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ORIGINAL RESEARCH

Emergency Health Care Providers Lack Knowledge About Managing the Spine-Injured Athlete

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Context: Current practice in management of the spine-injured athletes appears to be inconsistent with literature. Moreover, evidence expands faster than integration into instruction, practice, and evaluation, likely leading to an overall lack of knowledge, both perceived and actual.

Objective: The primary purpose was to evaluate athletic trainers' (ATs), paramedics', emergency medical technicians' (EMTs), and dual-credentialed personnel's actual and perceived knowledge regarding management of the spine-injured athlete.

Design: Cross-sectional.

Setting: Web-based knowledge assessment

Patients or Other Participants: We recruited participants (N = 1305) from the National Athletic Trainers' Association, Facebook, and Twitter. Only those participants (N = 785, 60.2% completion rate) who completed the actual knowledge assessment were used in analysis (age = 35.5 ± 10.8 years, male = 378 [48.2%], female = 375 [47.8%], sex not indicated = 32 [4.1%], ATs = 726, emergency personnel = 30, dual credentialed = 29).

Main Outcome Measure(s): We measured perceived and actual knowledge (10 items, 9 scored) among participants and compared subgroups (ATs, emergency personnel [paramedics and EMTs], and dual credentialed [AT and either paramedic or EMT]).

Results: Participants performed poorly on the actual knowledge assessment (5.5 ± 1.2, 60.8% ± 13.5%). Participants had limited change between preassessment perceived knowledge (5.0 ± 0.7) and postassessment perceived knowledge (4.7 ± 0.8).

Conclusions: We identified that participants performed poorly on the actual knowledge assessment, indicating the need for more preparation and continued training in managing spine-injured athletes. Interprofessional practice and education may improve knowledge and behavioral skills, given that diverse training and increased exposure to spine boarding likely contributed to higher performance. A lack of actual knowledge, particularly regarding life-preserving skills for spine-injury management, has potentially serious consequences for patients.

Key Words: Continuing education, emergency care, actual knowledge, perceived knowledge, knowledge gap

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Emergency Health Care Providers Lack Knowledge About Managing the Spine-Injured Athlete

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KEY POINTS

- Athletic trainers and emergency personnel perceived they were skilled in the management of a spine-injured athlete, yet performed poorly on the actual knowledge assessment.
- Athletic trainers rarely perform the skill of spine boarding during clinical practice and must frequently practice the skill to minimize skill decay.
- Interprofessional collaboration and education may improve the knowledge and clinical skills of health care providers to address this knowledge gap.

INTRODUCTION

The National Spinal Cord Injury Statistical Center reports that approximately 12 500 cases of spinal cord injury (SCI) occur each year in the United States.[1] Of these 12 500 cases, 9% are attributed to sports participation.[1] Although accounting for only a small percentage of injuries sustained within athletics, injuries that occur to the neck or spine can have life-threatening implications requiring appropriate intervention for optimal outcomes. Immediate treatment and care of an SCI should be performed accurately to minimize morbidity, based on current evidence.[2]

Trained medical professionals such as athletic trainers (ATs), paramedics, and emergency medical technicians (EMTs) are typically the first to treat patients with SCI emergencies.[3] Numerous methods of moving the spine-injured patient from the field or court to prehospital transportation exist in the literature.[4–7] Two of the most commonly used techniques are the log roll and the 8-person lift (formerly the 6+ person lift); however common use does not always correlate with best practice.[8] Research suggests that certain methods, including the log roll and scoop stretchers, are more likely to result in additional spinal movement, therefore putting the patient at increased risk of life-altering injury.[2,3,9]

Practicing ATs, paramedics, and EMTs must remain current with best evidence for spine boarding to provide the most effective treatments and positive results for the patient. Recommendations for the optimal technique are continually modified based on new evidence. According to standards, when there is a conflict between new evidence and standard practice, EMTs and paramedics are guided to use the log roll or a lifting technique.[10] In athletic training, the position statement recommends that the practitioner use the technique that produces the least amount of spinal movement that has been reviewed and rehearsed.[3] Ideally, the health care providers are trained and have practiced the most up-to-date and evidence-based techniques for managing spine injuries in athletes.

One unified spine-boarding method for all patients is not identified in the most recent position statement because patient size, location, and situational demands vary, requiring different clinical practices.[3] In addition, emergency medical personnel such as paramedics and EMTs lack systematic policy comparable with the position statements for ATs. Policy is created at a local and state level. Thus, current evidence should be disseminated through continuing education (CE) opportunities, both formal and informal, as well as locally and nationally.

Recent literature suggests that updates to the most recent National Athletic Trainers' Association (NATA) position statement on the acute management of cervical spine–injured athletes[3] are necessary. Yet it is unclear whether the current procedures have been effectively disseminated. Clinicians may be unaware of the best evidence, and although some mechanisms exist to disseminate information, there is no current CE mechanism to ensure the information is received, consumed, and practiced by all clinicians, so a knowledge gap forms. A knowledge gap is defined as the relationship between actual and perceived knowledge.[11,12] Understanding the clinicians' actual and perceived knowledge is critical in examining patient needs at an individual level, but can also help identify the CE needs of practicing clinicians. Updates to the NATA position statement theoretically enhance clinical practice, but only if the information is disseminated and consumed. At present, clinicians must determine their own knowledge gaps and select CE to account for their own needs. Current literature suggests that self-selected CE is not an effective strategy to gain or enhance the knowledge that is being recommended.[11,12] The purpose of the study was to determine if clinicians, including ATs, paramedics, and EMTs, are knowledgeable about the best practices for managing the spine-injured athlete. Additionally, the rate at which health care professional spine board was studied.

METHODS

Research Design

We used a cross-sectional educational assessment to achieve 4 purposes: (1) evaluate actual knowledge among various emergency health care providers, (2) assess for a knowledge gap (the relationship between perceived and actual knowledge),[11,12] (3) compare pretest and posttest perceived knowledge, and (4) identify the rate at which various health professionals have spine boarded spine-injured athletes. In assessing posttest perceived knowledge, it is possible that we can gain insight into whether participants are likely to pursue CE in this area because of the change in perception.[12]

Participants

We recruited emergency personnel (paramedics and EMTs) using social media (Facebook and Twitter) only, as no professional organizations were willing to distribute the educational assessment to this population. We recruited ATs through the NATA research survey service and social media

posts on Facebook and Twitter. Institutional review board approval was received before we began data collection. Because of the nature of social media, we were not able to identify total engagements (shares, comments, etc) or the number of potential participants who viewed these posts. As a result of this limitation, combined with an unknown number of undeliverable e-mails sent from the NATA, we were not able to calculate an accurate response rate.

Instrumentation

We used Qualtrics (Provo, UT), an online survey platform, to construct an electronic educational assessment. Participants were asked to complete demographic information including age, gender, years of experience, credentials, job setting, level of education, spine-boarding history, and current region of practice. The tool included a perceived knowledge questionnaire (PKQ). The PKQ was modified from Flynn and Goldsmith's[13] 5-item subject knowledge assessment tool. Using a modified 6-point Likert scale, the participants rated their perception of their ability to perform spine-boarding protocol and procedures. Based on previous literature, this 6-point scale (6 = *strongly agree* to 1 = *strongly disagree*) can eliminate the centralized option and depicts strong correlation and greater variance in participants' responses.[13] The PKQ was provided at the beginning of the survey and after the actual knowledge assessment (AKA). The AKA instrument (Table 1) included knowledge retrieval (3 items), comprehension (3 items) and knowledge use (3 items) questions.

We validated the AKA using a Delphi panel (N = 4 experts) with researchers, both ATs and paramedics, with over 65 total publications regarding emergency care and spine management techniques. The Delphi panel technique has long been used across medical research to establish expert consensus.[14] Our Delphi panel included 2 rounds of review by each of the 4 experts. After the experts came to consensus on the 9 items (plus 1 question not included in scored analysis), we used a factor analysis (Table 2) to assess whether participants answered similarly to like questions. The factor analysis identified 4 factors that assumed 55.4% of the variance. Factor 1 indicated items 1 and 3 resulted in consistent responses (17.4%) regarding a prone patient. Items 2, 4, and 7 depicted consistent results in factor 2 (13.7%) for traditional spine-boarding techniques. Factor 3 resulted in consistent responses (12.8%) regarding new evidence and techniques for spine boarding. Factor 4, item 8 (11.6%), represented new evidence that has not necessarily been well communicated across the emergency health care provider community. Items aligning with each other shared similar content or approaches to spine boarding and acknowledged that participants answered similarly within those areas.

Procedures

We posted 100 tweets on Twitter through the Indiana State University Athletic Training Program's Twitter page (@isuathltraining). We addressed the tweets to 188 organizations. We also posted to the following Facebook sites (No. of posts): Athletic Trainers 4 Athletic Trainers (2), NATA (1), Paramedics on Facebook community group (1) and Paramedics on Facebook closed group (1). New literature suggests that social media is a viable option for the distribution of surveys.[15] Through the popular social media sites of Twitter and Facebook, we mass communicated a short introduction as well as a link to the survey for potential participants.

The NATA e-mailed the informed consent and a link to the educational assessment to 5 random samples of NATA members (each sample contained 1000 members). Randomization included members who worked in the college/university setting, secondary school setting, professional athletics, performing arts, amateur/recreational/youth sports, and the military/law enforcement/government. These members consisted of those who were certified, associate members, certified students, noncertified students, international noncertified members, and international certified members. All 10 NATA districts were studied as well as all international members who met the previous criteria. Retired clinicians were excluded from the study. The NATA e-mailed reminders to each sample after 2 weeks. Participants had access to the survey for a span of 10 weeks. We downloaded the data and analyzed completed responses.

Statistical Analysis

We recruited participants (N = 1305) from e-mail and social media posts on Facebook and Twitter. Not all participants provided responses for all questions, but demographic analyses were completed with partial data. In order for a participant to be included within this study, the participant had to have completed the entire knowledge assessment. A total of 785 data sets were used for analysis of the key variables of interest (actual knowledge, perceived knowledge, and discipline). We analyzed the data using descriptive statistics for knowledge items, including the mean and standard deviation. We used separate, nonparametric Kruskal-Wallis tests to compare actual knowledge scores from the different disciplines. We assessed the relationship between perceived and actual knowledge using the Spearman ρ correlation. We used a Wilcoxon repeated-measures analysis to compare groups between the pretest and posttest measures of perceived knowledge. Analysis were considered significant if $P < .05$.

RESULTS

Participants included 378 men (48.2%) and 375 women (47.8%); 32 (4.1%) did not answer this question. The majority of participants were ATs (n = 726), followed by emergency personnel (n = 30) and dual-credentialed (AT/EMT or AT/paramedic) health care workers (n = 29). The average age of the participant was 35.5 ± 10.8 years (n = 783).

Participants as a whole performed poorly on the AKA (5.5 ± 1.2 of 9, 60.8% ± 13.5%). We identified statistical differences ($df = 3$, $\chi^2 = 8.150$, $P = .043$) between the subgroups on actual knowledge total scores. Dual-credentialed clinicians scored the highest on the AKA (5.7 ± 0.2 of 9, 63.3% ± 18%), followed by ATs (5.5 ± 0.5 of 9, 60% ± 45%), and emergency personnel (5.1 ± 0.2 of 9, 56.7% ± 18%). We identified a poor and insignificant relationship between preassessment perceived knowledge and actual knowledge (Spearman $\rho = 0.054$, $P = .149$). We identified a statistically significant decrease from preassessment (5.0 ± 0.7) to postassessment perceived knowledge (4.7 ± 0.8; $Z = -15.357$, $P < .001$, ES = 0.64, $1 - \beta = 1.000$).

Table 1. Actual Knowledge Questionnaire

Question	Possible Answer Choices
1. Providing there is the required number of clinicians to assist, which method of spine boarding is the best according to evidence-based medicine for an athlete that is prone?	6-man lift/lift and slide Log roll Prone log roll push Prone log roll pull
2. Providing there is the required number of clinicians to assist, which method spine boarding is best according to evidence-based medicine for an athlete that is supine?	6-man lift/lift and slide Log roll Prone log roll push Prone log roll pull
3. A 15-year-old male football player received a blind-side blow that resulted in whiplash and the head subsequently hit the ground. The athletic training staff immediately responded to the situation and found the athlete lying supine with his head tilted to the side lying in the middle of the field. The patient reported pain around C4/C5 and associated neurological deficits. The decision was made to spine board the athlete. On site there are a certified athletic trainer, 2 students, and 2 paramedics that arrived on the scene who are all trained in spine boarding. Should the athlete's helmet be removed on the field?	No. Only in situations where the face mask cannot be removed and the airway is compromised should the helmet be removed. Yes. All football helmets should always be removed.
4. A 22-year-old collegiate male soccer player was heading a soccer ball when he collided with an opponent. The athlete was reported blacking out and was dazed and confused. His head was tilted toward his shoulder. He did not seem to be in much pain but was too incoherent to gather more information. The patient is prone with his head facing the left side of his body. Along with the certified athletic trainer, 1 student and 2 paramedics have arrived to assist in the injury. What method of spine boarding should be performed for this athlete?	Log roll/lift and slide 6-man lift Prone log roll push Prone log roll pull This athlete does not need to be spine boarded.
5. With the head tilted to the side, what should the clinician's decision be regarding the alignment of the head?	The athlete should be spine boarded in the exact position found. The athlete's head should always be moved into spinal neutral. The athlete's head should be moved into spinal neutral as long as there is no blocking feeling or increasing neurological signs and symptoms.
6. The patient is lying prone. With a clinician stabilizing the head, 3 other clinicians roll the patient away while a spine board is then placed underneath the athlete. Together, the athlete/patient is then slowly lowered onto the board by the medical staff. What type of spine boarding method does this describe?	Log roll/lift and slide Prone log roll push Prone log roll pull 6-man lift
7. The athlete/patient is lying supine on the ground. With a clinician stabilizing the head, 5 other clinicians assist in simultaneously lifting the patient up while the spine board is placed underneath. What type of spine boarding method does this describe?	Log roll/lift and slide 6-man lift Prone log roll push Prone log roll pull
8. The athlete/patient is lying supine on the ground. With a clinician stabilizing the head, 3 other clinicians lift the patient onto the side while a spine board is then placed underneath the athlete. Together, the athlete/patient is then slowly lowered onto the board by the medical staff. What type of spine boarding method does this describe?	Log roll/lift and slide Prone log roll push Prone log roll pull 6-man lift
9. An athlete can be properly ventilated with the helmet still in place but the face mask removed.	True False
10. In the event that an athlete's helmet must be removed, what should occur with the rest of the equipment?[a]	No other changes should happen; the helmet removal is sufficient. The shoulder pads must also be removed. A towel or like object may be placed under the athlete's head to fill the void left by the helmet.

[a] Question 10 was not used in the actual knowledge assessment but was used for other descriptive purposes.

Table 2. Factor Analysis of Actual Knowledge Assessment

Question	Factor 1: Prone Patient	Factor 2: Traditional Spine Boarding Techniques	Factor 3: New Evidence and Techniques for Spine Boarding	Factor 4: New Evidence Not Well Known to Clinicians
1	0.826[a]	−0.047	0.128	0.155
2	−0.048	0.587[a]	0.403	0.137
3	0.820[a]	−0.181	0.119	0.139
4	0.062	0.597[a]	0.073	0.466
5	−0.389	−0.214	0.419[a]	0.390
6	0.087	0.363	0.444[a]	−0.306
7	0.191	0.406[a]	−0.485	−0.334
8	−0.033	−0.024	−0.468	0.636[a]
9	0.038	−0.385	0.359[a]	−0.049

[a] Denotes factor loadings over 0.40.

Spine boarding is a skill more often performed by emergency personnel (Table 3). In addition, ATs have a defined scope of practice both in the role of spine boarding when patients wear sports equipment and in working with a broad array of other health care providers. Athletic trainers report infrequent skill use, with only 2 of 686 (0.29%) performing the skill once per week. More often ATs perform the skill once or twice per year (492 of 686 = 71.7%); some clinicians have never spine boarded in real time (166 of 686, 24.2%). In this particular study, the emergency personnel spine boarded once a month (n = 11 of 27, 40.7%) or once a week (n = 14 of 27, 51.9%), whereas dual-credentialed individuals predominantly spine boarded once a month (10 of 19, 52.6%).

DISCUSSION

The primary purpose of this educational assessment was to determine if emergency health care providers, including ATs, paramedics, EMTs, and dual-credentialed professionals, know how to manage a spine-injured athlete's condition.

Knowledge Gap

Our findings indicate that clinicians have an inaccurate perception of their skill level compared with their actual knowledge. These findings, in addition to related literature, suggest practice is necessary to maintain cognitive knowledge and behavioral skill, but moreover, when new techniques are presented in research, clinicians have a responsibility to update their skill set and knowledge. A poor relationship between perceived and actual knowledge can have fatal implications for a spine-injured patient. This poor relationship, a knowledge gap, exists among the emergency health care providers in this study. The participants' average score (5.5 ± 1.2 of 9, 61.11%) was low. Participants, on average, rated their perceived knowledge relatively high (agreed = 5 on a 6-point Likert scale). A low actual knowledge combined with a high perceived knowledge indicates an inability to recognize that a knowledge gap exists. An inability to recognize a gap within knowledge can hinder clinicians from pursuing further education on particular topics.[12]

A knowledge gap may exist for a number of reasons. A knowledge gap could be attributed to a clinician's lack of desire to learn, not staying current with published literature, or material that was neglected in the education process. One particular area of weakness among participants was equipment removal. If the sport helmet needs to be removed, all of the equipment should be removed[3] and the void left by the helmet should be filled with a towel or like object.[16] Although a majority of participants stated that the shoulder pads should also be removed (561 of 785, 71.5%), very few understood that they should fill the void with a towel or like object (209 of 785, 26.6%) after helmet removal. Current experts in the field stated during the Delphi panel discussion that better dissemination of literature must be produced for a substantive change to occur within the scope of practice (as such, we did not score the item). There is currently nothing in place to ensure that ATs are not only receiving information, but

Table 3. Estimated Total Number of Athletes Spine Boarded in Career by Profession

No. of Athletes	Athletic Trainer, No. (%; n = 723)[a]	EMT, No. (%; n = 13)	Paramedic, No. (%; n = 17)	Dual Credential, No. (%; n = 29)
0	99 (13.7)	0 (0.0)	0 (0.0)	0 (0.0)
1	107 (14.8)	1 (7.7)	0 (0.0)	0 (0.0)
2	95 (13.1)	1 (7.7)	1 (5.9)	3 (10.3)
3	77 (10.7)	1 (7.7)	0 (0.0)	2 (6.9)
4	39 (5.4)	0 (0.0)	0 (0.0)	1 (3.5)
5	46 (6.4)	2 (15.4)	0 (0.0)	0 (0.0)
6–10	126 (17.4)	2 (15.4)	0 (0.0)	2 (6.9)
10+	134 (18.5)	6 (46.1)	16 (94.1)	21 (72.4)

Abbreviation: EMT, emergency medical technician.
[a] Missing data: 3 athletic trainers did not respond to this item.

putting into practice the best techniques and evidence available. Athletic trainers should use their best judgement about equipment removal if it is warranted prior to transportation.[3]

Dual-credentialed clinicians scored higher on the AKA than any other subgroup of participants. A lack of evidence exists when studying the effects of medical professionals' being dual credentialed; however, interprofessional education literature does suggest that the involvement of several clinicians from various disciplines improves patient outcomes.[17] Although it is not practical to ask every clinician to be dual credentialed, an avenue to continue further education is interprofessional practice. Interprofessional practice is critical for the transitional care aspect of managing a spine injury.[18] In a spine-boarding situation, cohesive interprofessional teamwork is required to provide the best care to the patient. Thus, intimate knowledge of another discipline's standard of care and common procedures is necessary when spine boarding for optimal outcomes.[17,19,20] Collaborative efforts, through hands-on training sessions and educational seminars, are suggested yearly for emergency preparedness.[12] Interprofessional practice between athletic training students and those enrolled in a paramedic/EMT program, so that these students can assist each other and learn together, should be considered. We suggest that these collaboration sessions must include clinicians of various backgrounds that have the potential to practice alongside each other, specifically with emerging settings in athletic training such as military and industrial settings in which unique obstacles may present themselves during the transport process. In addition, health care providers who do not spine board in specific circumstances, such as with equipment-laden patients, can learn from and with other providers with more experience.

Skill Decay

It was our assumption that spine boarding would occur more frequently in the EMTs and paramedics, but the infrequency of experience in spine boarding athletes among the EMTs may have diminished the scores in that population. However, the ratio of athletes spine boarded among dual-credentialed individuals to years of experience (2.206 athletes per year of experience) suggests that these clinicians are more likely to experience spine boarding over the course of a career than those in the other groups (ATs = 1.714, paramedics = 1.353, EMTs = 1.579).

Literature suggests skills decay when clinicians do not have the opportunity to practice or perform a skill over time.[21] For instance, within 6 months to a year, health care providers who do not have the opportunity to practice cardiopulmonary resuscitation regularly demonstrate decreased proficiency over time.[21] Much like spine boarding, CPR is likely applied at a low frequency for ATs, but is a highly critical skill. More frequent training sessions must occur in order to eliminate skill decay.[22] Practice sessions must occur collaboratively, including ATs and emergency personnel, to ensure efficient and safe transition of care using best practices.[18] Additionally, the use of learning over time and practicing skills multiple times should be iterated to students within professional programs to develop an awareness and prevention for skill decay.

Continuing Education

As new research is produced, documents such as NATA position statements may need to be updated to incorporate new techniques. The patient is at risk for secondary injury and clinicians may be liable when the best current evidence is not used. When the standard of care is updated, patient outcomes improve.[23] Various models for CE exist among different health care professions. Athletic trainers are required to obtain 50 CE units (CEUs) every 2 years.[22] Beginning in 2014, 20% (10) of these CEUs are required to be evidence-based practice CEUs. The purpose of the new requirement is to ensure that CE is evidence based in promoting best practices.[22] Paramedics and EMTs have slightly different requirements based on the states in which they practice, but all average approximately 30 CEUs per year.[24–26]

As athletic training and emergency personnel professional programs continue to incorporate more evidence-based medicine into their curricula, practicing clinicians must continue to adapt and align with these practices.[27] Clinicians must be able to find and translate this evidence into clinical practice; otherwise the scholarship of discovery is futile. This is important, not only because these individuals might serve to mentor incoming professionals, but also because they may be held accountable for the knowledge and skills in a court of law. According to the reasonable person standard, an AT is expected to provide the level of care that a reasonable sports medicine professional or AT would under the same circumstances.[28] The standard of care is often well established by the literature and recognized by professional organizations in position statements, interassociation task force statements, and other similar published documents.[29] Currently, there has been no research conducted on the interprofessional CE of ATs and emergency personnel.

We know that CE does have a positive impact on knowledge gains,[30] so this may help to resolve knowledge gaps as new evidence is produced in the field. Small knowledge gains have been demonstrated for health care providers immediately after attendance of educational sessions such as those at conventions,[30] but the CE had little to no effect on clinical practice.[23,31–33] Web seminars have grown in popularity recently as another platform for CE.[34] As this is a new dissemination platform, it is unknown if knowledge gain and retention from Web seminars occurs. Clinical workshops, professional conferences and seminars, and small-group lectures are among the preferred methods of CE to maintain certification.[35] Further research is needed to determine the most effective form of CE for health care professionals to gain information for retention and the ability to translate that information into clinical practice.

Continuing education is imperative for practicing clinicians to diminish the knowledge gap with new evidence. Athletic trainers and emergency personnel have differences in regard to the regulations their organizing bodies have established. Within emergency personnel, states on average require half to three-quarters of the required CE to be spent on specified topics and policies.[24–26] Athletic trainers currently do not have a requirement of specific areas to be addressed within a CEU period.[36] Each clinician can determine the style of CE (lab, lecture, various conference types, etc) and the topic based on convenience, cost, affinity, etc. Practitioners have a natural

tendency to shift toward areas that they are interested in or in which they may have a large amount of knowledge already.[30] Although seeking new information in one's desired area of interest has value, the lack of requirements to update knowledge in critical areas is resulting in poor demonstration of knowledge in these areas,[11,12] including spine boarding.

Limitations

Terminology used throughout the literature is continually changing, which may have posed a challenge to respondents. However, terms like *log-roll push* or *log-roll pull* are self-explanatory on face value. These terminology issues may have impacted our findings, but we are confident that using experts to help develop our tool limited the impact. Although we experienced unequal responses between groups, we used nonparametric statistics and did not violate assumptions of statistical tests to account for the different sample sizes.

Future Research

Because a knowledge gap was indicated as a result of this study, future research needs to focus on helping clinicians recognize and address their knowledge deficits. Determining which methods might be most effective and looking at global approaches to addressing individual knowledge deficits of each clinician are next steps for future research. Tracking new information as it is disseminated to health care professionals and how the professionals use that information is also a potential area of future research. Moreover, the role and methods of the CE planner should be evaluated. Selecting topics, identifying appropriate participants, and synthesizing the literature are all important in the CE planning process. Collaborations with clinicians in preparing effective CE may also pose to be a more effective strategy to meeting the needs of clinician learners.

CONCLUSIONS

Emergency health care providers lack knowledge of spine boarding while simultaneously possessing a positive perception of their skills. This knowledge gap can prevent the clinician from integrating emerging evidence-based information into clinical practice. In an effort to mitigate knowledge gaps, emergency health care providers need to continue to update on current evidence, especially regarding spine boarding.

Continuing education is mandatory for health care professionals to maintain certification. A mechanism of individualizing CE, particularly formal CE, to focus on areas of weakness or emerging evidence may help practitioners to stay current on the changing scope of practice. The current NATA position statement and its update are considered informal CE, but our study suggests practitioners may not engage with the information in a meaningful way to resolve gaps in knowledge. In addition, position statements from the NATA as well as spine-boarding practice should be conducted with other emergency health care professions such as EMTs and paramedics to succinctly combine research for the clinician. The best care for a spine-injured athlete will come through thorough, well-practiced health care professionals of varying positions working together.

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