we sought to understand team physicians' perspectives on EHS, including their preferred methods for assessment and treatment, as well as ways to increase compliance with the recommended practices among ATs. Qualitative methodology was chosen to build a holistic picture,[12-14] as well as gain insight into this specific phenomenon[13] and expand upon the existing literature.[8-11]

Participants

After securing IRB approval, participants were recruited purposefully using criterion sampling.[12,15] These criteria included: 1) being a team physician currently working with athletes and serving as the "team physician" for a college, university, or secondary school; 2) having at least 3 years of full-time work experience beyond their medical residency; and 3) possessing either a family medicine or internal medicine specialization. In total, 13 physicians (10 male, 3 female) with a mean age of 44 ± 4 with 10 ± 8 years of sports medicine specific experience were recruited. Participants represented 11 states and 6 NATA districts, and supported the use, practicality, and the need for T_{re} and CWI when evaluating and treating a case of EHS. Table 1 summarizes the individual data using participant pseudonyms.

Procedures

Two weeks prior to the 57th ACSM Annual Meeting in 2010, a recruitment letter was posted on the American Medical Society of Sports Medicine (AMSSM) listserv, (the national organization body for team physicians). Potential participants were also referred by other participants and team physicians acquainted with the researchers. In total, 9 participants were recruited from the AMSSM list serve and 4 through referrals. All participants completed a demographic sheet, informed consent form, and a brief survey prior to data collection sessions.

Instrument

Participants completed a brief background questionnaire that collected basic demographic characteristics (eg, age, gender, years of experience), educational background, and prior experiences with EHS. The semi-structured interview guide included 10 open-ended questions regarding the physicians' clinical practice expectations for EHS, their perceptions of T_{re} and CWI, and their opinions on ways to increase use of these practices by ATs.

Both documents were developed by a group of researchers that included athletic training educators (n=2) with previous research experience with qualitative methods and EHS and graduate students (n=3) in athletic training. Two team physicians each with 15 years of clinical practice experience reviewed the background questionnaire and interview guide for clarity, interpretability, and flow prior to data collection. Only minor grammatical changes were made based upon the physicians' reviews.

Table 1. Participant Background

Pseudonym	M/F	Age	State	Yrs. Board Certified	Yrs. Specializing in Sports Medicine	Setting	Credentials
Nick	M	38	TN	10 yrs.	10 yrs.	College D1	CAQ Sports Med.
Derek	M	52	AL	22 yrs.	21 yrs.	College, high school, recreational	N/A
Bud	M	46	MI	12 yrs.	12 yrs.	Professional, college, high school	ATC, CAQ Sports Med.
Colby	M	39	PA	7 yrs.	6 yrs.	High School	N/A
Keri	F	35	MA	7 yrs.	6 yrs.	College D1	CAQ Sports Med.
Kane	M	46	NC	10 yrs.	6 yrs.	Military	CAQ Sports Med.
Tate	M	41	IN	13 yrs.	12 yrs.	College, Olympic, HS	CSCS, FACSM
Clark	M	44	TX	3.5 yrs.	3 yrs.	NASA astronauts, marathon participants	N/A
Andrew	M	63	MN	33 yrs.	23 yrs.	College, high school	CAQ Sports Med.
Will	M	50	NC	20 yrs.	15 yrs.	College	CAQ Sports Med.
Danny	M	43	MD	15 yrs.	11 yrs.	College, military	N/A
Brooke	F	37	WI	7 yrs.	2 yrs.	College, high school	MPH
Ceci	F	42	MA	12 yrs.	3 yrs.	College	N/A
Summary	10 Males 3 Females	44±4	11 States	13±9	10±8		

Data Collection

The interview sessions followed a semi-structured format to allow the researchers to ask follow up questions for a more elaborate response or to add further insights not initially established at the outset of the study. The researchers purposefully selected 2 separate methods for data collection: focus groups and telephone interviews. This was done to ascertain credibility of the findings through multiple-analyst triangulation, as well as to take advantage of each methods' strengths as a form of data collection.[12,15] All interview sessions were recorded digitally and transcribed verbatim for subsequent data analysis.

Two members of the research team were present during each interview session, with one member serving as the moderator and the other as a field note-taker. The moderator, in this case, was both an AT and an experienced qualitative researcher with more than 7 years of experience with qualitative methodology. The inclusion of field notes was purposeful, as they helped capture the interview environment,[12] record commonalities that emerged during the discussions, and added rigor to the data analysis by confirming or refuting themes that were derived from the transcribed data.[12,15-16]

Three focus groups with at least two participants each (n=7) were conducted at the ACSM meeting. This small number was chosen to be manageable, allow the participants to feel at ease, increase the likelihood of discussion, and retain their interest. Each focus group lasted approximately 45 minutes. Six individual telephone interviews were completed after the ACSM meeting, each lasting approximately 30 minutes.

Establishing Credibility

Participant checks, peer review, multiple analyst triangulation, and methodological triangulation were used to establish data credibility and dependability. After transcription, each participant had an opportunity to review the transcripts from their focus group or telephone interview and make any changes, if necessary, to ensure accuracy in the transcription process. A peer debriefer, a researcher with previous experience in both the content of the research project and focus group methodology, was also used to review the data collection procedures, data management, and the data analysis process to ensure a systematic approach was maintained throughout the process.[12] Multiple-analyst triangulation[15] was used during the data analysis phase to add rigor to the research and enhance the trustworthiness of the emergent themes. Multiple-analyst triangulation included a four-member research team (three researchers and a peer debriefer) who independently evaluated the data using open coding and content analysis procedures. Finally, credibility was established using methodological triangulation.

Data Analysis

Interview transcripts were analyzed inductively, borrowing from the grounded theory model described by Strauss and Corbin[17-18] and other researchers.[12,16] Initial analysis involved open coding, where single sentences or thoughts related to the research purpose were identified. These conceptual categories emerged from the transcripts, and were continually updated, organized, and combined when necessary through axial coding. Next, the resulting categories were explored for key themes using selective

coding. Upon completion of these steps, the researchers compared notes and negotiated to reach agreement on the resulting terminology of both the categories and themes. The final step, as previously mentioned, involved sharing the results with the peer debriefer. All research team members agreed on the final theme presentation.

RESULTS

The overall goal of this study was to determine how to encourage ATs to utilize best practices for EHS from the perspective of the sports medicine physician. Two major themes materialized from the data: 1) *pre-certification* and 2) *post-certification*. The pre-certification theme was supported by two sub-themes, including: a) *skill set mandate* and b) *real-life experience*, while the second theme was illustrated by one sub-theme: *professional development*. Figure 1 provides an illustration of the findings related to both themes. Each theme is supported below with participant quotations. Pseudonyms were used to protect the participants' identities.

Pre-Certification

The central theme of *pre-certification* references the physicians' opinion that students currently enrolled in athletic training degree programs should be mandated by educational governing bodies to receive formal training in the best practices for EHS, which includes both T_{re} and CWI. Danny stated, "right now, it is the best professional practice out there, and to not teach people, that is not right [in my opinion]." Brooke's comments were comparable to Danny's, saying, "I'd say they [T_{re} and CWI] should be mandated if there's compelling evidence known that that should be the standard of care." Andrew explained that the training of an AT needs to parallel the training of a physician. He stated,

> *Mandate this [T_{re}, CWI] as part of their training. They work some event where it happens so they can observe a physician doing this. If you observe someone do it, then it's not that difficult to see one and do one, would be my opinion at least on T_{re} because that's how we did it in residency or as medical students.*

Ceci agreed with the need to mandate T_{re} and CWI in athletic training education,

> *Yes I think it should be part of the clinical education that everyone knows how to take the T_{re} and that is the standard of care. It should be implemented that that is the standard of care and you should have that available onsite in case of an [exertional] heat stroke.*

Nick summed it up simply,

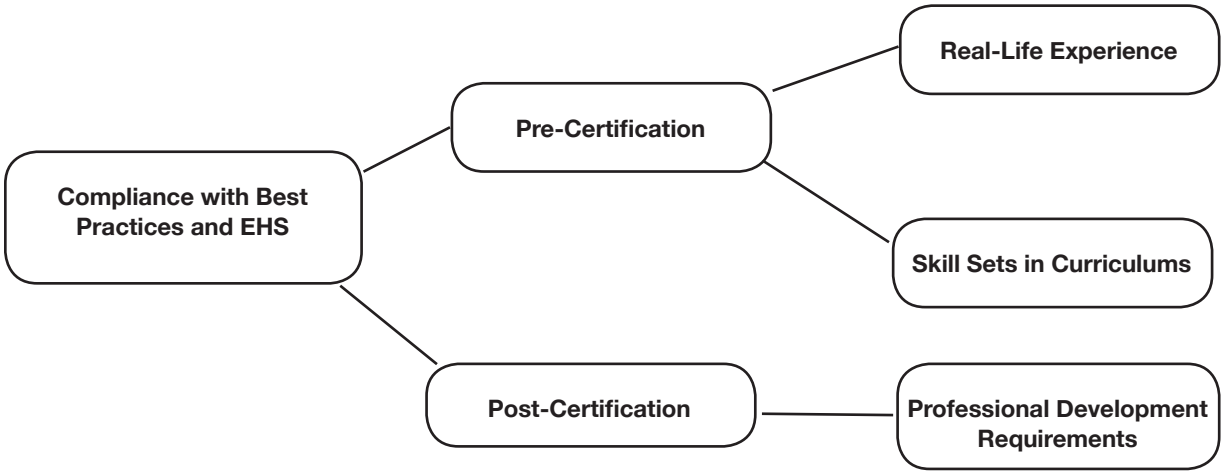
> *I think it is education. That it is considered the best on-site resources for measuring the accurate core temperature as well as to ensure rapid cooling. I think a lot of it has to do with just education [we need to educate future professionals].*

The physicians were in agreement, that in order to encourage the use of these practices, ATs' educational training needed to incorporate the skills into the curriculum, as well as provide authentic experiences, to make the condition seem real.

Pre-Certification: Skill set mandate

The participants all expressed their belief that ATs should be educated on T_{re} and CWI skills in the athletic training curriculum, as they are the best practices for diagnosis and treatment of EHS. The participants described their training in the skill during medical

Figure 1. Sports Medicine Team Physician's Suggestions for Endorsing Rectal Temperature and Cold-Water Immersion among ATs



school, and stated that the preparation of an athletic training student could be similar. Keri stated, "You could describe it [T_{re} assessment] and they could see me do it twice. With a little bit of instruction and observation, it's done."

Tate stated,

> *I would mandate it, in a perfect world, if we could make a policy right now, right here. You need to incorporate into the curriculum [for the AT]. Make it part of the certification process.*

Danny, in a separate individual interview, echoed Tate's thoughts, "I think education is the first thing." Rob, in the same focus group as Tate, offered this thought, "Mandate it as part of their training, by having them observe a physician completing the task." Kane mentioned,

> *To me, that's the only way you're going to get it [mandate being trained in the skills] because everybody has to do it. You need to do it [learn the skills] in a safe environment, and I would recommend it for the athletic training school. Be more like the medical school set-up. You start off on a model [anatomical replica], get some confidence, and then you go onto a real patient with confidence…You're getting comfortable with practice.'*

Tate had similar sentiments as Kane saying,

> *You incorporate it into the athletic training curriculum. Mandatory on assessment, which includes, how to insert their own rectal thermometer device into a patient, by using a fake butt [anatomical replica].*

Tate went on to discuss the importance of accountability for the student or future medical provider,

> *Make it part of when they take the certification exam. Make it part of their practicum [on the exam]. If they know they have to possibly put it in, they're probably going to practice if they know it's part of their test.*

The recommendation for the educational preparation of the athletic training professional, from the perspective of the team physician, was to include the skills in the curriculums to ensure clinical competency.

Pre-Certification: Real-life experience

Throughout the interviews, it was clear that participants firmly believed that real-life experience, and not laboratory-based training, should be required as part of an AT's education. Many discussed the importance of observing the use of T_{re} and CWI as a means to promote use and comfort with the devices. For example, the physicians felt that exposure to the devices' implementation in real-time would send the message that they are easy and practical to use.

Andrew suggested,

> *If you observe someone do it, it's not that difficult to see one [being performed]. My opinion would be, in at least in regards to T_{re}, would be to have everyone observe how it is done. That is how we did it in residency and as medical students.*

Many suggested that events like marathons would allow the student to observe a physician performing the skill correctly. The participants further paralleled their experiences during sports medicine fellowship training to what should be required of an athletic training professional, including working triage at a mass medical event. Brooke reflected, "as part of our fellowship, we are required to cover several mass medical tents." Amy, also recounted her fellowship experiences, "I did some marathon coverage, which was when the implementation of T_{re} and CWI were most applicable." Overall, observing these practices as used in real-time appeared to be the most significant factor for appreciating their purpose and effectiveness.

Most physicians agreed that ATs need to be educated in the proper use of T_{re} and CWI to encourage best practice, but agree that lack of awareness of or exposure to T_{re} and CWI were reasons why they felt their staff ATs were apprehensive to utilize them to recognize and treat EHS. Clark explained,

> *I get the feeling that my ATs haven't been prepared for dealing with this [EHS and T_{re} and CWI] and they're not ready to throw people in the tub and take responsibility [for using T_{re}]. [To me] it is a lack of exposure and lack of the experience [with the condition].*

Tate agreed with a lack of exposure as precipitating the avoidance of the use of T_{re} and CWI by ATs, and added onto Clark's thoughts during the focus group by saying,

> *Show them [the student or AT] what someone dying with heat stroke looks like. Show them a rectal thermometer [assessment], teach them how to do it, and if all else fails, [educate them to] throw them [a person with EHS] in a tub of water.*

Amy, too, believed that the only way to increase adherence to best practices regarding EHS and T_{re} was to provide exposure to real-life implementation of those skills sets. She stated, "Doing a mass medical tent [the athletic training student]. Because, basically, they could see me do it." Nick truly believed that education was the key to using the devices saying, "I think it has a lot to do with education. I think there are a lot of providers [ATs and EMTs] that don't recognize that CWI cools most rapidly, and they don't understand how simple it really is to do."

Real-life experiences appeared to be a common thread to provide the sports medicine physician with the competence and confidence to utilize T_{re} and CWI when appropriate in the case of EHS, and in their opinion, can be paralleled in athletic training preparation.

Post-Certification

The physicians were acutely aware that current AT professionals might have not have received the training necessary to implement currently established best practices or feel comfortable with T_{re} or CWI. A common point of discussion among the participants included the discomfort that ATs have in using T_{re}, which was

rooted in a lack of educational training. The physicians also recognized that the ATs at their universities, despite knowledge of best practices, are uncomfortable with performing the skill.

Keri stated,

> *People are 'squirrely' about using T_{re}…I can tell you at my institution, they know they are supposed to use T_{re} but they don't want to [for comfort reasons].*

Despite previous formal training, the physicians felt it was important for practicing clinicians to receive formal training, perhaps through professional development courses or continuing education units.

Post-Certification: Professional development

The participants expressed the need for ATs to continue their education on exertional heat injuries beyond initial certification through mandated continuing education units (CEU) designed to create proficiency in the proposed skills.

Bud said,

> *As physicians, we have ongoing education…It's updating and you show evidence that you are proficient in what you need to do. I think that's probably the only way you're going to catch those individuals up with what's new in the field.*

Examples of ways ATs could be educated on heat stroke best practices include NATA workshops, district or state meetings, or annual review and practice of emergency protocols. Bud indicated while it is important to go conferences, there needs to be a way to recertify online post-conference. He stated,

> *You have to do some sort of CME [CEU] type activity that updates you on whatever area that that's most pertinent in your area...Documentation that you're keeping up to date with those skills that you don't use very often.*

Many of the participants recommended using the "heads of leadership," such as the NATA, state legislations, and school boards, to mandate and implement an organized system to ensure knowledge of and proficiency in current evidence based evaluation tools and treatment protocols.

DISCUSSION

Despite overwhelming evidence that EHS can be successfully treated, death is a possible outcome if it's not accurately diagnosed and properly treated. Existing literature identifies ATs as one type of medical professional who is often the first to respond to EHS.[8,9] Unfortunately, knowledge of best practices does not always equate to implementation in the clinical practice, predominately due to a lack of training[8-9] and preconceived barriers.[8,9] The goal of this study was to ascertain team physicians' perspectives about how they could encourage ATs to implement evidence based practice (EBP) with EHS. Our results indicated that physicians recognize that strategies must be in place to promote the use of best practices among ATs, but that lack of educational preparation was a significant roadblock.[9-11]

Pre-certification

Several participants acknowledged, as previously reported in the literature,[9,10] that many ATs are ill-prepared to use T_{re} due to a lack of formalized training and field exposure. They unanimously agreed that, like themselves, ATs must receive formal instruction to use best practices as part of their ethical and legal duty.[19] Therefore, the most logical step is to incorporate T_{re} and CWI skills into the educational competencies[24], which will become mandatory for accredited AT education programs beginning fall of 2012. Their inclusion is in direct response to a research study's[10] recommendations to increase the use of T_{re} and CWI, and is an important first step toward improving ATs' competence in diagnosing and treating EHS.

Despite their addition to the new educational competencies, individual program compliance cannot be fully ensured. For example, discussions among many AT professionals and educators at the 2011 NATA Educators' Conference revealed the continued apprehension regarding the use of and need for a $T_{re.}$ During the conference, some educators were so bold as to say that they would refuse to teach the skill to their students. Moreover, the literature[8,9] shows that many ATs, some of whom serve as clinical instructors, do not follow the NATA recommendations[2] for best practice, thereby reducing the likelihood that a student would have an opportunity to implement these skills in a real-time setting.

Since AT educators tend to favor traditional lecture techniques on EHS treatment[10] rather than give students laboratory time to practice using CWI and a T_{re} device,[10,11] many team physicians also supported adding mandatory experiences, similar to their sports medicine fellowships, to the clinical education component of the AT curriculum[20] to encourage eventual implementation into clinical practice.[8,9] The literature demonstrates that interactive learning has a more positive influence on physician education than lectures and presentations;[22,23] therefore, it has been suggested by this group of team physicians, as well as in anecdotal reports, that AT education curriculums should follow the medical school model and capitalize on the benefits of problem-based learning (PBL). Medical schools have used PBL for 40 years to promote knowledge application and provide realism to skill acquisition. In several published reports,[21-23] PBL has proven to be a more advanced method of instruction allowing the medical student to demonstrate knowledge application and perform better in the clinical environment, compared to other traditional modes of learning. Other methods of instruction, which can capture a more realistic approach to learning, include simulations, case study reviews, and hands-on, structured laboratory sessions.

The most easily implemented suggestion made by the team physicians was for students to have an authentic experience regarding the evaluation and treatment of EHS by attending a mass medical tent, such as at a marathon event. Logistically, most marathons occur during the months of September, October, November, April, and May, which align well with most academic calendars. Some athletic training education programs currently capitalize on this learning opportunity by participating at large events, such as the Marine Corps, Chicago, New York City, and Boston Marathons. And although the students may not have an opportunity to use the skills themselves, they would be able to observe them being used effectively and practically by other medical professionals.

Post-Certification: Professional Development

As discovered by Mazerolle and collegagues,[8-10] ATs have a sound knowledge base regarding appropriate diagnosis and treatment of EHS, and recognize T_{re} and CWI as the most accurate tools to use.[9-11] However, many ATs would hesitate to use these methods due to lack of training. The team physicians in this study agreed with the literature[8-11] that ATs are not confident or proficient with the skills due to their lack of educational training and limited exposure to actual cases of EHS. To address the dynamic nature of medicine, many of the team physicians suggested using professional development criteria, similar to the continuing education training required CPR. A similar course in EHS and T_{re} could easily be included as a specific continuing education (CE) requirement to maintain certification.

Although both formal and informal types of CE activities can greatly improve professional practice, ATs usually attend informal events more frequently, despite the fact that CE credit is not awarded.[25] And while these informal opportunities are perceived to improve clinical skills and abilities for patient care,[25] the most successful CE activities include live presentations and workshops, personalized practice audits, and interactive computer programs.[21] Since CE activities are not always meant to change behavior, but rather to reinforce correct practice methods that already exist,[23] perhaps the team physician can help improve ATs' T_{re} and CWI skills by hosting impromptu training sessions or integrating them into the annual EAP rehearsal. Similarly, modeling of behaviors and practices by clinical instructors has been shown to promote AT student learning;[26] therefore, it is plausible to assume that, if the team physician models this behavior and provides informal learning opportunities for the AT, the skills will be implemented appropriately.

Conclusions

EHS, despite its strong prognosis for recovery, continues to be one of the top three causes of sudden death in sport. Unfortunately, while knowing the signs and symptoms of EHS, ATs often fail to use current best practices to diagnose and treat the condition. Purposeful education is critical to improving their confidence and the likelihood that they'll implement the NATA recommendations in practice.[2] According to team physicians, this can be accomplished by real time exposure and continued professional development. Therefore, athletic training education programs should be encouraged to find ways to provide both structured hands-on learning opportunities and authentic experiences to build student confidence and competence. While this could include the use of anatomical models and scholarly publications to enrich the on-campus learning environment, integrating the team physician into practical labs and using experiential opportunities at mass medical events could also serve as great teaching tools.

Limitations and Future Research

Because the participants of this study were board certified family physicians who also completed a sports medicine fellowship and were currently serving as a team physician in the military, a secondary school, or a collegiate setting, the results cannot be generalized. Since many team physicians at the secondary level may not have the sports medicine credential, future studies should examine their familiarity with EHS and their practice beliefs surrounding its assessment and treatment. While this sample size was purposefully small, future studies should survey a larger, more diverse group of team physicians to evaluate and improve the solutions given by this cohort to change the culture among the AT professionals and their use of EBP and EHS. Finally, emergency room physicians and emergency response personnel (EMTs and paramedics) play an integral part in the initial and/or continuing treatment of an EHS victim; understanding their perspectives may also be beneficial.

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