

Concussion Care Practices and Utilization of Evidence-Based Guidelines in the Evaluation and Management of Concussion: A Survey of New England Emergency Departments

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Abstract

Evidence-based clinical practice guidelines can facilitate proper evaluation and management of concussions in the emergency department (ED), often the initial and primary point of contact for concussion care. There is no universally adopted set of guidelines for concussion management, and extant evidence suggests that there may be variability in concussion care practices and limited application of clinical practice guidelines in the ED. This study surveyed EDs throughout New England to examine current practices of concussion care and utilization of evidence-based clinical practice guidelines in the evaluation and management of concussions. In 2013, a 32-item online survey was e-mailed to 149/168 EDs throughout New England (Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, Maine). Respondents included senior administrators asked to report on their EDs use of clinical practice guidelines, neuroimaging decision-making, and discharge instructions for concussion management. Of the 72/78 respondents included, 35% reported absence of clinical practice guidelines, and 57% reported inconsistency in the type of guidelines used. Practitioner preference guided neuroimaging decision-making for 57%. Although 94% provided written discharge instructions, there was inconsistency in the recommended time frame for follow-up care (13% provided no specific time frame), the referral specialist to be seen (25% did not recommend any specialist), and return to activity instructions were inconsistent. There is much variability in concussion care practices and application of evidence-based clinical practice guidelines in the evaluation and management of concussions in New England EDs. Knowledge translational efforts will be critical to improve concussion management in the ED setting.

Keywords: clinical practice guidelines; concussion; emergency department; New England; traumatic brain injury

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Introduction

PROPER EVALUATION and management of concussions has emerged at the forefront of clinical care because of increased awareness of their short- and long-term consequences. Although the neurological, behavioral, and psychiatric sequelae that accompany a single concussion are typically short-lived (e.g., days to weeks),¹ symptoms can persist for months² and even last longer than 1 year.³ Concussion can lead to psychosocial dysfunction (e.g., decreased life satisfaction),^{4,5} and repetitive head impacts may increase risk for neurodegeneration (i.e., chronic traumatic encephalopathy).⁶

The emergency department (ED) is often the initial point of contact for concussion management, and ED clinicians are called on to evaluate concussions and make discharge recommendations. Evidence-based clinical practice guidelines have been developed to facilitate appropriate concussion care. In 2011, Tavender and associates⁷ conducted a systematic review of the literature since 2000 and identified six evidence-based clinical practice guidelines for the management of concussion tailored to the ED setting and included one from the United States. Other evidence-based clinical guidelines for general outpatient concussion care that can be extended to the ED include those set forth by the American Academy of Neurology (AAN).^{8–10}

Evidence-based clinical practice guidelines target four thematic areas: (1) symptom assessment using a validated tool, (2) safe and appropriate neuroimaging use, (3) verbal and written discharge information, and (4) psychoeducation on symptom course and follow-up care.¹⁰ The aspirations of these guidelines is to facilitate decision-making, improve patient outcomes, and promote efficient use of healthcare resources.¹¹

Despite the above, there remains no “gold standard” set of concussion management guidelines, and the array of published guidelines is inconsistent, based on only Level II or III evidence and on expert opinions from small, special interest consensus groups. These may serve as barriers to the transfer of clinical research knowledge to practice, known as knowledge translation, thus creating an evidence-practice gap.¹²

Extant research has indeed examined the use of and adherence to evidence-based clinical practice guidelines for concussion management in the United States (and international) EDs. Among ED physicians in Kalamazoo County, Michigan, nearly 75% reported no use of a nationally recognized guideline in sports-related concussion management.¹³ Other work shows unnecessary neuroimaging, incomplete symptom assessment and lack of validated assessment tools, and inconsistency in discharge recommendations.^{14–22} Only 51% of patients with concussions have been reported to receive written information at discharge,²² and 38% are discharged without recommendations for follow-up care.²⁰

The Centers for Disease Control and Prevention (CDC) launched a Heads-Up concussion educational campaign in 2007 to address the lack of adherence to appropriate ED discharge recommendations for youth sports-related concussions.²³ A recent study that evaluated the effectiveness of this campaign found that among 497 sports-related concussions in patients who presented to a pediatric ED between 2004 and 2012, only 66% were provided with appropriate discharge recommendations; after 2010, there was a slight, nonsignificant improvement to 75%.²⁴ The variable and inappropriate use of formal guidelines for concussion management in the ED raises concern that many patients with concussion in this setting receive an inaccurate diagnosis and/or are provided with faulty discharge recommendations.

The scope and understanding of concussion care practices in U.S. EDs and adherence to evidence-based clinical practice guidelines for concussion management in U.S. EDs remains limited, given past survey work has been among small community and/or geographically restricted EDs, did not examine formal evidence-based guidelines, and is accompanied by methodological limitations (e.g., secondary data abstraction,²⁰ focus on adherence to one specific set of guidelines,¹⁵ and administration of a short (i.e., 11-item) survey in only Level I trauma centers).²¹

The current study examined concussion care practices and utilization of evidence-based clinical practice guidelines in the evaluation and management of concussion patients in EDs throughout New England—a geographical region that has not yet been targeted in terms of application of concussion care guidelines in the ED. We surveyed senior administrators of New England EDs to characterize the extent and nature of the application of standardized clinical practice guidelines in New England.

Methods

New England (Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine) hospitals with an ED were identified through the *American Hospital Association Guide*, 2013 Edition.²⁵ Contact information to each ED administrator with a senior role in the department was obtained through publicly available online websites. An e-mail containing a study description and the link to a 32-item anonymous online “surveymonkey.com” survey was initially sent to participants in December 2013. Two follow-up reminder e-mails were sent at approximately 2-week intervals thereafter to all respondents. All aspects of the study were

TABLE 1. CHARACTERISTICS OF NEW ENGLAND EMERGENCY DEPARTMENTS

	Survey responders (n = 72) n (%)	All New England EDs (N = 168)
Completed by an ED physician	67 (93%)	—
Director/Chief/Chair		
Geographic environment		
- Urban	22 (31%)	51 (30%)
- Suburban*	27 (37%)	32 (19%)
- Rural*	23 (32%)	85 (51%)
Trauma center	19 (26%)	34 (20%)
ACS verified: n = 18		
- Level 1	8 (44%)	15 (44%)
- Level 2	7 (39%)	11 (32%)
- Level 3	3 (17%)	8 (24%)
State certified: n = 17		
- Level 1	6 (35%)	—
- Level 2	7 (41%)	—
- Level 3	4 (24%)	—
ED affiliated with teaching hospital	33 (46%)	70 (42%)
Patient population		
- Adult and pediatric	69 (96%)	—
- Adult only	2 (3%)	—
- Pediatric only	1 (1%)	—

*Significant differences between respondents and all New England EDs, $p < 0.05$.

ED, emergency department; ACS, American College of Surgeons.

TABLE 2. USE OF EVIDENCE-BASED CLINICAL PRACTICE GUIDELINES FOR CONCUSSION MANAGEMENT IN NEW ENGLAND EMERGENCY DEPARTMENTS

<i>Survey question: Are Clinicians Using Formal Clinical Guidelines for Concussion?</i>	<i>Survey responders (n = 72) n (%)</i>
No	25 (35%)
Yes, consistently across all clinicians (Select all that apply)	6 (8%)
- AAN 2013	4
- CDC	3
- AAN 1997	1
- ACEP	1
- PECARN	1
Yes, but there is variability across clinicians (Select all that apply)	41 (57%)
- CDC	26
- AAN 2013	17
- Cantu	6
- Colorado Medical Society	3
- AAN 1997	2
- ACEP	2
- PECARN	2
- Institution-specific guidelines	4

AAN, American Academy of Neurology; CDC, Centers for Disease Control and Prevention; ACEP, American College of Emergency Physicians; PECARN, Pediatric Emergency Care Applied Research Network.

approved by the Boston University Medical Campus Institutional Review Board and adhered to necessary ethical guidelines.

Measures

The survey was developed by a multidisciplinary team of collaborators at Boston University School of Medicine and Boston Medical Center. It was reviewed and revised based on feedback from emergency physicians and other clinicians regarding clarity, readability, content, and amount of time to complete. The survey began with the American Academy of Neurology (AAN) Practice Parameter⁸ concussion definition, and respondents were then asked to provide information on demographic characteristics, utilization of evidence-based clinical practice guidelines for concussion, and hospital practice on concussion evaluation and management. Tables 1–5 contain survey content.

Statistical analyses

Respondents with more than three principal questions missing were excluded from the final analysis ($n = 6$). Respondent ED department geographic environments were compared with the general New England ED geographic environments for external validity by z-test of proportions. The reported utilization of clinical practice

guidelines was categorized by ED department characteristic variables (i.e., geographic environment, trauma center, and affiliation with a teaching hospital) to explore usage differences across facilities via chi-square testing. Statistical significance was determined at the $p < 0.05$ level. Statistical analysis was performed with SPSS 20 software (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp).

Results

Descriptive characteristics of New England EDs

Table 1 presents characteristics of EDs surveyed in New England. Of the 168 EDs in New England, direct contact e-mail addresses for senior administrators were obtained for 149 (89%). Surveys were completed between December 2013 and February 2014. There were a total of 78 (52%) respondents; 72 (48%) were included in the final analysis after exclusion for missing data. Surveys were completed by a single senior administrator in the ED—namely, ED Physician Director, Chief, or Chair. Respondent EDs largely resembled all New England ED departments, although they were overrepresented by suburban location and underrepresented by rural location; this may be because of the use of population density to define the geographical setting.

Clinical practice guidelines for concussion management in New England EDs

The most commonly reported guidelines were the CDC and AAN 2013 (Table 2). Nevertheless, of the respondents, 25 (35%) reported no use of evidence-based clinical practice guidelines. Among the 65% that identified some use, 57% reported inconsistency across clinicians in the type of guidelines used. There were no statistically significant ED characteristic differences between respondents who did or did not use clinical practice guidelines (Table 3).

Concussion evaluation and management in New England EDs

As shown in Table 4, all respondents reported that patients with concussion are evaluated by an emergency medicine physician in addition to many other clinicians (e.g., physician assistant or nurse practitioner). Clinical decision-making for neuroimaging was based more on practitioner preference (57%) than clinical practice guidelines (42%). Patients <12 years old underwent neuroimaging less frequently than patients >12 years old, and the concern for radiation exposure was, as expected, greater for patients <12 years. Vomiting and loss of consciousness (LOC) were the most common factors influencing clinicians' decision for neuroimaging in patients <12 years. Anticoagulant use, age >60 years old, and drug or alcohol intoxication were primary reasons for neuroimaging decisions among patients >12 years.

TABLE 3. USE VERSUS NO USE OF CLINICAL PRACTICE GUIDELINES: EMERGENCY DEPARTMENT COMPARISON

Emergency department characteristics							
Clinical practice guideline use	Trauma Center		Geography			Teaching facility	
	Yes	No	Urban	Suburban	Rural	Yes	No
Yes	12 (63%)	35 (66%)	14 (64%)	20 (74%)	13 (57%)	23 (70%)	24 (62%)
No	7 (37%)	18 (34%)	8 (36%)	7 (26%)	10 (43%)	10 (30%)	15 (38%)
Total	19	53	22	27	23	33	39

TABLE 4. EVALUATION AND MANAGEMENT OF CONCUSSIONS IN NEW ENGLAND EMERGENCY DEPARTMENTS

Survey question	Survey responders (n = 72) n (%)
Who Performs Evaluations of Patients with Concussion? (Select all that apply)	
- Emergency medicine physician	72 (100%)
- Physician assistant, nurse practitioner	44 (61%)
- Registered nurse	12 (17%)
- Neurology/neurosurgery physician	10 (14%)
- Other physicians	7 (10%)
What Are Clinical Decisions for Neuroimaging Based on?	
- Practitioner preference	41 (57%)
- Clinical guidelines	30 (42%)
- Department policy	1 (1%)
What Percentage of Concussion Patients Under 12 Receive a CT (or MRI) Scan?	
- ≤24%	36 (50%)
- 25–49%	17 (24%)
- ≥50%	17 (24%)
- N/A	2 (2%)
What Symptoms/Factors Are More Likely to Result in a CT (or MRI) Scan in Patients Under 12? (Select all that apply)	
- Vomiting	59 (82%)
- Loss of consciousness	57 (79%)
- Visualized head/neck trauma	44 (61%)
- Antero/retrograde amnesia	39 (54%)
- Headache	21 (29%)
- Confusion/altered mental status	2 (3%)
- Parental request	2 (3%)
To What Extent Does the Concern for Radiation Exposure Affect the Decision to Obtain a CT Scan in Patients under 12?	
- Significantly	38 (53%)
- Moderately	24 (33%)
- Somewhat	8 (11%)
- N/A	2 (3%)
What Percentage of Concussion Patients Over 12 Receive a CT (or MRI) Scan?	
- ≤24%	18 (25%)
- 25–49%	24 (33%)
- ≥50%	30 (42%)
What Symptoms/Factors Are More Likely to Result in a CT (or MRI) Scan in Patients Over 12? (Select all that apply)	
- Anticoagulation	69 (96%)
- Age over 60	67 (93%)
- Drug/alcohol intoxication	63 (88%)
- Vomiting	60 (83%)
- Loss of consciousness	60 (83%)
- Visualized head/neck trauma	48 (67%)
- Ante/retrograde amnesia	40 (56%)
- Headache	28 (39%)
To What Extent Does the Concern for Radiation Exposure Affect the Decision to Obtain a CT Scan in Patients Over 12?	
- Significantly	10 (14%)
- Moderately	32 (44%)
- Somewhat	22 (31%)
- Not at All	8 (11%)

CT, computed tomography; MRI, magnetic resonance imaging.

Discharge instructions for concussions in New England EDs

Table 5 summarizes concussion discharge instructions provided. The majority of respondents (94%) reported providing formal written discharge instructions that were primarily hospital-specific (78%) and most frequently reviewed with the patient by a registered nurse (99%). The most common post-concussive symptoms reviewed with the patient included cognitive difficulties (97%) and physical symptoms (94%). Respondents reported routinely referring patients with concussion to follow-up with a physician, but the time frame to do so and referral specialty to be seen varied. This included 13% who reported providing no specific instructions on time frame for follow-up and 25% who did not specify a referral specialist. Of the respondents, only 19% and 13% recommended a graded or gradual, respectively, return to play/school/work/activity.

Discussion

The current study found significant variability in the utilization of and adherence to evidence-based clinical concussion guidelines in EDs throughout New England. Specifically, 35% of ED respondents reported no utilization of evidence-based guidelines for the evaluation of a patient with concussion presenting to the ED. Past research that has examined ED concussion management through surveys of a large number of U.S. EDs also demonstrates inconsistency in concussion care practices, but is flawed by secondary data abstraction from ED charts (thereby limiting knowledge on the exact care provided),²⁰ survey responses from nonsenior administrators with focus on adherence to one specific set of guidelines,¹⁵ and administration of a short (i.e., 11-item) survey in only Level I trauma centers.²¹

The reason for the inconsistent use of clinical practice guidelines is unclear, but a recent study offers several possible explanations. Tavender and associates¹¹ conducted semi-structured interviews with ED staff in the Australian state of Victoria and found that a variety of factors influenced utilization of evidence-based practices in concussion management, particularly knowledge (e.g., difficulty keeping up to date with assessment tools), beliefs about consequences (e.g., rationale for using clinical practice guidelines), environmental context and resources (e.g., workload), and social/professional role and identity (e.g., lack of clarity regarding professional responsibility to adhere to published guidelines). If future work shows these factors influence concussion management in EDs in the United States, these domains may serve as important targets for intervention.

An alternative explanation for the inconsistent use of clinical practice guidelines is the historical lack of a uniform definition and operationalization of concussion, and absence of a 'gold standard' set of concussion care guidelines. Remote guidelines (e.g., 1986 Cantu,²⁶ 1997 AAN,⁸ 1994 Colorado Medical Society¹⁰) are based on LOC and post-traumatic amnesia (PTA) grading scales. Recent guidelines disposed of LOC and PTA-based grading scales because of the lack of sensitivity of this approach,²⁷ and the more recent guidelines (Zurich consensus statement,²⁸ AAN 2013,⁹ and CDC²³) now emphasize the presence, number, and duration of concussive symptoms for concussion diagnosis.

The AAN 2013 and CDC guidelines were most commonly reported in this study, and these guidelines provide step-by-step protocols for a suspected concussion, ranging from recommendations for detection and assessment of concussion to return to activity. The decision to return to activity is complex,²⁹ and guidelines have been refined and developed over the years in response to the

TABLE 5. DISCHARGE INSTRUCTIONS FOR CONCUSSION MANAGEMENT IN NEW ENGLAND EMERGENCY DEPARTMENTS

<i>Survey question</i>	<i>Survey responders (n = 72) n (%)</i>
What Post-Concussive Symptoms Are Discussed with Patients Prior to Discharge? (Select all that apply)	
- Difficulty thinking/remembering	70 (97%)
- Physical symptoms	68 (94%)
- Emotional/mood symptoms	49 (68%)
- Problems with sleep	45 (63%)
Does Your Emergency Department Have Formal Written Discharge Instructions Specifically for Concussion?	
- Yes, and these are routinely provided	68 (94%)
- Yes, but these are not routinely provided	4 (6%)
Which Types of Written Discharge Recommendations Are Provided? (Select all that apply)	
- Hospital-specific	56 (78%)
- Commercial EHR vendor	13 (18%)
- Physician-choice	11 (15%)
- Centers for Disease Control and Prevention (CDC) discharge instructions (i.e., Heads Up Program patient take-home instructions)	7 (10%)
Who Reviews Discharge Instructions with Patients? (Select all that apply)	
- Registered nurse	71 (99%)
- Physician: emergency medicine	55 (76%)
- Physician's assistant, nurse practitioner	39 (54%)
When Discharge Instructions Are Given, Are Patients Routinely Instructed to Follow Up with Their PCP/Pediatrician?	
- Yes, within 24–48 hours	32 (44%)
- Yes, within 1 week	25 (35%)
- Yes, varied time frame	6 (8%)
- No routine instructions for follow up	9 (13%)
When Discharge Instructions Are Given, What Type(s) of Specialist Are Patients Routinely Referred To? (Select all that apply)	
- Primary care provider	31 (57%)
- Neurologist	25 (46%)
- Sports medicine specialist	11 (20%)
- Neuropsychologist	4 (7%)
- Concussion clinic	3 (6%)
- None	18 (25%)
When Discharge Instructions Are Given, Are Patients Routinely Instructed to Refrain From Returning to Work, School, Sports, or Similar Activities Until Cleared by a Health Care Professional?	
- Yes	59 (82%)
- No	13 (18%)
What Recommendations for Return to Work, School, Sports, or Similar Activities Are Routinely Made? (Select all that apply)	
- Clinical evaluation prior to return	45 (63%)
- Symptom-driven return (i.e., return to work/school after symptoms resolve off medication)	33 (46%)
- Stepwise return (i.e., graded return)	14 (19%)
- Gradual return	9 (13%)
- Referred to primary care provider for clearance	4 (6%)
- Activity-specific clearance	2 (3%)

(continued)

TABLE 5. (CONTINUED)

<i>Survey question</i>	<i>Survey responders (n = 72) n (%)</i>
Are Concussion Patients Routinely Instructed to be Awakened to Assess Mental Status?	
When no CT scan is performed	
- Yes	35 (49%)
- No	37 (51%)
With a negative CT scan result	
- Yes	13 (18%)
- No	59 (82%)

EHR, electronic healthcare record; CT, computed tomography.

rapidly evolving research on evaluation and treatment of concussive injuries. There remains insufficient evidence and significant interindividual variability in many aspects of concussions, however, including risk factors, consequences, and recovery, that may ultimately contribute to clinicians' lack of adherence to current concussion management protocols.

Practitioner preference emerged as a primary modifier of decision to use neuroimaging to evaluate concussions and was mostly performed when vomiting or LOC was a symptom. Head computed tomography (CT) is believed to contribute little to concussion evaluations²⁸ and is recommended by guidelines only to rule out intracranial injury (e.g., skull fracture).^{1,9,30} Although ruling out intracranial injury is essential, concussions rarely result in such injury, and neuroimaging may not always be necessary for the evaluation of concussion in the ED setting.¹¹

CT scans are associated with radiation hazards and high health-care costs, and a negative head CT scan lacks prognostic utility in concussion and should not be used in isolation for discharge decisions.³⁰ Much attention has been devoted to reducing unnecessary neuroimaging through the use of clinical tools (e.g., history and physical examinations) that help guide decision-making for appropriate CT use in the ED.³¹ This can often be misleading, however, given the aforementioned limitations associated with CT scans.³²

Moreover, the development of effective in-hospital interventions that can help to reduce unnecessary CT scans may be challenging. A randomized trial in Canada found education, hospital policy changes, and real-time reminders were unsuccessful in reducing rates of CT scans in EDs during concussion care.³³ The patient safety and economic consequences associated with unnecessary CT scans makes it imperative that future research identify methods to limit the ED physician's use of CT scans during routine concussion care.

The majority of respondents provided formal written discharge instructions to patients with concussion, most with hospital-specific discharge instructions. Yet, there was inconsistency in the details of these instructions. For example, time frame for follow-up care and recommendations for referral specialist to be seen varied and were absent in some cases. Previous work shows written ED discharge instructions tend to be vague, not evidence-based, and require a high level of education to interpret.¹⁴ A majority of respondents in the present study recommended that the patient undergo clinical evaluation before return to activity, and few advised a graded return. Current consensus guidelines recommend physical and cognitive rest until symptom resolution, followed by a graded return to school/daily activities or athletic play.^{9,23,28}

Even national public efforts to improve the use and appropriateness of discharge guidelines and recommendations over the past decade (e.g., CDC Heads-Up) have translated to suboptimal results. In an effort to evaluate the CDC Heads-Up campaign, a retrospective chart review showed that among 497 patients who presented to a pediatric ED with a sports-related concussion between 2004 and 2012, only 4% were provided with the recommendation of cognitive rest, improving to 12% after 2010, and referral to a concussion specialist or center was made for only 8% of patients before 2010, improving to 43% after 2010.²⁴ Our survey was administered in late 2013 to early 2014, suggesting that the appropriateness of ED discharge recommendations for concussions continued to be problematic, despite the tremendous public education efforts.

Last, only 68% of EDs reviewed emotional or behavioral symptoms of concussion. The assessment and care of neuropsychiatric sequelae in the ED setting should be a clinical priority given that post-concussive mood symptoms affect recovery course.^{34,35}

A somewhat concerning finding of the survey was the prevalence of discharge recommendations to awaken patients to assess mental status, even when no CT was performed (49%) or when CT was negative (18%). This practice of periodic awakening to detect a potentially worsening hemorrhage may not be warranted, especially with a negative CT, because of its potential detriments to recovery.^{36,37} It is recommended that EDs specifically improve their internal guidelines and educate their clinicians about this issue.

The overarching problem and potential solution to the variability in concussion management practices, in general, and in the U.S. EDs, in particular, likely resides in the failure to translate research into clinical practice, also known as “evidence-practice gaps.”¹² This phenomenon is evident in all aspects of healthcare, and evidence-practice gaps can lead to exposure to unnecessary harm and inefficient use of healthcare resources.^{38,39} There has thus been increasing global efforts to improve the translation of clinical research knowledge into clinical practice.¹² Further, there is increasing literature examining the implementation of best practice guidelines in the sports medicine setting.^{40–44} Most frequently, these studies have found that active steps are required to ensure implementation of best practice guidelines.⁴¹

To rectify poor concussion management, it would be important to consider the strategies and core principles of knowledge translation and implementation science. For example, and as outlined by Grimshaw and colleagues,¹² once the target population is identified (in this case, ED clinicians) and the barriers of knowledge transfer are identified (in this case, the numerous and often inconsistent concussion management guidelines), there are several methods that may effectively transfer knowledge on concussions, such as printed educational materials, educational meetings, educational outreach, local opinion leaders, audit and feedback, and/or tailored and multifaceted interventions that facilitate communication and decision making, behavior change, and inform and educate. As mentioned previously, some of these strategies have been implemented for concussion care in the ED (e.g., Canadian CT Head Rule³³), but their success has been limited. Research on knowledge translation for concussion management in sports settings, however, is rapidly evolving,^{23,40–46} and recent work among college coaches shows that educational handouts by their institution led to improved concussion management practices.⁴⁷ Further research efforts are needed to identify effective knowledge transfer methods for concussion management in the ED setting.

Our findings are limited in several ways. This is one of the largest geographical survey studies of concussion guideline practice in U.S. EDs, but the external validity is restricted to New England. Moreover, generalizability to rural hospitals in New England may also be limited, given they were underrepresented in this study. Although we had a relatively modest response rate, physicians can be a difficult population to gather information from using research surveys because of their demanding schedule and lack of time, and their response rates tend to be lower than that of the general population.⁴⁸

The current sample may have been biased by respondents with better concussion care or policies, who are likely more inclined to participate in a survey about ED concussion management. Desirability bias may have also influenced respondents to portray their hospitals in a more positive manner. In fact, those who did not participate may include individuals less likely to use or be familiar with clinical practice guidelines for concussion, and the actual evidence practice gap may be even more considerable than what is suggested by the current findings.

We surveyed only one senior administrator from each hospital, and the survey did not ask for information regarding exact training or exposure and familiarity with concussion management guidelines. As such, survey responses may have significantly varied depending on the respondent's experience, practice, or knowledge.

Conclusions

There is significant variability in concussion care practices and the application of evidence-based clinical practice guidelines for the evaluation and management of concussion in EDs throughout New England. Prospective randomized trials are needed to investigate knowledge translational methods to increase adherence to clinical practice guidelines for concussion management in U.S. EDs. In the short-term, however, we strongly recommend ED clinicians to become familiar with current practice guidelines and knowledge regarding concussion diagnosis and management. This is particularly important for acute management, which may require complete physical and cognitive rest (depending on symptom severity).

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