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original research

The Secondary School Football Coach's Relationship With the Athletic Trainer and Perspectives on Exertional Heat Stroke

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Context: Prior researchers have examined the first-aid knowledge and decision making among high school coaches, but little is known about their perceived knowledge of exertional heat stroke (EHS) or their relationships with an athletic trainer (AT).

Objective: To examine secondary school football coaches' perceived knowledge of EHS and their professional relationship with an AT.

Design: Qualitative study.

Setting: Web-based management system.

Patients or Other Participants: Thirty-eight secondary school head football coaches (37 men, 1 woman) participated in this study. Their average age was 47 ± 10 years old, and they had 12 ± 9 years' experience as a head football coach.

Data Collection and Analysis: Participants responded to a series of online questions that were focused on their perceived knowledge of EHS and professional relationships with ATs. Data credibility was established through multiple-analyst triangulation and peer review. We analyzed the data by borrowing from the principles of a general inductive approach.

Results: Two dominant themes emerged from the data: perceived *self-confidence of the secondary school coach* and the *influence of the AT*. The first theme highlighted the perceived confidence, due to basic emergency care training, of the coach regarding management of an emergency situation, despite a lack of knowledge. The second theme illustrated the secondary school coach's positive professional relationships with ATs regarding patient care and emergency procedures. Of the coaches who participated, 89% (34 out of 38) indicated positive interactions with their ATs.

Conclusions: These secondary school coaches were unaware of the potential causes of EHS or the symptoms associated with EHS, and they had higher perceived levels of self-confidence in management abilities than indicated by their perceived knowledge level. The secondary school football coaches valued and understood the role of the AT regarding patient and emergency care.

Key Words: sudden death in sport, emergency care, heat injuries, coach's knowledge

Key Points

- Because of the limited knowledge of secondary school head football coaches related to the management and care of exertional heat stroke, state high school athletic associations should require all coaches to undergo continuing education on the recognition and management of emergency situations in sport.
- To ensure the safety of secondary school student–athletes, school administrators are encouraged to employ the services of an athletic trainer.

Sudden death in sport continues to be a concern for the secondary school athlete and athletic trainer (AT), as evident by the number of deaths reported during the fall 2011.[1] Cardiac conditions, exertional sickling, and exertional heat stroke (EHS) were the most commonly reported causes of these sport-related deaths. Data regarding sudden death indicate the most common causes, in order, are cardiac death, traumatic head injuries, EHS, exertional sickling, and hyponatremia.[2,3] Advancements including screening instruments, rule changes, and guidelines for participation and activity modifications have helped to reduce and prevent sudden death in sport.

Death from EHS is preventable when proper precautions are taken during training and conditioning. Educating athletes, coaches, and parents on the importance of proper hydration during activity and implementing an appropriate heat-acclimatization period during training are some examples of ways EHS deaths can be prevented.[4] From July 21 through August 15, 2011, 17 deaths occurred during participation in sport and physical activity. Of those 17, 7 have been either confirmed or speculated to be the result of EHS.[1] There have been 13 deaths from EHS in the past 2 years alone, which is on pace to surpass the number of EHS deaths during the 5-year block from 2005 to 2009, during which 18 EHS deaths were recorded.[3] Exertional heat stroke can occur regardless of the time of year but often spikes during the preseason conditioning months, especially July and August.[5]

Precautions for minimizing sudden death due to EHS consist of appropriate management and treatment, includ-

ing but not limited to properly trained medical personnel, such as an AT available onsite. Colleges and universities provide health care services to their athletes in the form of athletic training services; however, most secondary school athletes do not benefit from the same consistent onsite medical care that collegiate athletes receive. Fewer than 45% of high schools in the United States employ an AT,[6] potentially leaving the care in the hands of the coach, parent, or bystander.

Lack of proper medical coverage has played a role in some recent EHS deaths. In August 2010, Tyler Davenport, a junior football player from Arkansas, collapsed during practice after suffering EHS. He later died due to complications resulting from the EHS he suffered. Unfortunately, as has happened with other secondary school-aged athletes who have died from EHS, the coaching staff, despite the onset of symptoms and subsequent collapse, did not cool Tyler immediately. In addition, no AT was present to diagnose and begin immediate treatment before the arrival of emergency personnel (D. J. Casa, unpublished data, 2011). Another case highlighting the role of the coach in preventing sudden death in sport involved Max Gilpin, who, similar to Tyler, died of EHS during football practice. Medical reports state that, on the day of Max's death, the head football coach had the team run condition drills in full gear without water breaks for 45 minutes. At the time of Max's EHS, no medical staff was present to monitor practice, diagnose his condition, or implement appropriate treatment. Max's case was the first in United States history in which a coach was prosecuted in criminal court for his role in a player's death (D. J. Casa, unpublished data, 2011).

Despite the recommendations of the National Athletic Trainers' Association regarding appropriate medical coverage for the secondary school,[7] many schools fail to provide medical coverage. In lieu of having an AT employed at every secondary school, some states have opted to implement policies placing care in the hands of the coach,[8] as is the case in the state of Kentucky. This policy change was influenced by the Max Gilpin case and requires coaches to receive advanced sports medicine training to help minimize the occurrence of sudden death.[8] Currently, there are no national regulations regarding coaching certifications, and many states have adopted their own regulations regarding requirements for initial certification as well as maintenance of the coaching credential. Some states require that all coaches receive training in cardiopulmonary resuscitation (CPR), use of the automated external defibrillator, and first aid as a means to address emergency care procedures, whereas other states have no mandates regarding basic emergency care training. According to the National Federation of State High Schools,[9] only 37 states require that coaches obtain basic first-aid training to be eligible to coach. Only 14 of those 37 states require coaches to obtain CPR and automated external defibrillation training in addition to basic first aid.[9] However, the curriculum in these 37 states often centers on more basic concepts rather than on causes, signs and symptoms, and treatment of emergency situations such as EHS and concussions, for example. Additionally, these sessions are often conducted in 1 day of training, during which a coach is expected to retain and put into practice what would take an AT years to master. This training most likely leaves coaches unprepared to handle an emergency situation because they do not have the proper knowledge or training.[8,9]

The impetus for this study stemmed from the realization that the secondary school coach plays a significant role in preventing sudden death in sport, especially EHS. Because many secondary schools continue to rely on their coaches to protect the safety of their players, it is important to understand secondary school coaches' current perceptions of and knowledge related to EHS. Evidence of the reliance on the coach as an emergency care provider and determinant in the student–athlete's well-being is the number of lawsuits filed against coaches. Within the last 5 years, several coaches have been prosecuted under both criminal and civil law for their negligent roles in failing to follow safety guidelines or take precautions related to preventing sudden death in sport. Many of the cases of sudden death in sport have involved EHS or exertional sickling during conditioning sessions or preseason practices, when an AT may not have been present to provide medical care. This may indicate a limited understanding by the coach regarding the causes of sudden death, signs and symptoms of those conditions, and effective prevention measures. Due to the limited data regarding the knowledge of the secondary school head football coach as it relates to the recognition and prevention of EHS, our goal was to gain coaches' perspectives on this matter.

Athletic trainers and coaches are both integral members of the sports medicine team and, despite different roles and training, must be able to work together to help protect the health and safety of the student–athlete. We also paid particular attention to the coaches' relationships with ATs. The limited research that exists regarding the professional relationship between the 2 indicates that communication is essential; however, coaches lack a complete understanding of the role and training of the AT.[10] Moreover, the presence of an AT within the secondary school setting appears to provide the secondary school coach with a reason to not maintain skills and knowledge regarding emergency care procedures.[11–17] Therefore, the purpose of this study was to examine secondary school football coaches' perceived knowledge of EHS as well as the professional relationship that exists between them and ATs.

METHODS

In this investigative research study, we used a mixed-methods sequential design to evaluate the study's purpose. Selection of a mixed-methods approach allowed us to draw upon the salient strengths of each research paradigm. We gathered descriptive data through close-ended questions, which permitted us to quantify the relationships and experiences of the secondary school coaches. Asynchronous online interviewing allowed us to gather contextual data regarding the perceived knowledge of the coaches as well as their experiences with EHS.[18,19] Interviewing, particularly online journaling, is emerging as an important data-collection tool because it supports confidentiality and anonymity, provides access to a regionally diverse group of participants, and offers time to reflect and process the question posed before responding.[19,20]

Participants

Participant Sampling. We purposefully recruited participants with professional experience as head football coaches in the secondary school setting using a criterion-sampling procedure.[21] For this study, the primary inclusion criterion was fulfilling the position of head football coach at the secondary school level. In addition, a conscious effort was made to recruit participants based upon (1) region: northern and southern regions of the country, which was established using the Mason–Dixon line; and (2) years of experience: novice coach (0 to 10 years) or experienced coach (more than 10 years).

Participants. Thirty-eight participants were recruited with a near equal distribution between region (21 coaches from the north and 17 coaches from the south) and years of experience (22 novice coaches and 16 experienced coaches). We relied upon data redundancy to guide participant recruitment.[19] The average age of the participants was 47 ± 10 years of age. The average number of years' experience as a head football coach at the secondary school level was 12 ± 9 years. A summary of demographic data is provided in Table 1.

Table 1. Demographics of Participating Secondary School Head Football Coaches

Participants	Number
Men	37
Women	1
Degree	
Associate's	1
Bachelor's	8
Master's	28
PhD	0
EdD	0
Other	1
States represented	
North	
Connecticut	3
Delaware	1
Illinois	1
Michigan	1
Minnesota	3
New Hampshire	3
Ohio	2
Wisconsin	7
South	
Alabama	1
Florida	1
Georgia	1
Kentucky	2
Louisiana	1
Missouri	1
North Carolina	3
South Carolina	1
Tennessee	1
Texas	5
Medical coverage	
Full-time AT	17
Part-time AT	17
EMT/EMS	10[a]
Nurse	0
Non-medical	0
Other	4

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

[a] Number indicates dual coverage at some events.

Data-Collection Procedures

Once institutional review board approval was gained, potential participants were initially recruited at the 2011 American Football Coaches Association annual meeting held in Dallas, Texas, using an informational sheet that contained the study's purpose and collection procedures. Contact information was collected at the meeting, and e-mails were sent to those who indicated interest. In addition, we randomly selected secondary schools from each state's interscholastic athletic association Web site and retrieved contact information for the head football coach at each school. Potential participants were recruited via e-mail; contained in the e-mail was the invitation letter (the same used at the conference) and a link to complete the online, open-ended interview questions. All participants who received invitation e-mails were sent reminder e-mails at 1 and 2 weeks after the initial invitation e-mail.

Participants were directed to the interview questions via e-mail, and completed responses were stored on the Zoomerang Web site (http://www.zoomerang.com/). The online interview was split into 3 phases: (1) open-ended questions, which required journaling responses; (2) demographic and background questions including age, coaching experience, and other factors to describe the coach; and (3) closed-ended questions, which addressed EHS symptoms, and Likert-scale questions regarding his or her relationship with an AT. In total, the participants responded to 39 questions.

Instrumentation

Open-Ended Questions. The open-ended questions asked about the coach's experience dealing with emergency situations, recognition and prevention of EHS, knowledge of the role of an AT, and relationship with an AT. Questions explored the coach's preparedness and experiences with emergency situations, recognition, treatment, and prevention of EHS, along with his or her professional relationship with and knowledge of an AT's qualifications. The full list of open-ended questions is shown in Table 2.

Demographic Information. The demographic questions asked about the participant's experience as a head football coach in the secondary school setting, level of education, and the type of medical coverage at the secondary school in which he or she was employed. Embedded within the demographic and background questions was a list of signs and symptoms of EHS; coaches were asked to select which ones they would look for in a suspected case of EHS.

Closed-Ended Questions. A Likert scale was used as a descriptor to quantitatively assess the professional relationship the coach had with an AT. A 10-point scale (1 indicating *not* or *lacking* to 10 indicating *very*) was used to assess 7 attributes associated with a positive relationship: *cooperativeness*, *professionalism*, *helpfulness*, *honesty*, *respectfulness*, *informative*, and *communicative*. We developed the Likert scale by borrowing from the findings of Mensch et al[10] to help provide credibility to

Table 2. Online Interview: Open-Ended Questions[a]

1. Do you feel qualified and prepared to handle an emergency situation such as exertional heat stroke or cardiac arrest?
   1a. Do you feel you should gain training in emergency care procedures?
2. What strategies, if any, do you implement into your practices to prevent exertional heat stroke?
   2a. Does your school have an emergency action plan spelling out what to do in the case of an athlete suffering from exertional heat stroke or other emergency situations?
3. There has been a lot of attention placed upon the role of the coach, especially following the case of Max Gilpin (Kentucky). Do you believe the coach has a role in preventing sudden death in sport?
   3a. What is your opinion of the case, if you are aware of it?
   3b. How realistic do you feel a case of sudden death is for your team?
4. What environmental conditions would lead you to alter practice and/or games?
   4a. Please explain how you would alter your schedule in accordance with the environmental conditions you just listed
   4b. Are there any environmental conditions that are cause for concern in the state in which you coach? If so, please explain how you prepare for the possible issues that can arise because of the conditions
5. Have you ever had a case of an athlete suffering from exertional heat stroke? If so, please describe the situation.
   5a. What signs did you notice?
   5b. Did you have an athletic trainer present?
   5c. What was the course of treatment?
6. Have you had any experience with a case of sudden death or an emergency situation (spine boarding, concussion, etc)?
   6a. Please describe the situation and the course of treatment
7. Please describe your previous experiences with having an athletic trainer on staff
   7a. What role do you believe that an athletic trainer plays in health care and high school athletics?
8. Are you in support of having an athletic trainer available during practices and games at your high school? Please explain.
   8a. What is your rationale for having or not having an athletic trainer onsite?
   8b. What do you believe the athletic trainer is qualified to do for athletes?
9. What do you believe is the extent of knowledge that an athletic trainer has and the extent to their practical skills in dealing with an emergency situation?
10. What barriers do you perceive as the reason for a lack of athletic trainers employed at the secondary school level? What would you think is the biggest reason why secondary schools do not hire an athletic trainer?
    10a. If you have an athletic trainer at your school: Why do you think other schools are not following along with hiring athletic trainers to provide medical care for the school's athletes?
    10b. If you do NOT have an athletic trainer at your school: What reasons exist for not hiring an athletic trainer at your school? Who makes the ultimate decision as to whether or not an athletic trainer is hired at the school?

[a] Questionnaire reprinted with original wording.

the findings in the open-ended questions, a common practice used in mixed-methods studies as well as in some qualitative studies.[12,13]

Content and Face Validation. The online interview (all 3 phases) was developed by the 5-member research team, which consisted of 2 athletic training educators, 2 graduate assistant ATs, and 1 qualitative researcher. Each member of the research team brought knowledge in the areas of EHS, athletic training, or research methods (or a combination of these). Before data collection, the online interview guide was reviewed by an expert qualitative researcher not involved with the data-collection procedures and was piloted with a small cohort of coaches ($n = 2$) who were also not involved in the final data collection. Updates and changes were made, including grammatical edits, order of questions, and rephrasing for clarity. The data gathered from the pilot were not used for data analysis but rather for ensuring credibility in the data-collection procedures.

Credibility

We established credibility of the research procedures and trustworthiness of the data analysis and interpretation using 3 strategies: (1) peer review,[19] (2) multiple-analyst triangulations,[19] and (3) data-source triangulation.[22] As described previously, an independent researcher examined the data-collection procedures in advance and evaluated the themes identified by the research team. Three researchers, consisting of 1 graduate student and 2 experienced qualitative researchers, were involved with data analysis autonomously. After completion, the researchers discussed their findings and agreed regarding the final presentation of the data.

Data Analysis

We analyzed the data by borrowing from both a modified ground theory approach[23,24] and a general inductive analysis.[25] All data were reviewed in their entirety before analysis to gain a sense of the dominant themes. We used the study's overall research agenda to guide the next step in the analysis: coding the data with labels to represent their meaning based on the frequency of common responses. Common labels were grouped and eventually assigned a category to represent their overall meaning as agreed upon by the research team. We evaluated the Likert-type scale data by finding the median and 25th and 75th percentile interquartile ranges of each attribute based on the participant responses and used the resulting numbers as the overall perception of the professional relationship between the coaches and the ATs.

RESULTS

Two dominant themes emerged from the qualitative data: the *perceived self-confidence of the secondary school football coach* and the *influence of the athletic trainer* (Figure 1). The first theme is supported by the coach's positive perceived self-confidence as it relates to handling emergency situations despite his or her lack of knowledge of the issue. The second theme is supported by the positive professional relationship between the head football coach and the AT, as well as the coach's perspectives on the role of the AT. Each theme is defined and discussed next with supporting quotes and quantitative data from the coaches.

Perceived Self-Confidence of the Secondary School Football Coach

Qualitative Findings. The head football coaches were asked if they felt prepared to handle an emergency situation such as EHS or cardiac arrest. Of the 38 participants, 24

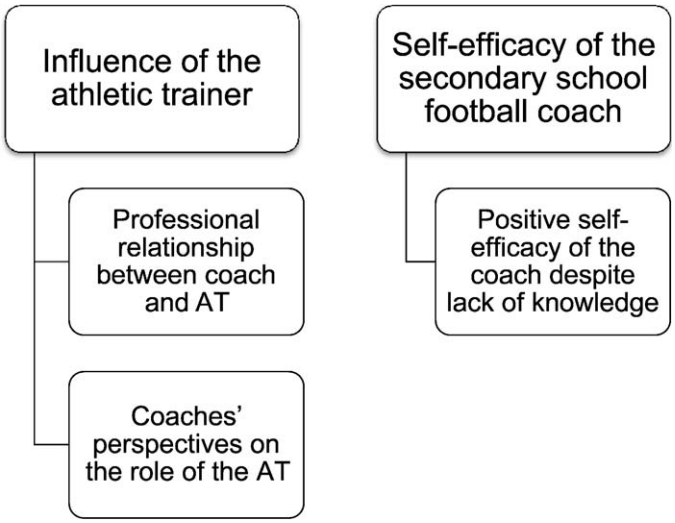

Figure 1. Dominant themes from the qualitative data. Secondary school football coaches' influence by and knowledge about the role of the athletic trainer. Abbreviation: AT, athletic trainer.

(63%) felt that they were prepared to handle an emergency situation. The responses of coaches with and coaches without ATs were not different from one another. One coach responded, "I feel qualified and prepared to handle an emergency situation. I am on our school's emergency response team." Another noted, "I feel prepared to deal with the initial response and identification of such injuries. We are required to have CPR training to coach." A third coach stated, "I feel prepared because I have received training in emergency care."

Coaches' perceived positive self-confidence, however, did not match their knowledge of emergency situations. Coaches were given a list of signs and symptoms and were asked which ones they thought were indicative of EHS, as we were particularly interested in their knowledge of EHS. The list of signs and symptoms of EHS and the number of coaches selecting the associated sign and symptom as something they would look for in a suspected case of EHS are shown in Figure 2. The coaches were asked to state why they chose the symptoms they did. Varying responses were given: "Those are what I've been told are signs to look for," "Because in my experience they are easy to see and quick to identify," and "Those things happen in the heat." Other coaches stated "cold and clammy, no sweat is a bad sign," "dizziness is one of the first signs to stop everything," and "I believe they would help lead me to a problem." Based on these responses, coaches have limited knowledge of the signs and symptoms of EHS.

In addition to their lack of knowledge about the signs and symptoms of EHS, the head football coaches also lacked knowledge of how to prevent EHS. Coaches described in depth the prevention strategies they used for EHS. One coach commented,

> (1) We cancel activities when conditions are too severe. (2) We keep plenty of water and ice on hand. (3) We schedule many hydration breaks. (4) We are vigilant to observe athletes who might exhibit any signs.

Another coach noted,

> As a staff, we monitor the heat and heat index. We try to practice during the cooler temps of the day. Also, if we must practice during higher temps, we [provide] frequent water breaks and reduce the equipment worn by our players. Also, we will lessen the high activity and try to do more of a teaching walkthrough type practice.

A third coach said, "We monitor temps. At 104°F [40°C], practice is off. Water breaks are allowed at any time. We remove helmets and shoulder pads when it gets close to but not quite 104°F."

Although most of the coaches in this study declared that they felt prepared to handle an emergency situation, it is clear that their knowledge base did not match their perceptions. The coaches' inability to recognize all the signs, symptoms, and prevention strategies of EHS, shows that secondary school coaches are unprepared to handle an

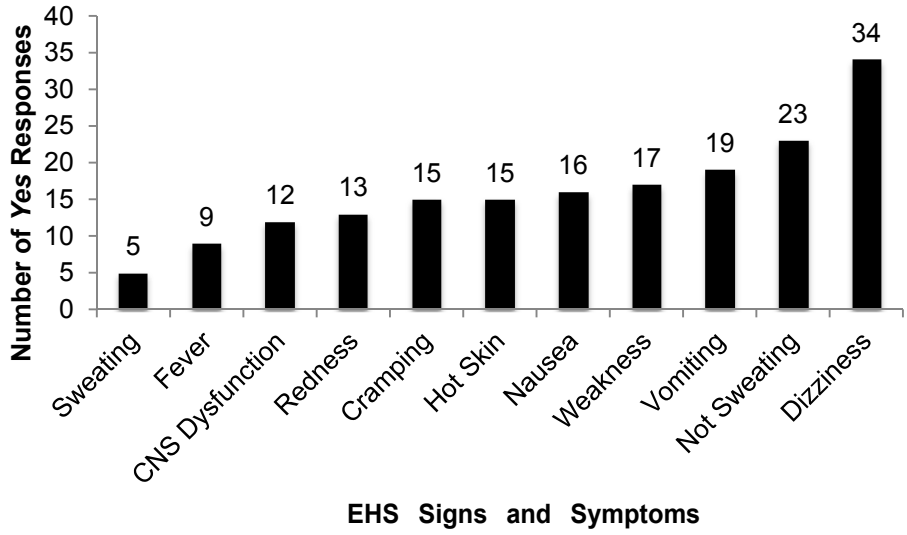

Figure 2. Secondary school football coaches' perceived knowledge of the signs and symptoms of exertional heat stroke (EHS). Abbreviation: CNS, central nervous system.

emergency situation that could result in the death of an athlete.

Quantitative Findings. Central nervous system dysfunction is the most prevalent sign of EHS aside from a core temperature above 104°F (40°C). A total of 92% of the coaches (34/38) listed dizziness as the most important factor in recognizing EHS, whereas only 32% (12/38) listed central nervous dysfunction as most important. Coaches were also asked which prevention strategies they used during practice to prevent EHS; 66% (25/38) mentioned frequent water breaks. Of those, 72% (18/25) stated that frequent water breaks were the only prevention strategy they used.

Influence of the Athletic Trainer

Qualitative Findings. The theme *influence of the athletic trainer* reflects a positive professional relationship between the secondary school football coach and the AT. All but 4 of the coaches currently worked with an AT; however, all 38 participants had worked with an AT at some point in their coaching career. One coach shared, "having a [n athletic] trainer on staff has always been a positive [experience]." Another coach noted, "an athletic trainer is invaluable [to our athletics program]." Another coach also felt the AT was a valuable asset to a secondary school's athletic program:

> A good athletic trainer is more valuable to a high school staff than any of the coaches. If I were at a high school that did not have a [athletic] trainer, I would go with 1 less coach on my staff to make sure I had the money to hire an athletic trainer for my athletic program.

The coaches' positive evaluation of ATs was partially due to their basic understanding of the role of the AT within the health care team, which included injury assessment and return-to-play decisions. One coach said, "They [ATs] are very important to treating injuries and getting kids back to playing." Another coach responded comparably, "helping to diagnose injuries is valuable; more importantly, the valuable input and therapy to bring that athlete back from an injury." When asked about an AT's qualifications, a coach commented, "for diagnosis, immediate care, and prevention and also for treatment and clearance to resume play." Another coach stated an AT is qualified to "diagnose, treat, and prevent injury (further injury)." "I believe they are qualified to identify injuries and determine the course of action following" was the statement of yet another coach. To sum up what the participants felt the AT was qualified to do, a coach responded, "Without an athletic trainer present, our programs and the coaches will be at a disadvantage, and the health of the student–athletes would be at a higher risk level."

Although coaches demonstrated a fundamental knowledge of the role of the AT, they did not mention emergency or acute care until prompted by the specific question. Questions related to the role of the AT in the secondary school were sequenced as follows: the role of the AT in the health care of secondary school athletics, what the AT is qualified to do for athletes, and if the coach believed the AT was qualified to handle emergency situations. Not until the coaches were specifically asked about the AT's qualifications in regard to emergency situations did they address this item. All of the coaches agreed that an AT is qualified to handle life-threatening conditions if and when necessary. One coach said, "Fully capable of handling emergency situations." Another coach, speaking directly about his AT, shared, "He is extremely more qualified [than I am] and probably has [experience] dealing with more serious issues than the coaches." Another coach spoke in relative terms: "They are highly trained in dealing with emergency situations." One coach was very detailed, providing "[an AT can do] CPR, automated external defibrillation, first aid, oxygen administration, mouthpiece removal, spine boarding, helmet removal, suction, all types of helmet removal, current knowledge of emergency action plan and local [emergency medical services] resources."

Quantitative Findings. The theme of an AT's influence was further supported by data collected from the background questionnaire in which the coach evaluated his or her professional relationship with the AT using a Likert-type scale. Based upon the responses, coaches summarized their relationship as honest (median [25%, 75% quartile range]: 10 [10,10]), respectful (10 [10,10]), and helpful (10 [10,10]). These data are summarized in Table 3.

Table 3. Perceived Level of Professional Relationship Between the Secondary School Head Football Coach and Athletic Trainer[a]

Attribute	Median	Interquartile Range	
		25th Percentile	75th Percentile
Cooperative	10	9	10
Professional	10	9	10
Helpful	10	10	10
Honest	10	10	10
Respectful	10	10	10
Informative	10	9	10
Communicating	10	8.75	10

[a] Values scored on a scale from 1 to 10 with 1 meaning *not* and 10 meaning *very*.

DISCUSSION

Similar to previous authors, we found that coaches were deficient in their perceived knowledge of emergency procedures and conditions leading to EHS. Our results also demonstrate that the relationship between the coach and the AT is professional, honest, and important in navigating the management and treatment of an emergency situation. Moreover, secondary school coaches reported positive self-perceptions regarding their abilities to handle an emergency situation but lacked actual knowledge regarding EHS.

Positive Perceived Self-Confidence and Emergency Care

The coaches in this study had positive perceptions regarding their knowledge of and ability to manage an emergency situation during a practice or competition. This perceived confidence was directly attributed to annual emergency care CPR and first-aid training offered through the American Red Cross or a comparable provider. This is an interesting finding, as many coaches apparently fail to meet the standards established by emergency response organizations for first aid and CPR.[11] Ransone et al

observed that 36% of coaches working in metropolitan school districts achieved a passing score on an adapted first-aid assessment examination, despite possessing basic CPR and first-aid certification.[11] The results of Ransone et al are not shocking because the data regarding coaches and their first-aid knowledge and decision making have consistently yielded unfavorable results. Barron et al reported that only 5% of coaches surveyed passed a revised first-aid assessment that consisted of questions adapted from the American Red Cross CPR and first-aid examinations.[14]

Although we did not ask the coaches whether or not they were certified in CPR and first aid, many indicated that they had received CPR and first-aid training. Our study demonstrated that coaches were unable to properly recognize a possible case of EHS based on signs and symptoms, and they lacked knowledge of EHS prevention. The most important signs indicating EHS are central nervous system dysfunction and a core temperature greater than 104°F (40°C).[4] Other signs and symptoms (Figure 2) are indicative of EHS but should not be used alone to identify EHS, as they are common to other emergency situations. Central nervous system dysfunction and a core temperature above 104°F (40°C) are the 2 signs to look for when dealing with a suspected case of EHS, but the participants in our study stated they would most often look for dizziness (92%) as an indicator of EHS. Only 32% of participants listed central nervous system dysfunction. Our results are consistent with those of Ransone et al[11] and Barron et al[14] in highlighting the deficiencies in the coaches' knowledge regarding first aid, injury prevention, and emergency care. Because many secondary schools do not employ the services of an AT, these findings are concerning because the health care of student–athletes may be placed into the hands of the coach.

Our results and those of Ransone et al[11] also indicate that coaches are not prepared to initially assess an injury or emergency situation or make return-to-play decisions. This information is important to share with policy makers and school boards; some states, such as Kentucky, have considered providing additional medical training to coaches in lieu of hiring ATs to help prevent sudden death in athletes.[8,26] Clearly, this is not a feasible option as the coaches, despite receiving training, do not appear to retain the information or use it properly.[11] This deficiency is most notably due to a failure to appreciate the seriousness of these conditions. In our study, 63% of the coaches felt prepared to handle an emergency situation, and most based this response on the fact that they held both CPR and first-aid certification. Despite that large percentage, many were unable to identify all of the signs and symptoms of EHS or to list proper preventive strategies for EHS. They were more focused on conditions such as cardiac and head injuries, which are addressed during basic emergency care courses.

In addition to the coaches' lack of knowledge in regard to first aid, Ransone et al[11] showed that coaches displayed poor decision-making skills when dealing with return to play of athletes. That is, many coaches, especially those with demonstrated competence in emergency care, were more likely to return an injured player despite continued symptoms or pain.[11] Although we did not evaluate this variable, the deficiency in coaches' knowledge regarding key signs and symptoms of EHS or plausible conditions indicates that they are ill prepared to make medical or return-to-play decisions. Furthermore, ATs working with secondary school coaches need to be aware that a coach's knowledge may not match his or her level of preparedness, which may, at best, be overconfident. Continued education and communication between the coach and AT can help increase the coach's knowledge of these conditions and of the ways to prevent a condition from occurring and enhance the appreciation for the seriousness of sudden death in sport and the role training can have on its incidence.

Influence of the Athletic Trainer

The coaches in this study reported having positive professional relationships with their ATs and listed the relationships as honest, respectful, and helpful. Consistent with the work of Mensch et al,[10] the secondary school coaches trusted the judgments of their ATs and had overall good working relationships. The positive relationship we found was partially mediated by the coaches' basic understanding of the role of the AT as it relates to injury assessment and return to play of injured athletes. Our findings refute previous results[10] that indicated a limited understanding of the roles and qualifications of the AT. A plausible explanation for this discrepancy could be the purpose of the research study. Mensch et al[10] were concerned with the coaches' understanding of the ATs' credentials and services provided, whereas we looked at the coaches' knowledge of the skills and role of the ATs, including their role in managing emergency situations. The coaches in our study were aware of the AT's abilities to evaluate, diagnose, and treat a variety of athletic injuries. They also valued the role the ATs played in the health care and wellbeing of their student–athletes.

Comparable with our findings, previous researchers[10] demonstrated the importance of good communication between the coach and AT as critical to the development of a positive relationship between these professionals.[10] Effective communication between the coach and the AT is necessary to both provide appropriate continuity of care to the student–athlete, especially at the secondary school level (where medical coverage can be limited), and, as demonstrated by our findings, to promote a strong professional relationship. Moreover, our results help to describe the coaches' improved understanding of the role of the AT, which can most likely be attributed to increased exposure due to increased AT employment in the secondary school setting.

Effective communication is essential for coaches and ATs to develop trusting and respectful relationships, as highlighted by our findings as well as those of Mensch et al.[10] Communication must be cooperative: the coach should and must respect the medical decisions made by the AT, and the AT needs to be considerate of the non-medical decisions of the coach as long as they are in the best interest of the student–athlete.[27] Furthermore, efficient communication can facilitate the care provided to an athlete because a primary role of the AT is to educate the student–athlete and the coach regarding injury prevention and training strategies.[28] Therefore, the AT can serve as a powerful resource in preventing sudden death in athletes, as the relationship he or she develops with the coach appears to positively affect the coach's awareness of these conditions

and understanding of the AT's skills related to managing these conditions.

Our findings also indicate that the coach can be a strong ally for the AT at the secondary school level. The coaches in this study were very supportive of having ATs on staff and could be enlisted to help secure additional resources for the AT. The support of the AT was definitely facilitated by the professional relationship developed between the 2 parties, which were founded on respect and effective communication.

Limitations

Our study is not without limitations. We used asynchronous, online, open-ended interview questions to collect qualitative data. Although this is a popular new method that produces rich data, anonymity of the responses limits the researchers' ability to follow up on questions posed or responses provided. The structured interview guide was reviewed for content and piloted with 2 coaches before data collection, which helped to reduce instances of misinterpretation, but we recognize the limitations of online interviewing. Due to the small sample size, our results cannot be generalized to all secondary school head football coaches, especially coaches without ATs at their schools. Athletic trainers were employed by the secondary schools of all but 4 of the coaches who participated in this study; therefore, it is likely that the coaches responded to the survey based on their positive professional working relationships with ATs. In addition, we looked only at the perspective of the head coach in the secondary school setting, so it is unclear whether the perceptions of an AT working in the secondary school would match those of the head football coach. As previously indicated, communication with an AT can both enhance the coaches' perceptions of their role and increase their knowledge and comfort level regarding the management of sudden death in student–athletes. Finally, the mean age for this cohort of coaches was 47 years, with an average of 12 years' head coach coaching experience. The results may not completely reflect the secondary school coach with less experience in the role of the head coach.

Recommendations

To increase the knowledge base of the secondary school football coach related to the prevention of EHS, we offer several recommendations. First, an AT employed by a school can teach an emergency care course for all of the coaches at the school. The course can address prevention, recognition, and treatment of the various causes of sudden death in athletes, including EHS. The course can also include hands-on training to familiarize the coaches with the correct way to handle emergencies. The AT should stress the importance of effective communication with the coach to facilitate proper care of the student–athlete. In addition, states can mandate that all coaches take a course on emergency care with an annual or biannual recertification requirement because fewer than 45% of secondary schools currently employ an AT. Requiring coaches to take an emergency care course will help prepare them to handle emergency situations, especially in the absence of an onsite AT. Further emergency preparedness education is suggested for coaches, but this should not serve as a permanent alternative to AT employment. Secondary schools should continue to strive for appropriate medical care to improve the safety of their student–athletes.

Future Research

Our sample was small, and although our results help to describe coaches' understanding of sudden death in student–athletes as well as the relationship between the coach and AT, a larger study using the current model will help to expand on the findings. Whereas our study answered questions regarding the coaches' perspectives on the prevention of EHS and the role of the AT, additional questions arose that can be the basis for further research. For example, are the coaches' perspectives of preventing sudden death in sport and the role of the AT as similar across other sports as they are in football? Head coaches in sports such as soccer, basketball, and lacrosse should be studied.

Because all except 4 of the participants in this study had a working relationship with an AT, a study looking at a larger sample of coaches who do not have a working relationship with an AT would provide a better understanding of their perspectives on sudden death in athletes. In addition, we examined only the coaches' perspectives on sudden death in student–athletes and the relationship between the coach and the AT. Looking at the AT's or athletic director's perspectives in relation to sudden death in athletes and the relationship between the AT and the coach might provide a different insight and should be explored.

Coaches in our study indicated positive self-confidence in knowledge and preparedness relating to emergency situations in sport despite their lack of factual knowledge. In addition to asking if the coach feels prepared to handle emergency situations, further research examining coaches' decision making regarding the proper management of potential emergency situations should be performed. Investigating coaches' responses to scenarios involving potential sudden death in athletes and asking the steps they would take to treat the situation would expand our understanding of both the coaches' knowledge base and what they would do if faced with an emergency.

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