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Cervical Spine Injury Policy Adoption: Describing High Schools' Readiness Using the Precaution Adoption Process Model

Courtney M. Meyer, MS, ATC*; Erik E. Swartz, PhD, ATC†; Johna K. Register-Mihalik, PhD, LAT, ATC‡; Susan Yeargin, PhD, ATC*; Samantha E. Scarneo-Miller, PhD, ATC§

*Exercise Science, University of South Carolina, Columbia; †School of Health Sciences, Adelphi University, Garden City, NY; ‡Department of Exercise and Sport Science, University of North Carolina at Chapel Hill; §Athletic Training, West Virginia University, Morgantown

Context: Best practices to manage cervical spine injury (CSI) in sport have been published, yet knowledge of their use is unknown.

Objective: To explore adoption of CSI management policies by high school (HS) athletic trainers (ATs) and their associated behaviors, barriers, and facilitators.

Design: Cross-sectional study.

Setting: Online survey platform.

Patients or Other Participants: Athletic trainers providing medical services to US HSs.

Main Outcome Measure(s): The precaution adoption process model was used in an online questionnaire to determine the stage of adoption by ATs for each CSI management policy component. Components obtained from the National Athletic Trainers' Association position statement on acute management of an athlete with a CSI included immediate care, emergency tools to remove equipment, and maintenance of equipment-removal skills. Questions assessed AT demographics, HS characteristics, and facilitators and barriers to policy adoption. Data are presented as proportions and associations determined through χ^2 analysis ($P < .05$).

Results: A total of 508 ATs' responses were included. Of these ATs, 33.1% reported adoption of incomplete policies (<3 components of a CSI management policy, n = 168; 95% CI = 29.0%, 37.1%), and 66.9% reported adoption of comprehensive policies (n = 339; 95% CI = 62.9%, 71.0%). A significant association was found between coordination of CSI policies with emergency medical services (EMS) and adoption of the policy components for comprehensive immediate CSI care ($\chi^2_1 = 49.56$, $P < .001$), emergency tools for athletic equipment removal ($\chi^2_1 = 41.49$, $P < .001$), and the practice and maintenance of equipment-removal skills ($\chi^2_1 = 86.12$, $P < .001$). Approximately two-thirds (66.5%) reported that a positive relationship with EMS (n = 338; 95% CI = 62.4%, 70.7%) was a facilitator, whereas 42.5% reported challenges with local EMS as a barrier (n = 216; 95% CI = 38.2%, 46.9%).

Conclusions: Immediate care and emergency tool policy components had the highest rates of adoption. Higher rates of adoption in this project were associated with coordination of CSI policies with local EMS. Athletic trainers also reported challenges in coordinating with EMS. Interventions to improve collaboration, training, and interprofessional respect between ATs and EMS personnel may improve policy adoption.

Key Words: catastrophic injury, best practices, emergency procedures, health behavior

Key Points

- Although most athletic trainers at US high schools have adopted comprehensive cervical spine injury (CSI) management policies, 1 in 3 have not.
- There is a significant association between coordinating CSI management policies with emergency medical services (EMS) and adoption of each of the 3 CSI management policy components.
- The most reported facilitator of CSI management policy adoption was a positive relationship with EMS; conversely, challenges in EMS coordination were the most reported barriers.

Traumatic spinal cord injuries are defined as spinal cord injuries resulting from a physical impact requiring hospitalization.[1] Traumatic spinal cord injuries in youth and adolescents have been estimated at a rate of 1.48 per 100 000 persons.[1] Of those, the highest rates were reported in males, individuals identifying as Black or African American, and people aged 15 to 20 years.[1] Within high school (HS) sports, cervical spine injuries (CSIs), including traumatic spinal cord injuries, have been documented at an injury rate of 3.04 per 100 000 athlete-exposures,[2] with the highest rates of CSIs reported by football, wrestling, girls' gymnastics, cheerleading, and ice hockey.[2] Over 20 years (2000–2020), the National Center for Catastrophic Sport Injury Research has recorded 491 catastrophic CSIs and head injuries for HS football.[3] Of those injuries, 11% were fatal, 42% led to permanent disability, 42% resulted in temporary disability, and

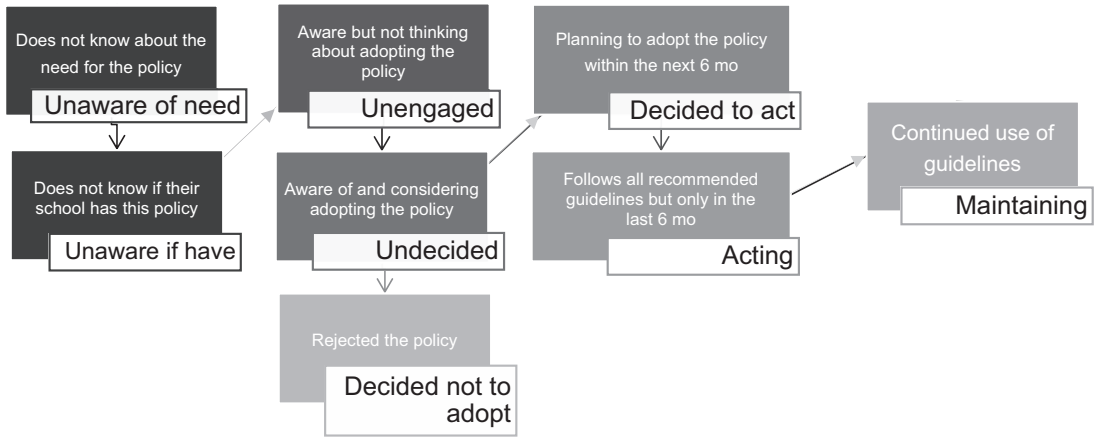

Figure 1. The precaution adoption process model, adapted and operationally defined for athletic trainers' policy adoption.

5% were categorized as unknown disability status.[3] These statistics have inspired and continue to warrant clinical intervention and research analysis.

Primary prevention methods (ie, rule changes and safety policies) have been successful at decreasing CSI, most notably in pole vaulting[4] and football.[5,6] Secondary prevention strategies (ie, spinal stabilization) for these injuries may be inconsistently applied, as specific recommendations vary.[6–11] Nevertheless, 3 areas of focus are typically emergency care, equipment removal, and routine practice of procedures and maintenance of equipment.[6–11] Several best-practice recommendations and consensus statements have been published to guide schools, athletic trainers (ATs), and medical providers in their development of emergency management policies for CSI.[6–11] Although consensus statements can be helpful, there may be confusion when conflicting information is presented across various documents. A qualitative study of ATs confirmed that inconsistencies in spine-boarding recommendations were affecting policy procedures and adoption.[12] Although the National Athletic Trainers' Association (NATA) position statement on CSI management[6] was published 14 years ago, authors of a recent study[13] reported an average score of only 59.3% on ATs' knowledge of CSI policy components. This lack of knowledge and confusion is of concern, as regular training and practice of emergency procedures are the duties of ATs as medical professionals.

To ensure regular training and practice of emergency management techniques, these components should be included in written CSI management policy and procedure documents.[6] In other domains, such as emergency action plans, exertional heat illnesses, and lightning, comprehensive policy and procedure adoption has been found to be low.[14–17] Athletic trainers employed in HSs have reported a variety of barriers to adoption of emergency action plans or other catastrophic injury policy components, including financial limitations, resistance from parents or guardians, liability for using them, resistance from coaches, and ATs not being employed full time.[14–17] Although the majority of previous studies have been focused on knowledge, barriers and facilitators, or implementation of these policies, recent authors[18] have approached this issue by assessing the decision-making of stakeholders through the use of health behavior models.

Two of the models previously used to better understand the athletic training profession are the health belief model and the precaution adoption process model (PAPM).[19] Although the health belief model allows for the understanding of how the perceptions of facilitators, barriers, and severity of the emergency influence likelihood to follow best practices, it does not address the readiness of ATs or stakeholders for adoption of these practices[19]; the PAPM, meanwhile, does.[19] More recently, the PAPM has been applied to ATs' decisions to adopt policy and procedure practices that impact patient care.[18,20,21] The PAPM typically classifies a person's behavior descriptors before acting on a decision into 7 stages, from *unaware of issue* to *maintenance*.[19] However, literature applying PAPM to ATs' adoption of best practices has expanded the number of stages to 8, splitting the *unaware* stage into 2 groups and adapting the wording to represent policy adoption (Figure 1).[18,20,21] Through use of the PAPM, we hope to describe ATs' health behaviors and identify areas that could benefit from upstream and root-cause interventions.

Athletic trainers have identified barriers to CSI policy adoption and struggled to correctly identify CSI policy components, yet the process of adopting comprehensive CSI management policies has yet to be described. Thus, the purpose of this study was to evaluate US HS ATs' knowledge of their HS's adoption of comprehensive spinal cord injury management policies. Secondarily, we aimed to investigate factors, facilitators, and barriers associated with development and adoption of policies and procedures as components of a written comprehensive policy.

METHODS

Researchers used a cross-sectional survey design to evaluate HSs' level of CSI policy adoption. Athletic trainers employed at HSs were purposively sampled and invited to participate in this study during the fall and spring of 1 academic year. This study was designated as exempt by the University of Connecticut institutional review board.

Participants

Recruitment of participants occurred through targeted emails and social media postings. Researchers sent invitations to ATs who participated in the Athletic Training

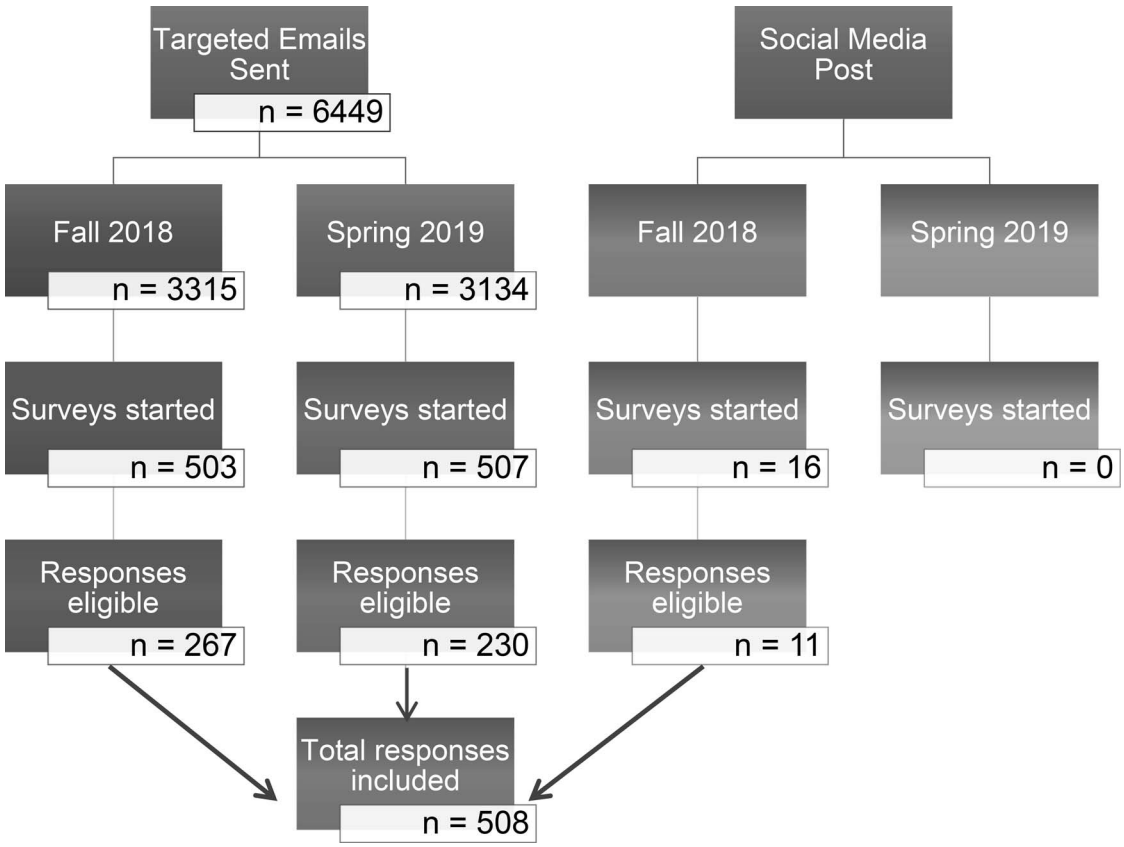

Figure 2. Survey distribution, responses, and eligibility for inclusion.

Locations and Services project via email a total of 3 times: the initial email and then 2 follow-up emails 2 weeks apart for both recruitment sessions (fall, n = 3315; spring, n = 3134).[22] Social media (Facebook, X [formerly Twitter], and Instagram) posts were published once a month for 2 months; posts received responses from participants only during fall (fall, n = 16; spring, n = 0). Our response rate for emails, not including incomplete surveys, was 8% in the fall and 7% in the spring. Because of the nature of social media platforms, the number of individual views or shares of the postings is unknown; therefore, a response rate was not calculated. After recruitment ended, all responses were combined, and those respondents not eligible for the survey (ie, non-AT or another clinical setting) and duplicate responses were removed. Duplicate responses were identified through use of unique identifiers assigned for those recruited by email and by comparing participant demographic data (state, sex, zip code, years in profession) of those recruited via social media. After the data cleaning, survey responses that were less than 80% complete, in addition to those that did not answer the CSI management questions, were removed. A total of 508 responses were included in this study (Figure 2).

Instrument

The survey included 2 sections (demographics and CSI) and was distributed via Qualtrics. Survey questions were developed by study authors with content (E.E.S.) and policy (S.E.S.-M.) expertise, and CSI management items were guided by the corresponding NATA position statement, providing face validity.[6] The survey was pilot tested with a sample of 5 ATs, resulting in changes to improve the clarity, relevance, and importance of the questionnaire. Athletic trainers were asked their demographics, employment and school characteristics, CSI management policy components, and facilitators or barriers to CSI management policy adoption. Survey items inquiring about policy components were developed using the PAPM (Figure 1).[19] The PAPM was used because of its ability to identify factors influencing an AT's ability to facilitate adoption or change in policies at their workplaces.

Questions for school zip code, AT age, and number of students were "fill in the blank." Questions on barriers and facilitators to implementation of all CSI policy components were "select all that apply." For this research, policy adoption was categorized as adopting or not adopting. *Adopting* was defined as reporting acting or maintaining from the PAPM. *Not adopting* was then defined as any response that fell into the 6 remaining PAPM stages (*unaware of need* through *deciding to act*).

Statistical Analysis

Descriptive statistics generated in the form of frequencies and proportions were calculated for most AT demographics and school characteristics, with means and SDs being used for AT age and number of students. Proportions with 95% CIs were used to present individual PAPM stages, adoption of policy components, facilitators, and barriers. To determine if the adoption of the practice and maintenance of AT skills policy component differed by ATs' age or number of enrolled students, variables were analyzed

Table 1. Characteristics of Athletic Trainers (ATs)

Characteristic	% (No.)
Sex (n = 507)	
Male	49.1 (249)
Female	50.1 (254)
Prefer not to disclose	0.8 (4)
Race (n = 506)	
American Indian or Alaska Native	0.2 (1)
Asian	0.8 (4)
Black/African American	1.0 (5)
Hispanic/Latino	1.8 (9)
Native Hawaiian/Pacific Islander	0.2 (1)
White/Caucasian	93.5 (473)
Mixed race	0.4 (2)
Other	0.8 (4)
Prefer not to disclose	1.4 (7)
Years in role at current high school (n = 507)	
<1	4.1 (21)
1–5	28.6 (145)
6–10	22.3 (113)
11–15	16.1 (82)
≥15	28.7 (146)
Years in athletic training profession (n = 508)	
<1	0.2 (1)
1–5	9.8 (50)
6–10	16.7 (85)
11–15	18.3 (93)
≥15	54.9 (279)
AT involved in care of athlete with spinal cord injury (n = 506)	
Yes	78.1 (395)
No	21.9 (111)

Table 2. High School (HS) Characteristics Reported by Athletic Trainers

Characteristics	% (No.)
Type of HS (n = 506)	
Public	81.3 (413)
Private	16.7 (85)
Charter	1.0 (5)
Magnet	0.4 (2)
Other	0.2 (1)
HS has a history of athlete spinal cord injury (n = 508)	
Yes	36.4 (185)
No	45.7 (232)
I am not sure	17.9 (91)
Comprehensive spinal cord injury policy is coordinated with local emergency management system (n = 508)	
Yes	59.3 (301)
No	26.2 (133)
I am not sure	7.3 (37)
Not applicable	7.3 (37)
Practice and maintenance of equipment-removal skills are documented (n = 508)	
Yes	36.2 (184)
No	43.7 (222)
I am not sure	10.4 (53)
Not applicable	9.6 (49)
Current transportation method used for spine-injured athletes (n = 507)	
Rigid immobilization device	65.5 (332)
Nonrigid immobilization device	28.6 (145)
Other	22.3 (113)
State requires schools to have policies for spinal cord injury management (n = 507)	
Yes	15.0 (76)
No	44.2 (224)
Not sure	40.8 (207)

using the Welch *t* test. The Welch *t* test was selected as the Levene test for homogeneity of variance resulted in $P > .05$, indicating that this assumption was violated. A 1-sided *t* test with 95% CIs was used to determine if AT age and the number of students enrolled differed between those adopting or not adopting a comprehensive CSI plan and emergency tools to remove athletic equipment. Pearson χ^2 analyses were used to establish if associations existed between all policy components and the following variables: years in the profession, years at their HS, sex, coordination of the spinal cord injury policy with emergency medical services (EMS), and HS setting. Both years in the profession and years at their current HS were viewed as ordinal data because of the use of multiple-choice categories for each question (categories listed in Table 1). These variables were dichotomized at natural cut points to perform χ^2 analyses: years in in the profession (dichotomized as *0–10 years* [55.2%] and *11+ years* [44.8%]) and years at their current HS (dichotomized as *0–15 years* [45.1%] and *15+ years* [54.9%]). Natural cut points were determined by observing the cumulative percentages across categories and determining where this would be closest to 50%. High school setting was dichotomized by grouping setting as *public* (81.3%) and *nonpublic* (18.7%) with all policy components. Sex was dichotomized by excluding those who preferred not to disclose (0.8%, n = 4) or did not answer (0.2%, n = 1) because of insufficient data, resulting in sex being presented as *male* (49.5%) or *female* (50.1%). Coordination of the spinal cord injury policy was dichotomized into *yes* (59.3%) and *no* (40.7%), with *I'm not sure* or *not applicable* being recoded as *no*. A *P* value of <.05 was used to determine statistical significance. Statistical analysis was performed using IBM SPSS (version 28).

RESULTS

Responses (n = 508) represented ATs in 46 states plus the District of Columbia (n = 501); the remainder were from unknown states (n = 7). The states with the most respondents were Texas (10.2%, n = 52), Pennsylvania (7.3%, n = 37), South Carolina (5.9%, n = 30), California (5.1%, n = 26), and New Jersey (5.1%, n = 26). Respondents were primarily White (93.5%, n = 474), with an average age of 41 ± 10 years. Most ATs had previously been involved in the care of an athlete with a CSI (78.1%, n = 395).

A majority of ATs reported that, at their current HSs, they coordinated their spinal cord injury policies with local EMS (59.3%, n = 301), and a plurality reported that the HS had no history of an athlete spinal cord injury (45.7%, n = 232) and that the practice and maintenance of equipment-removal skills were not documented (43.7%, n = 222). Additional AT and HS characteristics are reported in Tables 1 and 2, respectively.

Adoption of CSI Policy Components

Nearly one-third of ATs reported policies that did not contain all 3 components of a CSI management policy (33.1%, n = 168; 95% CI = 29.0%, 37.1%). The most

Table 3. Athletic Trainers' (N = 508) Precaution Adoption Process Model (PAPM) Response by Cervical Spine Injury Policy Component

Policy Component	PAPM Stage, % (No.) [95% CI]							
	Unaware We Needed	Unaware If We Have	Decided Not to Act	Unengaged	Undecided	Decided to Act	Acting	Maintaining
Comprehensive plans for immediate care of a potential severe head or spine injury are in place (n = 507)	2.0 (10) [0.8, 3.2]	2.0 (10) [0.8, 3.3]	2.2 (11) [1.0, 3.5]	2.6 (13) [1.4, 3.9]	2.6 (13) [1.2, 3.9]	3.2 (16) [1.8, 4.7]	2.0 (10) [0.8, 3.1]	83.6 (424) [80.1, 87.0]
Emergency equipment to remove face mask, helmet, and shoulder pads is on-site and in working order (n = 507)	2.6 (13) [1.4, 4.1]	2.6 (13) [1.2, 3.9]	2.4 (12) [1.2, 3.9]	3.8 (19) [2.2, 5.5]	2.4 (12) [1.2, 3.7]	2.0 (10) [0.8, 3.2]	1.8 (9) [0.8, 3.0]	82.6 (418) [79.2, 86.0]
Policies are in place for health care professionals to practice and maintain equipment-removal skills regularly (n = 504)	6.8 (34) [4.6, 9.1]	3.8 (19) [2.2, 5.6]	4.6 (23) [2.8, 6.3]	5.8 (29) [3.8, 7.9]	5.2 (26) [3.4, 7.3]	5.6 (28) [3.6, 7.5]	2.0 (10) [0.8, 3.4]	66.4 (334) [62.5, 70.4]

adopted policy component, at 85.6%, was a comprehensive plan for immediate care (n = 434 of 507; 95% CI = 82.6%, 88.6%). Of the respondents, 84.4% reported adopting a policy requiring emergency tools to remove sports equipment on-site and for those tools to be maintained in working order (n = 427 of 506; 95% CI = 81.0%, 87.4%). Athletic trainers reported adoption of the practice and maintenance of equipment-removal skills component at a lower level, with only 68.4% adopting (n = 344 of 503; 95% CI = 64.2%, 72.6%). The greatest proportion of ATs reported being in the PAPM stage of *maintaining* for all 3 policy components: comprehensive plans for immediate care (83.6%, n = 424 of 507; 95% CI = 80.2%, 87.0%), emergency tools for equipment removal (82.6%, n = 418 of 507; 95% CI = 79.2%, 86.0%), and practice and maintenance of equipment-removal skills (66.4%, n = 334 of 504; 95% CI = 62.5%, 70.4%). The PAPM stage with the next highest proportion of ATs reporting was *unaware of need* for the practice and maintenance of equipment-removal skills (6.8%, n = 34 of 504; 95% CI = 4.6%, 9.1%). Additional information on the proportion of ATs reporting each PAPM stage for CSI management policy components can be found in Table 3.

Differences in age between those adopting (41 ± 10 years) and not adopting (43 ± 10 years) a written emergency equipment policy existed (t = 1.905; 95% CI = −0.08, 5.01; P = .03), with those 41 ± 10 years old being more likely to adopt with a low magnitude effect ($g_{Hedges} = 0.191$). No differences were reported with AT age between those adopting or not adopting comprehensive plans for immediate care (P = .08) or the practice and maintenance of equipment-removal skill components (P = .19). No difference was observed in the number of students enrolled in the HS for those ATs adopting or not adopting any of the 3 CSI management policy components: comprehensive plans for immediate care, emergency tools for equipment removal, and practice and maintenance of equipment-removal skills ($P > .05$).

There was a statistically significant association between ATs who coordinated spinal cord injury policies with EMS and the adoption of the policy component for comprehensive plans for immediate care ($\chi^2_1 = 49.56$, $P < .001$), emergency tools for athletic equipment removal ($\chi^2_1 = 41.49$, $P < .001$), and the practice and maintenance of equipment-removal skills ($\chi^2_1 = 86.12$, $P < .001$). No differences between years in the profession, years at their HS, ATs' sex, or HS type were identified for any of the policy components ($P > .05$).

Facilitators and Barriers to Adoption of CSI Policy Components

Almost two-thirds of ATs reported that a positive relationship with EMS (66.5%, n = 338; 95% CI = 62.4%, 70.7%) was a facilitator to adoption of CSI management policies. Nearly half reported that having support from another medical professional (47.4%, n = 241; 95% CI = 43.0%, 51.9%) and having support from someone in an authoritative position at the school facilitated CSI policy adoption (46.1%, n = 234; 95% CI = 41.7%, 50.2%). Other reported facilitators of CSI management policy adoption were seeing how other schools facilitated training (39.4%, n = 200; 95% CI = 34.8%, 43.5%) and improved

Table 4. Facilitators and Barriers to Implementation of Cervical Spine Injury Management Policies in High Schools (n = 508)

Facilitators and Barriers	% (No.)	95% CI
Facilitators		
Having medical professional(s) (ie, athletic trainer) at the school	47.4 (241)	43.0, 51.9
Support from someone in an authoritative position (coach, nurse, school leader, etc)	46.1 (234)	41.7, 50.2
Seeing how other schools/programs facilitate training/equipment for cervical spine injuries	39.4 (200)	34.8, 43.5
Positive relationship with emergency medical services (EMS)	66.5 (338)	62.4, 70.7
Improved resources from national organizations	36.6 (186)	32.3, 40.9
Nothing would make it easier	6.1 (31)	3.9, 8.3
Barriers		
Resistance or apprehension from head coaches	10.6 (54)	8.1, 13.2
Resistance or apprehension from parents or legal guardians	2.8 (14)	1.6, 4.3
Financial limitations	15.2 (77)	12.0, 18.5
My school does not have the time to train the coaches and school personnel	11.2 (57)	8.5, 14.0
My school does not have the time to educate the parents or legal guardians	2.6 (13)	1.4, 3.9
My school would need more information, resources, assistance, etc	17.9 (91)	14.8, 21.5
Not comfortable with the skill in the prehospital setting	3.3 (17)	2.0, 4.9
Challenges in coordination of management plans with EMS	42.5 (216)	38.2, 46.9
Liability	11.8 (60)	9.1, 15.0
Lack of consensus across health care professionals for best practice	30.5 (155)	26.6, 34.3

resources from national organizations (36.6%, n = 186; 95% CI = 32.3%, 40.9%).

The most reported barrier to policy adoption from ATs was challenges with their local EMS (42.5%, n = 216; 95% CI = 38.2%, 46.9%). Other reported barriers to policy adoption included lack of health care provider consensus (30.5%, n = 155; 95% CI = 26.6%, 34.3%) and needing more information or resources for the school (17.9%, n = 91; 95% CI = 14.8%, 21.5%). Additional facilitators and barriers and their reported frequencies and proportions can be found in Table 4.

DISCUSSION

Cervical spine injury is one of the most frequently reported direct catastrophic sport injuries.[23] Although these injuries continue to be the focus of medical organizations' recommendations,[6,7,9,11] ATs' knowledge of the best practices for the prehospital management of CSI remains low.[13] Given this lack of knowledge on best practices, we investigated US HS ATs' adoption of these principles through their inclusion of CSI management policy components and factors associated with this process. Primary findings of this study were that, despite approximately a decade since dissemination of CSI recommendations, 33.1% of ATs did not have comprehensive CSI management policies that included all 3 policy components. Policies requiring the practice and maintenance of equipment-removal skills were most frequently missing from the CSI management policies. Through use of the PAPM, we identified that most ATs had policies that were in the *maintaining* stage for all 3 components: comprehensive plans for immediate care of a severe head injury or CSI (83.6%), emergency equipment to remove face masks, helmets, and shoulder pads that is on-site and working (82.6%), and policies for health care professionals to practice and maintain equipment-removal skills (66.4%). Coordination of CSI management policies with EMS was associated with the adoption of each of the 3 CSI management policy components.

Adoption of CSI Policy Components

Even though a third of ATs had not adopted comprehensive policies, the majority of ATs providing care at HSs had adopted individual policy components, including comprehensive plans for immediate care of CSI or head injuries. Although ATs reported adopting CSI care plans, nearly a quarter of ATs reported they used immobilization methods other than soft or hard spinal immobilization. This finding is especially concerning because the most recent spine injury consensus statement reaffirms that vacuum or hard spine boards are the supported immobilization methods before hospital transport.[8] A large percentage of ATs (78.1%) reported that they had had previous involvement in the care of an athlete with a CSI, with a small proportion (36.4%) reporting that the HS they are employed by had a history of athletes with CSIs. Although the percentage of ATs reporting involvement in the care of CSI is higher than expected, the percentage of those with a history of CSI at the HS where they were currently employed more closely reflects reported CSI injury rates.[2] We suspect that ATs may have interpreted the question to mean "suspected" or "initially assessed" a CSI rather than providing care to an individual with a final diagnosis of CSI. It is also possible that ATs provided care to an individual with a CSI in a setting outside of the HS where they were currently employed.

Most ATs had policies requiring emergency equipment for removing sports gear (ie, helmets, face masks, and shoulder pads) to be on-site and functional. We found that younger ATs were more likely to have policy components describing emergency tools for the removal of sports equipment. However, we do not believe the difference in the mean age between the groups is a meaningful finding because of the large overlap between average ages and the small-magnitude effect. The large proportion of ATs adopting this policy may be due to some overlap in best-practice recommendations with the NATA 2015 official statement on changes to CSI prehospital care.[7] In this statement, the NATA addressed prehospital removal of athletic equipment based on changes to spine-boarding protocols and cardiopulmonary resuscitation guidelines

that prioritized access to the chest for automated external defibrillator pad placement and compressions.[7]

Although comprehensive plans and emergency equipment for removal of sports gear had high proportions of adoption, almost a third of ATs had not adopted policies that included requirements for regular practice and maintenance of equipment-removal skills. Of those not adopting the policy, 6.8% were unaware that they needed this policy component, making it the policy with the highest proportion of the PAPM stage *unaware of need*. Although the PAPM has allowed for identification of this lack of knowledge, it was not as useful at identifying differences in readiness to act, as has been the case for policies with lower levels of adoption, such as exertional heat stroke.[16] The PAPM may be a more useful model for topics surrounded by more controversy, when individuals are more likely to be in early stages of readiness.

When analyzing policies with established and less controversial guidelines, it may be more beneficial to examine the implementation and knowledge of individual policy procedures. For example, a recent qualitative analysis of Pennsylvania HS concussion protocol documents reported that 23% contained all mandatory state law tenets and 50% of protocols did not include language on concussion education for coaches, parents, or student-athletes.[17] We found that approximately 41% of ATs were *not sure* if their states required CSI management policies and that documentation and practice of equipment-removal skills had the highest reports of *unaware of need*. Overall, adoption of this component may have the largest impact on CSI outcomes. In the prehospital setting, it was previously established that face-mask removal was safer than helmet removal for football players because of less spinal motion, ease of access for airway ventilation, and taking less time to perform.[24] Evidence supports regular continuing education and practice, as ATs who participated in continuing education opportunities on appropriate care of CSI in athletes have previously obtained higher composite knowledge scores than those who did not.[13] Although practice is essential for skills associated with CSI management, performing and improving equipment-removal skills would theoretically improve mortality and morbidity outcome measures.

The removal of the chest protector delays the initiation of chest compressions; however, keeping equipment on during cardiopulmonary resuscitation is not feasible, as it prevents full chest recoil and delays ventilation efficacy.[25,26] Similar analysis on those wearing equipment with quick-release mechanisms for the helmet, face masks, and shoulder pads found that these attachments allow for clinically acceptable removal times without compromising the spine further or increasing the task difficulty.[27] Due to the changes in evidence and recommendations for equipment removal, ATs must maintain training, education, and practice of these skills.[9] A lack of training can be a barrier to prehospital equipment removal.[28] In the present study, only 36.2% of ATs reported that they documented regular practice of equipment-removal skills. Without documentation of these skills, fulfilling duty of care would be challenging. A 2013 lawsuit demonstrates how poor staff training sessions can result in negligence claims. Crystal Dixon, the mother of a 13-year-old football player, filed a complaint against the Pop Warner corporation after her son suffered a CSI resulting in quadriplegia.[29,30] The complaint alleged that the Pop Warner organization failed to properly train or supervise its coaches against implementing negligent training techniques (head-down tackling).[29,30] In 2016, Dixon agreed to a settlement of over 1 million dollars in her lawsuit against Pop Warner.[29] This lawsuit provides an example demonstrating that, even if a policy on training athletics staff on emergency prevention or management is in place, it does not mean providers adhere to its content. To prevent a similar situation from occurring within an HS athletic setting, documenting which health care providers, coaches, and staff are involved in practicing the removal of equipment is crucial.

Facilitators and Barriers to Adoption of CSI Policy Components

The most reported facilitator of CSI management policy adoption was a positive relationship with EMS (66.5%), and the most reported barrier was the coordination of CSI management plans with EMS (42.5%). The present study determined associations between EMS involvement in the coordination of CSI management and the adoption of each of the 3 CSI management policy components. Local EMS personnel are some of the most important allied health professionals ATs should include in CSI management policy development and planning[6,7,9]; this is imperative in the HS setting, where EMS activation is more frequent.[31] Although over half (59%) of ATs in our study reported coordinating CSI policies with local EMS, HS ATs have reported fewer annual preseason planning and practice sessions with local EMS than collegiate ATs.[31] Athletic trainers in an HS setting have also reported more frequently perceived episodes of inappropriate care and on-field disagreement meetings with EMS than collegiate ATs[31] and described lacking confidence in EMS personnel's ability to remove sports equipment.[28] Emergency medical services personnel have expressed little understanding of the emergency care training and skills that ATs possess.[32] The disconnect between EMS and ATs in previous research and supported by our results is of clinical concern.

Of injuries requiring emergency transport, those to the head, face, or neck and those occurring at the HS level require more frequent transport.[33] When responding to on-field injuries, EMS personnel have reported that policies are their guiding factor for responding to the scenario and that previous experiences with ATs guide how much they trust them,[32] making it more concerning that ATs report practicing equipment removal with EMS infrequently.[28] Current recommendations indicate that at least 2 trained personnel should be involved in the removal of a face mask, helmet, or both—1 to remove the equipment and 1 to preserve in-line stabilization of the cervical spine.[8] The number of trained personnel recommended for shoulder pad removal in an athlete with a CSI varies by removal method, with at least 4 trained persons recommended for the torso-tilt method and at least 2 trained persons for the flat-torso method.[8] Though data support the removal of equipment, previous recommendations for keeping equipment on may be cause for confusion among ATs.[12] This aligns with ATs reporting a lack of consensus across health care professionals for best practices as the second most frequent barrier to CSI

management policy adoption and may influence the involvement of EMS in these practices. It is crucial that ATs implement regular practice of CSI management policies with EMS to increase trust, establish professional relationships, and improve policy component adoption.

Limitations

Although this study is one of the few to look at the adoption of CSI management policies rather than an individual facet, it is not without limitations. We collected the survey data before the release of the current Spine Injury in Sport Group consensus statement.[8] Although a weakness of this study is that it focuses solely on ATs' readiness to adopt, we were able to use a health behavior model to better understand ATs' actual adoption of CSI management policies. Authors of future research would benefit from applying this survey model to others involved in CSI management or policy and clarifying the route of employment of the AT in the HS setting (by the HS versus clinical outreach). Surveying local EMS and athletics administrators and directors could allow us to gain a better perspective about readiness to adopt these policies on a larger scale. Although the PAPM was useful in identifying that the maintenance and practice of equipment-removal skills had the highest reported levels of *unaware*, it was not as informative for the other 2 policy components. As these components had high levels of policy adoption, future authors should consider exploring the implementation of all 3 policy components.

CONCLUSIONS

Although most ATs were likely to adopt comprehensive CSI management policies, a significant percentage were missing key policy components. The inclusion of EMS in CSI management policy planning is associated with adoption of all policy components, as well as being the most frequently identified facilitator of and barrier to policy adoption. Additional insight into the relationship between ATs and local EMS is needed to develop strategies for establishing more continuity and collaboration in the care of athletes experiencing CSIs.

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Address correspondence to Courtney M. Meyer, MS, ATC, Exercise Science, University of South Carolina, 921 Assembly Street, Columbia Public Health Research Center, Columbia, SC 29201. Address email to cmmeyer@email.sc.edu.