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Adoption of Lightning Safety Best-Practices Policies in the Secondary School Setting

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Context: Lightning-related injuries are among the top 10 causes of sport-related death at all levels of sport, including the nearly 8 million athletes participating in US secondary school sports.

Objective: To investigate the adoption of lightning safety policies and the factors that influence the development of comprehensive lightning safety policies in United States secondary schools.

Design: Cross-sectional study.

Setting: Secondary school.

Patients or Other Participants: Athletic trainers (ATs).

Main Outcome Measure(s): An online questionnaire was developed based on the "National Athletic Trainers' Association Position Statement: Lightning Safety for Athletics and Recreation" using a health behavior model, the precaution adoption process model, along with facilitators of and barriers to the current adoption of lightning-related policies and factors that influence the adoption of lightning policies. Precaution adoption process model stage (*unaware for need*, *unaware if have*, *unengaged*, *undecided*, *decided not to act*, *decided to act*, *acting*, *maintaining*) responses are presented as frequencies. Chi-square tests of associations and prevalence ratios with 95% CIs were calculated to compare respondents in higher and lower vulnerability states, based on data regarding lightning-related deaths.

Results: The response rate for this questionnaire was 13.43% (n = 365), with additional questionnaires completed via social media (n = 56). A majority of ATs reported maintaining (69%, n = 287) and acting (6.5%, n = 27) a comprehensive lightning safety policy. Approximately 1 in 4 ATs (25.1%, n = 106) described using flash to bang as an evacuation criterion. Athletic trainers practicing in more vulnerable states were more likely to adopt a lightning policy than those in less vulnerable states (57.4% versus 42.6%, prevalence ratio [95% CI] = 1.16 [1.03, 1.30]; $P = .009$). The most commonly cited facilitator and barrier were a requirement from a state high school athletics association and financial limitations, respectively.

Conclusions: A majority of ATs related adopting (eg, maintaining and acting) the best practices for lightning safety. However, many ATs also indicated continued use of outdated methods (eg, flash to bang).

Key Words: preventing sudden death, policies and procedures, environmental hazards

Key Points

- A majority of athletic trainers in the US secondary school setting described adopting a comprehensive lightning policy.
- Participants who said they were not adopting a lightning safety policy appeared to most often be classified as *unaware if they have the policy*.
- Athletic trainers practicing at secondary schools in states that were more vulnerable to lightning (defined as the top 10 states with lightning-related deaths) were more likely to adopt a policy than those practicing in less vulnerable states.
- Even though a large proportion of respondents had adopted lightning safety policy components, nearly 1 in 4 noted continued use of outdated practices, such as flash to bang, as criteria for the evacuation of a venue.

Lightning is life threatening to those participating in outdoor activities. Despite this fact, fatalities are still annually attributed to this phenomenon.[1,2] *Lightning events* are defined as lightning that occurs from either cloud to ground or cloud to cloud.[3] The myth that intracloud (or cloud-to-cloud) lightning is not dangerous contributes to the lightning hazard. Any lightning is dangerous, and an intracloud event could produce a fatal cloud-to-ground strike in seconds. In the United States, lightning is most prevalent from April through September and from 10:00 AM to 7:00 PM, when outdoor activities, including scholastic sports, are at a peak.[3] The author[4] of a 13-year study attributed 62% of lightning deaths to leisure activities, and the greatest number of deaths in sport

occurred in soccer. According to the National Weather Service, 255 lightning-related fatalities occurred in the past 10 years; however, these data are likely underreported.[1] With millions of lightning events every year in the United States, vigilance about lightning safety is of utmost importance during sport participation.[2]

Some US geographic regions have more lightning activity per year and, consequently, a greater likelihood of lightning-related injury than other regions. In 2019, the National Weather Service[1] reported that 74% of the deaths over the previous 10 years occurred in 16 states, with Florida consistently among the top of this list. In addition to Florida, the southeastern Atlantic states, Midwest, Texas, Oklahoma, and areas of Arizona and Colorado were responsible for 75% of the nation's deaths from lightning.[3] Florida also led all other states with 228 lightning events per square mile in 2019, but Texas ranked number 1 in lightning ground strikes with 47 397 975 during the same period.[2] One of the properties that sets lightning apart from other weather-related incidents is that 1 ground strike can affect multiple people as it radiates outward, transferring the energy of the strike within seconds.[1,2] Most lightning deaths occurred when people either waited too long to seek appropriate refuge or returned to outdoor activity too soon.[3]

Fortunately, abundant evidence supports the implementation of best practices for reducing catastrophic injuries from lightning strikes.[1,2] Evacuating to a safe location that consists of a fully enclosed building with wiring and plumbing or fully enclosed metal vehicles can significantly reduce the likelihood of being struck by lightning. Yet how well these lightning-related best practices are being adopted or implemented in the secondary school athletics setting, which is a common setting for lightning-related injury, is unknown.[3,4]

In the collegiate setting, Walsh et al[5] in 1997 determined that only 8% of the institutions responding to a survey had a written policy regarding lightning safety. Although this study was published more than 20 years ago, the low adoption rate at the collegiate level warrants concern for the adoption of these policies at the secondary school level, which has been associated with many barriers to best-practice adoption in other areas related to health and safety.[5,6] Recently, Dunbar-Gaynor et al[7] found that 74.5% of secondary school athletic trainers (ATs) reported having an "operational and written" policy for a weather emergency, with an additional 2.6% reporting having a "written but not operational" weather emergency policy. Identifying the factors that influence the adoption of lightning safety policies is critical to developing strategies that aid ATs in overcoming barriers to the adoption of these best practices.

The purpose of our study was to investigate the adoption of best-practice policies in secondary schools for the prevention of lightning-related injuries. Specifically, we aimed to evaluate the adoption of lightning safety policies and the factors that influence the adoption of a comprehensive policy, including *more versus less vulnerable states* (ie, those states with a higher or lower, respectively, likelihood of lightning strikes). We hypothesized that a majority of secondary school ATs would acknowledge adopting a lightning safety policy but that few (less than 50%) would report *adopting a comprehensive policy* (defined as adoption of all components related to lightning).

METHODS

Setting

We used a cross-sectional design with an electronic questionnaire to evaluate the current level of adoption of lightning-related policies by secondary school ATs. The University of Connecticut Institutional Review Board reviewed the study procedures and determined them to be exempt from further review.

Participants

In the fall of 2018, we invited ATs practicing in the secondary school setting to participate in this study via 2 distribution methods: the Athletic Training Locations and Services (ATLAS) Project and social media.[8] We emailed the survey link to 3119 ATs who had agreed to be contacted through the ATLAS database.[8] We sent a follow-up email to ATs who had not responded after 3 weeks. A total of 439 ATs started the survey; however, 7 respondents were not ATs, 13 did not work in the secondary school setting, and 54 did not complete at least 80% of the items. Therefore, we considered only completed surveys in our analyses, yielding a response rate of 13.43% and a valid response rate of 11.70% (n = 365).

We also distributed a survey link through postings on social media. These postings captured 56 additional respondents, and the study analyses included these respondents' results. Because we were unable to accurately determine the number of individuals who viewed the study announcement on social media, we were unable to calculate an overall response rate from the distribution of the social media link.

Questionnaire

The survey was a web-based questionnaire administered through Qualtrics LLC and consisted of items concerning the respondents' demographic information and their schools' policies and procedures for lightning safety. Specifically, we based these items on the "National Athletic Trainers' Association Position Statement: Lightning Safety for Athletics and Recreation."[3] Respondents answered items that addressed their adoption of comprehensive lightning safety policies, as well as their perceptions of barriers and facilitators to adoption. We phrased items using the precaution adoption process model (PAPM), which was designed to identify one's readiness to act with regard to a particular policy.[9–11] The traditional PAPM has 7 stages: *unaware*, *unengaged*, *undecided*, *decided not to act*, *decided to act*, *acting*, and *maintaining*. For this project, we further distinguished unaware responses as *unaware of the need for this policy* or *unaware if we have this policy*, resulting in a total of 8 stages (Table 1).

We first validated the survey's items as an instrument for assessing the adoption of lightning safety policies by calling on content experts from within (S.E.S.M., K.W.F., L.N.B.) and external to (4 ATs working in the secondary school setting at the time) the research team. This internal validation was then followed up with a pilot study of 7 ATs to identify the clarity, importance, and relevance of the

Table 1. Precaution Adoption Process Model Responses[a]

Item	*Response*, No. (%) [95% CI][b]							
	My High School Was Not Aware We Needed to Have This Written Policy (Unaware of Need)	*I Do Not Know if My High School Has This Written Policy (Unaware if Have)*	*My High School Is Aware of This Policy, But Has Decided Not to Have This Written Policy (Decided Not to Act)*	*My High School Is Aware of This But Has Not Considered Creating This Written Policy (Unengaged)*	*My High School Is Aware of This and Is Considering Following and Creating This Written Policy (Undecided)*	*My High School Is Aware of This and Planning to Create This Written Policy Within the Next 6 mo (Decided to Act)*	*My High School Created This Written Policy in the Past 6 mo (Acting)*	*My High School Has Had This Written Policy for Longer Than 6 mo (Maintaining)*
1. My school has written policy for lightning-related injuries (prevention and treatment) (n = 416)	13 (3.13) [1.7–5.3]	20 (4.81) [3.0–7.3]	5 (1.20) [0.4–2.8]	22 (5.29) [3.3–7.9]	22 (5.29) [3.3–7.9]	20 (4.81) [3.0–7.3]	27 (6.49) [4.3–9.3]	287 (68.99) [64.3–73.4]
2. Lightning policy has specific guidelines for when to evacuate the field (n = 307)	0 (0) [0.0–1.2]	0 (0) [0.0–1.2]	0 (0) [0.0–1.2]	0 (0) [0.0–1.2]	0 (0) [0.0–1.2]	2 (0.65) [0.1–2.3]	21 (6.84) [4.3–10.3]	284 (92.51) [89.0–95.2]
3. Lightning policy has specific personnel who are responsible for field evacuation (n = 301)	4 (1.33) [0.4–3.4]	11 (3.65) [1.8–6.4]	0 (0) [0.0–1.2]	5 (1.66) [0.5–3.8]	3 (1.00) [0.2–2.9]	5 (1.66) [0.5–3.8]	19 (6.31) [3.8–9.7]	254 (84.39) [79.8–88.3]
4. Lightning policy identifies safe locations (n = 302)	3 (0.99) [0.2–2.9]	6 (1.99) [0.7–4.2]	1 (0.33) [0.0–1.8]	5 (1.66) [0.5–3.8]	4 (1.32) [0.4–3.4]	4 (1.32) [0.4–3.4]	21 (6.95) [4.4–10.4]	258 (85.43) [80.9–89.2]

[a] Items are reproduced in their original format.

[b] Percentages were rounded and, therefore, the sums may not total 100%.

Table 2. Participant Characteristics

Characteristic	No. (%)[a]
Sex	
Male	175 (41.7)
Female	243 (57.9)
Prefer not to say	2 (0.5)
Type of school	
Public	341 (81.2)
Private	70 (16.7)
Charter	4 (1.0)
Magnet	3 (0.7)
Other	2 (0.5)
Time in role at school, y[b]	
<1	28 (6.7)
1–5	222 (52.9)
6–10	69 (16.4)
11–15	39 (9.3)
15+	58 (13.8)
Time in role in profession, y	
<1	3 (0.7)
1–5	143 (34.0)
6–10	90 (21.4)
11–15	54 (12.9)
15+	129 (30.7)

[a] Percentages were rounded, and the sums may not total 100%.
[b] Not all participants answered the question.

questions. We revised the questionnaire based on the pilot study findings.

Data Analyses

Study findings are reported as descriptive results (percentage of responses). To assess the adoption of a comprehensive lightning safety policy, we dichotomized the PAPM responses into 2 categories: adopted (PAPM stages *acting* and *maintaining*) or not adopted (PAPM stages *unaware of the need for this policy, unaware if we have this policy, unengaged, undecided, decided not to act, decided to act*). We then summed the number of policies adopted for the 4 questions (Table 1). A comprehensive lightning safety policy was defined as having 4 out of 4 components. We divided the responses into those from more vulnerable or less vulnerable states based on the state the AT indicated in the demographic information. We classified more vulnerable states as the 16 with the most lightning-related deaths from 2010 to 2019 (Florida, Alabama, Texas, North Carolina, Arizona, Colorado, Missouri, Georgia, Louisiana, Ohio, Pennsylvania, Arkansas, Kentucky, New Jersey, New York, Utah).[1] Based on this dichotomization, we compared respondents in more and less vulnerable states according to their adoption of lightning safety policies using prevalence ratios and χ^2 tests of association. Prevalence ratios (PRs) with CIs that did not include 1 were considered statistically significant. We then compared the number of components of comprehensive policies adopted between more and less vulnerable states using Mann-Whitney *U* tests.

Items related to lightning best practices for field evacuation, technology used, and identification of a safe location were also included. Participants were asked to check all that applied for each of these items. The answers were summarized and presented as a proportion of the total who checked the option divided by the total sample.

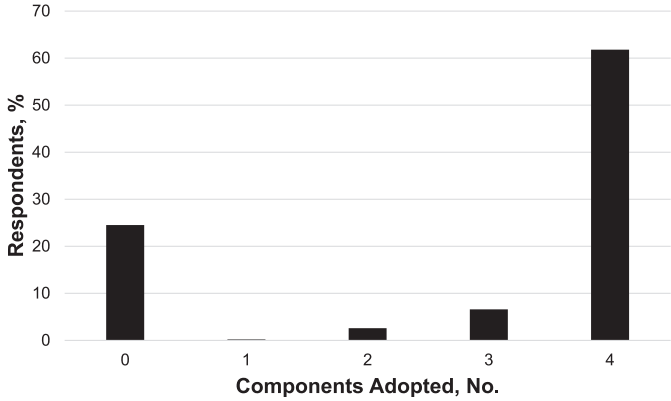

Figure 1. Number of lightning safety components adopted.

Finally, we evaluated differences in respondents' barriers and facilitators to policy adoption between those who had and had not adopted policies using a Mann-Whitney *U* test. Significance for all the Mann-Whitney *U* tests was determined by $P < .05$. We analyzed the data using SPSS (version 26; IBM Corp).

RESULTS

The states with the largest number of respondents were Texas (10.9%, n = 46), Florida (6.4%, n = 27), and North Carolina (5.9%, n = 25); 46 states were represented overall (Table 2). With regard to the health behavior of the ATs in this sample, a majority reported maintaining (69%, n = 287) and adopting (ie, acting; 6.5%, n = 27) policies for lightning-related injuries. However, 7.93% (n = 33) admitted to being unaware of the need for a lightning safety policy or unaware if the policy existed (Table 1). A large proportion of ATs (61.8%, n = 261) described adopting all 4 lightning safety policy components, whereas 24.5% (n = 102) acknowledged no current adoption of any policies related to lightning (Figure 1).

More Vulnerable States

Greater than half of respondents (53.9%, n = 222) practiced in more vulnerable states, with 57.4% of these reporting that they had adopted a lightning safety policy. This adoption rate was higher than the 42.6% of ATs in less vulnerable states who stated they had adopted a lightning policy (PR [95% CI] = 1.16 [1.03, 1.30]; $\chi^2 = 6.788$, $P = .009$). The number of components of a comprehensive lightning safety policy that had been adopted also differed between more and less vulnerable states (Mann-Whitney *U* test; $P = .002$). Of those who did not have a lightning safety policy in a more vulnerable state and commented on barriers, 20% indicated they were unaware if they had a policy, 20% described not considering a policy, and 20% said they had considered a policy.

Lightning Safety Best Practices

The ATs explained several methods of determining the need to evacuate for lightning. A majority portrayed tracking storms using technology and evacuating when a storm was within a certain distance (64%, n = 270). Respondents also reported ordering evacuation based on when lightning was

Table 3. Technology Used to Monitor Lightning

Type of Technology	No. (%)	95% CI	Top Answers in Text Entry Count for Name of Technology[a,b] Name	No. (%)	95% CI
We subscribe to a real-time satellite device that gives us notifications.	41 (9.7)	7.1, 13.0	DTN/Weather Sentry	11 (26.8)	14.2, 42.9
			Perry Weather/Pocket Perry	7 (17.1)	7.2, 32.1
			WeatherBug	5 (12.2)	4.1, 26.2
			Earth Networks	4 (9.8)	2.7, 23.1
We have a lightning monitor installed on our campus.	42 (10)	7.3, 13.2	Thor Guard	12 (28.6)	15.7, 44.6
			Weatherbug	5 (11.9)	4.0, 25.6
			Sky Scan	4 (9.5)	2.7, 22.6
We use an application on a phone.	307 (72.7)	68.4, 77.1	Weatherbug	221 (72.0)	66.6, 76.9
			My Lightning Tracker	36 (11.7)	8.3, 15.9
We check the local weather.	68 (16.2)	12.8, 20.0	Weatherbug	44 (64.7)	52.2, 75.9
			My Lightning Tracker	5 (7.4)	2.4, 16.3
			Weather Channel	3 (4.4)	0.9, 12.4
We check the website.	59 (14.0)	10.8, 17.7	Weather Channel	26 (44.1)	31.2, 57.6
			WeatherBug	15 (25.4)	15.0, 38.4
Other	27 (6.4)	4.3, 9.2	My Lightning Tracker	3 (11.1)	2.4, 29.2
			Hand-held device	6 (22.2)	8.6, 42.3
We do not use any technology.	29 (6.9)	4.7, 9.7	NA		

Abbreviation: NA, not applicable.

[a] Respondents checked all that applied for the type of technology used to determine field evacuation. If they checked a box, they were asked to name the technology for that section.

[b] WeatherSentry, DTN; WeatherBug, GroundTruth; SkyScan; La Crosse Technology Ltd; My Lightning Tracker, jRuston Apps.

observed (32%, n = 286), when flash to bang occurred in a specific time frame (25.1%, n = 106), when thunder was heard (24.9%, n = 105), and when both lightning was observed and thunder was heard (19%, n = 80). Participants who worked in less vulnerable states were more likely to indicate using flash to bang than those in more vulnerable states (34.7% versus 17.6%, $\chi^2 = 15.89$; $P < .001$; PR = 1.98, 95% CI = 1.40, 2.79). Respondents labeled the following sites as safe locations for evacuation as part of their lightning safety policy: dugout (14.2%, n = 60), locker rooms (87.7%, n = 370), gym (88.6%, n = 374), under the stadium or under a walkway (8.1%, n = 34), school building (92.4%, n = 390), and vehicle (ie, school bus, car; 67.8%, n = 286). A majority of ATs described using an application on their phones to monitor lightning (72.7%, n = 307) and identified WeatherBug (GroundTruth) as the most frequently used application (71.9%, n = 221; Table 3).

Facilitators and Barriers

The most commonly reported facilitators in the adoption of a lightning safety policy were a state mandate from the secondary school athletics association (51.9%, n = 219) and having a medical professional (ie, AT) at the school (50%, n = 211; Figure 2). We found no differences in the number of facilitators mentioned by ATs who reported adopting a

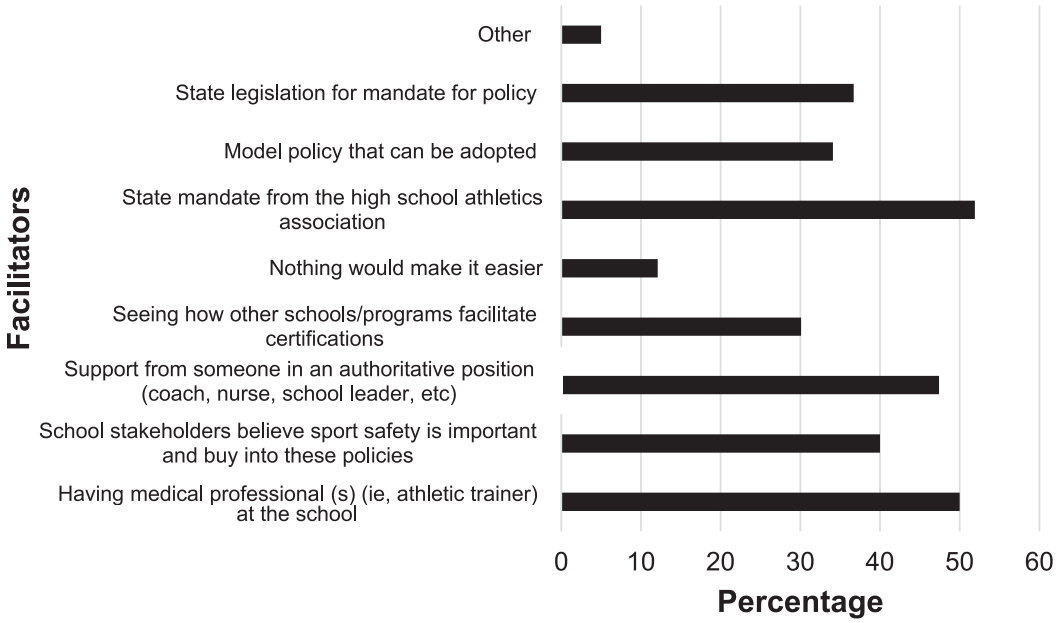

Figure 2. Facilitators of adoption of a lightning safety policy.

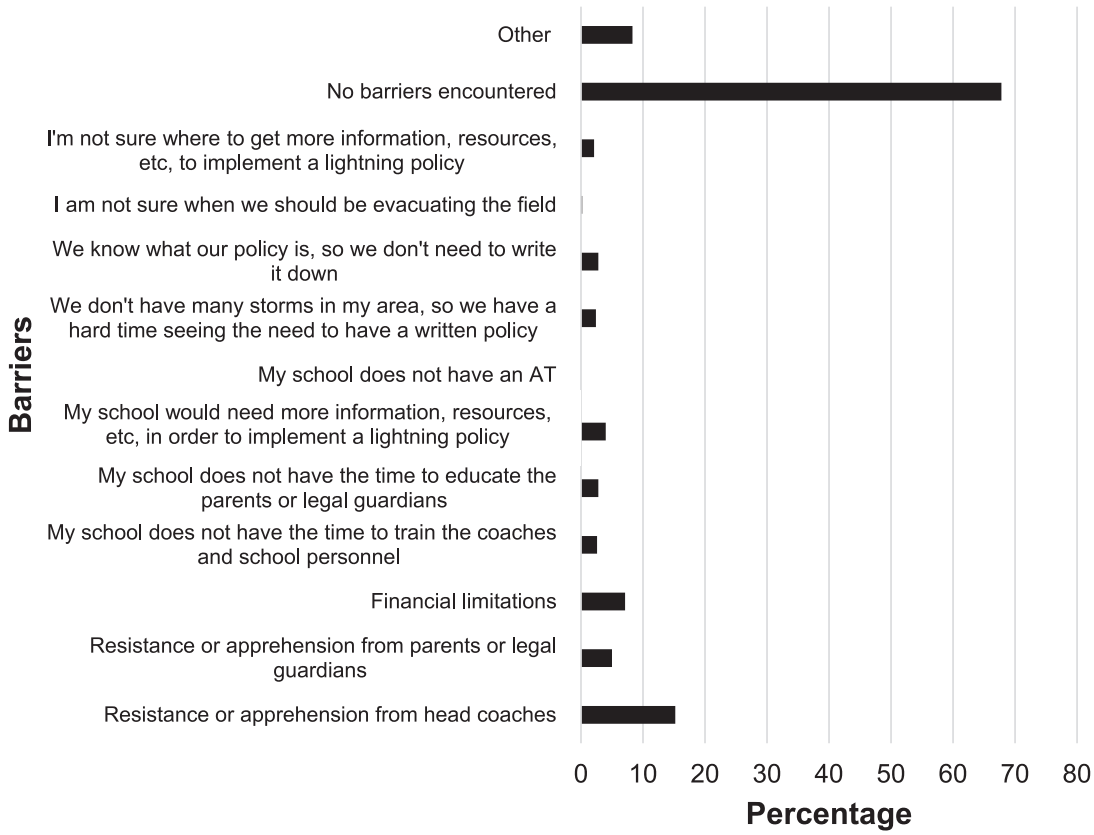

Figure 3. Barriers to adoption of a comprehensive lightning safety policy.

lightning safety policy compared with those who had not adopted a policy ($P < .05$). The most often reported barriers were resistance from head coaches (15.2%, n = 64) and financial limitations (7.1%, n = 30; Figure 3), yet ATs who stated they experienced more barriers to adopting a lightning safety policy were more likely to comment that they had adopted a policy ($P < .001$) than ATs who did not encounter as many barriers.

DISCUSSION

Best practices for lightning safety have been published and widely disseminated in the secondary school community for the past 2 decades.[3,12] When these best practices for lightning safety have been followed, lightning-related injuries and deaths have decreased.[1,2] However, before our investigation, the current level of adoption of these best practices in secondary school athletics programs was unknown. Our findings demonstrated that approximately 75% of ATs acknowledged adopting a lightning safety policy and just over 60% indicated adopting all 4 components of a comprehensive policy. Although a majority of ATs noted using best practices to evacuate the venue when a lightning storm was approaching, nearly 1 in 4 ATs were still using flash to bang as an evacuation criterion, despite this method being outdated for nearly a decade. Thus, whereas many ATs in secondary schools said they had adopted appropriate best practices for preventing injuries from lightning, opportunities exist for developing strategies to support the remainder of ATs in adopting best practices.

The PAPM can aid us in conceptualizing the readiness to act of the ATs who did not describe adoption of a lightning safety policy.[9–11] Overall, a large percentage of ATs who had not adopted such a policy reported they were not considering or were considering adopting one; the remainder were unaware if they had a policy, unaware of the need for a policy, decided not to have a policy, or decided to act on a policy. These data provide a benchmark for the staging of clinical behaviors related to this topic. With this knowledge, we can create interventions tailored to these stages and focus on the ATs' readiness to act. For example, ATs who are not considering a lightning safety policy may be influenced by education on the epidemiology of lightning injuries in their state.

The geographic locations of ATs appeared to be associated with the adoption of a comprehensive lightning safety policy. Those living in more vulnerable states were more likely to have a comprehensive lightning safety policy than those ATs living in less vulnerable states (57.4% versus 42.6%). Millions of lightning events occur each year,[2] so it is imperative that all ATs across the United States, not only those in more vulnerable areas, be vigilant about developing safety policies. This finding suggests that perceived vulnerability may be a facilitating factor and should be considered in future efforts to improve adoption. The health behavior results, coupled with this finding, can help us conceptualize the readiness of ATs to act on the adoption of these policies. The ATs who reported working in more vulnerable states without a policy were largely self-classified as being unaware, unengaged, and undecided. These stages point to the need for interventions to change the ATs' behavior. For example, those ATs in a more

vulnerable area who are unaware of their school's lightning safety policies can be provided with information related to the number of lightning events and deaths in the state, highlighting the importance of knowing the current policies to address these concerns in their school.

A site-specific lightning safety policy and procedure is critical to mitigate catastrophe. A 50 000-seat stadium requires a different monitoring and evacuation plan than a large open field. For each site, safer structures must be identified and made accessible; also necessary is determining the time it would take to safely evacuate participants and spectators to the safer building(s).[12] For the most part, our ATs indicated their policy was to evacuate to safe locations (eg, school building, vehicle). However, some ATs also identified a dugout (14.2%) and under the stadium or a walkway (8.1%) as safe locations, which contradicts current best practices.[3] Future interventions to improve the understanding of safe versus unsafe locations should be aimed at both ATs and other stakeholders, such as athletic directors and coaches.

Further, ATs in this sample reported evacuating the field when lightning was observed (32%), thunder was heard (24.9%), both lightning was observed and thunder was heard (19%), or a storm was within a certain distance according to technology (64%), all of which support best practices. It is important to reiterate that the ATs were asked to "select all that apply" in this item. As such, they were not asked to select their primary means of evacuation. Therefore, an AT may have been using any and all means to evacuate the field or may have been using a different method that was inconsistent with best practice. It is also critical to note that use of a flash-to-bang method, regardless of whether it is primary or secondary, is not considered best practice. Nevertheless, a reliable means of monitoring the weather begins with local information from the regional weather service and monitoring the current and projected weather before and throughout the practice or event.[3] We found that 10% of respondents described having a lightning monitor installed on campus, despite it not being best practice. Subscription to a commercial, real-time, independently and objectively verified lightning detection service is the criterion standard for monitoring the weather,[3,13] but great care and research are needed to ensure the company is doing what it claims, as these services can be expensive. Lightning safety slogans are an easy, no-cost way to remember basic safety tenets. Key slogans supported by the National Weather Service are "No Place Outside Is Safe When Thunderstorms Are In The Area!" "When Thunder Roars, Go Indoors!" "See It, Flee It; Hear It, Clear It," and "Half An Hour Since Thunder Roars, Now It's Safe To Go Outdoors."[1] All of these are useful reminders and offer good support for decisions on when to vacate and return to outdoor activity. None require funding, making them appropriate in nearly all situations.

The most commonly reported facilitators of lightning safety policies were a state mandate from the secondary school athletics association and having a medical professional at the school. This result parallels policy evaluation research that suggested ATs and athletic directors appeared to depend on the state secondary school athletics association requirement to facilitate the adoption of emergency action plans.[6,14] Earlier studies[15,16] indicated improved compliance and patient outcomes when emergency action plans and heat-acclimatization policies were required at the state level. Although state-level lightning safety policies have yet to be evaluated, it would be interesting to investigate if the findings are similar with respect to lightning safety preparedness.

Our ATs characterized themselves as the individuals responsible for the development of emergency action plans[6] and also appeared to be reporting themselves as among the most influential facilitators for developing a lightning safety policy. Given the educational and evidence-based background of ATs, this finding is not surprising. Educational competencies to develop policies and procedures for mitigating and managing emergent conditions have been part of athletic training curriculums for years.[17] Thus, these competencies should prepare athletic training students to properly develop and implement policies and procedures for athletic-related emergent conditions, including lightning. It is also important to note that overall, a majority of ATs in this sample noted no barriers to the development of a comprehensive lightning safety policy. Best practices to prevent lightning injuries and deaths begin with widely published, written, and venue-specific lightning safety policies along with a venue-specific generalized emergency action plan. Fortunately, only a fraction (7%) of the respondents reported financial limitations as a barrier to adopting a comprehensive lightning safety policy. This is a positive sign, given that adhering to the best practices for lightning safety need not be costly. Simply watching the weather and evacuating when lightning is observed or thunder is heard are appropriate evacuation measures.[3,12]

Limitations and Future Research

To our knowledge, this study is the first to identify the current benchmark for the adoption of lightning safety policies in the secondary school setting. Further, we do not believe any previous authors have addressed the factors that influence adoption, including ATs' readiness to act and facilitators of and barriers to the adoption of these policies. This research provides a starting point for the development of strategies based on the current factors influencing adoption. For example, because ATs reported state secondary school athletics association mandates as a facilitator, advocacy efforts to enhance standards at the state level may prove beneficial in improving adoption rates. However, although these data are beneficial, this investigation was not without limitations. Mainly, as with any questionnaire data, we assumed truthfulness in the responses. We also anticipated some level of bias in answering the items, in that ATs with policies may have been more likely to report pursuing these best practices. As we aimed to increase the response rate by decreasing the time to complete the survey, we may not have addressed all possible best practices for lightning safety. For instance, future researchers may wish to evaluate the chain of command for evacuation from a venue or the process of identifying personnel with unchallengeable authority to evacuate venues. Additionally, the items related to field evacuation criteria and safe locations for evacuation asked the ATs to "select all that apply." This may have motivated the ATs to report all methods as potentially used rather than those that were primarily used.

CONCLUSIONS

Our purpose was to identify the current adoption of best-practices policies, along with factors influencing lightning safety policies and procedures. The findings indicate that a majority of ATs practicing in the secondary school setting were adopting such policies. However, given that only 61.8% of ATs described full compliance and 1 in 4 ATs reported the use of the flash-to-bang method, it is evident that educational interventions are needed to enhance the adoption of best practices for lightning safety overall.

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