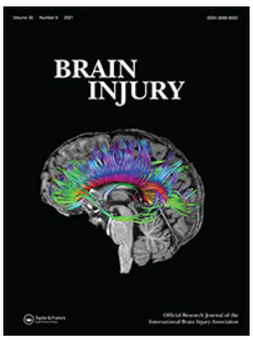

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Management of sport-related concussion in emergency departments in England: a multi-center study

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ABSTRACT

Objective:: To establish the current knowledge of sport-related concussion (SRC) management of clinicians in emergency departments in the North West of England.

Methods:: A cross-sectional, multi-center study design was used and included emergency department clinicians (EDCs) across 15 centers in the North West of England. A 22-question survey was issued with questions focused on the 5th International Conference on Concussion Consensus Statement. Absolute and percentages were presented, and comparisons in knowledge of guidelines and confidence between EDCs were made using the Kruskal-Wallis test.

Results:: Of an estimated 300 EDCs, 111 (37%) responded. Thirty (27%) were aware of the guidelines, whilst 63 (57%) had heard of a graduated return-to-sport protocol. Physical rest was advised by 106 (95%) respondents, with 68 (61%) advising cognitive rest and 47 (42%) providing written advice. There was no difference ($p > .05$) in awareness of SRC guidelines or confidence between clinician grade, with most receiving no SRC training.

Conclusions:: There is a lack of knowledge amongst EDCs in the North West of England in managing and providing discharge advice to patients with SRC. This is likely due to the limited awareness of guidelines and training, and therefore further education delivery on SRC management guidelines is required.

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Traumatic brain injury; emergency medicine; survey

Introduction

Traumatic brain injuries (TBIs) are on a spectrum from mild to severe (1), with management in emergency departments (ED) focusing on acute neurosurgical intervention or other in-hospital management (1). If patients are deemed to be low risk of intracranial pathology, demonstratable using computed tomography or ruled out using the National Institute for Health and Care Excellence (NICE) Head Injury Clinical Guideline, the patient is discharged from the ED (2). These patients are termed to have suffered a mild TBI or concussion (3).

Headway, the brain injury association, estimate that a million people attend EDs each year in the UK after sustaining a 'head injury,' 90% of which are diagnosed with mild TBI (4). Mild TBI and concussion are terms often used interchangeably in the literature, but concussion can be thought of as a subset of mild TBI (5). It is estimated that 25% of patients diagnosed with concussion will go on to have post-concussive symptoms that persist beyond one year (6,7). There is also an association between repeated concussions and later-life cognitive decline and chronic traumatic encephalopathy (8,9).

Concussion can occur in any patient population, such as elderly patients who attend EDs following falls (~28%), patients who present after road traffic collisions (~20%) non motor-related transport (~5%), assault (~11%), and due to being struck on the head (~19%), which typically encompasses the mechanism for sport-related concussion (SRC) (3,10,11). Whilst many professional athletes have emergency medical care readily available in the form of physiotherapists, team doctors and emergency services, other athletes such as those considered amateur are predominantly managed in EDs. Despite differences in medical support between amateur and professional standards, the 5th International Conference on Concussion Consensus Statement in 2016 states that all athletes, regardless of level of participation who experience a SRC, should be managed using the same principles of physical and cognitive rest followed by a graduated return-to-sport (12,13). Therefore, it is necessary for those working in EDs to have adequate knowledge and delivery of current SRC management protocols including identifying patients with concussion, managing their symptoms, giving appropriate advice with regards to return-to-sport and referring those at risk of further injuries to an appropriate service (5).

The 5th International Conference on Concussion Consensus Statement in 2016 brought about the most up to date consensus on the management of concussion for children and adult populations participating in sport (12). The cornerstone of concussion management was emphasized as being physical and cognitive rest followed by a graduated return-to-work and/or sporting activity (6). This protocol has been the basis of concussion management since the 3rd iteration of the International Conference on Concussion Consensus Statement for the management of concussion in 2008 (14,15). Since the inception of the Concussion in Sport Group in 2002 (15), there has been a limited but steady body of research in SRC

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management in the ED in the (16)* US and in Canada (6,17–20). Collectively, the results of these studies demonstrated that most emergency department clinicians (EDCs) did use guidelines, but that 20–48% were unaware of the International Conference on Concussion Consensus Statement for the management of SRC. Across the literature, most recommended physical rest (>90%) but variability for cognitive rest (47%-80%) existed as there were inconsistencies evident for adhering to specific guidelines (17,18) as well as the advice regarding work, school, avoiding screen time and remaining at home (17,18,20). In the UK, there is no specific guidance on the management of SRC for use in EDs (21,22) and the Royal College of Emergency Medicine, the training standards body for Emergency Medicine, does not necessitate ED trainees to undertake SRC management training as part of its curriculum (23). Currently, EDCs in England follow the NICE guidelines (24) during the initial assessment upon arrival to an ED, to determine if a computed tomography scan is required, to determine if the patient requires a transfer to a neurosurgical center, and to guide discharge advice. Whilst the initial processes are likely to be the same regardless of the mechanism of concussion, there are additional guidelines associated with SRC. This is particularly evident when considering the discharge advice, where in addition to providing general details on the nature and severity, discussing risk factors associated with returning to the ED, and providing contact information in case of delayed complications, the 5th International Conference on Concussion Consensus Statement provides specific advice on the graduated return-to-sport with precise aims, activities and goals. In contrast, the NICE guidelines merely state that printed advice should include information on return to everyday activity including school, work, sport and driving. Therefore, due to the absence of specific SRC guidance in England, EDCs awareness of the current guidelines and how this might be influenced by factors such as clinician grade is of importance given the long-term implications that are now emerging in sporting individuals and the risks associated with incorrect discharge advice.

This study aimed to 1). establish the current knowledge of SRC and how it is managed in emergency departments in the North West of England, and 2). to establish if there was a difference in awareness of guidelines and perceived confidence in concussion management between clinician grades. The objective was to use a questionnaire with distinct sections that identify who the clinicians are and their role, if and how they current managed SRC and their confidence and training for managing SRC.

Materials and methods

After initial consultation and checking staff profiles, an estimated total sample of 300 EDCs were identified spread across 24 sites. ED consultant leads from 15 sites responded to our invite and distributed the survey to their colleagues meeting the inclusion criteria. One hundred and fifteen participants returned the survey including those in EDs and urgent care centers in the North West of England who were working substantively in EDs or were in an emergency medicine training programme, including nurse practitioners. A total of four survey responses were excluded as they included doctors working in EDs in short placements such as foundation doctors trainees and short-term locum doctors, resulting in a final sample of 111 surveys. Ethics approval for this study was granted by the Faculty of Health, Psychology and Social Care ethics committee at Manchester Metropolitan University and consent was is implied by the participant returning the questionnaire.

A modified Dillman method was utilized to maximize the response rate amongst EDCs (25). Twenty-four EDs and urgent care centres in the North West of England were approached for participation in this study. Contact details for each ED consultant lead was obtained from publicly available websites. E-mails were sent to the consultant lead at each site for distribution to the appropriate clinicians and to all emergency medicine trainees in the North West Deanery via the Deanery emergency medicine administrators. The survey was 'live' over a four-week period with a reminder e-mail sent to the consultant lead and administrators at the half-way point.

A pilot study was conducted for validation at a single ED before distributing the survey. This involved a paper-based survey in the same format as the online survey and was handed out to five clinicians of various grades: one advanced nurse practitioner, one clinical fellow, one specialty doctor and two higher specialty trainees. The survey was revised based on their feedback with regards to the content, readability and clarity of questions. Pilot participants were not permitted to participate in the online survey.

Following the pilot study, a 22-question survey was created distributed in an online format. The survey comprised of a mixture of dichotomous questions, rating scale questions and multiple-choice questions. The survey was split into three sections. The first section collected demographic data on the respondents including clinician grade (consultant, registrar, specialty and associated specialty grade, clinical fellow, advanced nurse practitioner, acute care common stem, trainee, clinical fellow), place of work and number of SRC diagnosed. The second section related to specific recommendations for management of SRC. Questions for this section were designed using previous research in this field and are based on the 5th International Conference on Concussion Consensus Statement (12). The key questions in the second section focused on the advice given to patients on discharge, the importance of cognitive and physical rest as well as knowledge of the graduated return-to-sport protocol. The third section explored the clinician's experiences and views on concussion training in emergency medicine, asking questions about their previous education on SRC and if they deemed it an essential part of future education. Questions from the survey can be found in Appendix 1.

Standard descriptive statistics including frequencies and percentages were calculated. The Kruskal-Wallis H test was performed to establish if there was any difference between clinician grade with regards to awareness or current guidelines and their perceived confidence in managing SRC. The data was analyzed using the SPSS Statistics version 25 software package (IBM SPSS Statistics for Mac, Version 25.0. Armonk, NY) and statistical significance was set at $p < .05$.

Results

Demographic information

A total of 115 (38%) clinicians completed the survey with none partially completed. Four clinicians who completed the survey were excluded; three were foundation doctors and one was a trainee advanced nurse practitioner. As such 111 (37%) respondents who fit the inclusion criteria were included in the study. The breakdown of the participants with respect to job role, department and number of SRC diagnosed are presented in Table 1.

Table 1. Demographic information.

Demographic Information	Respondents
Clinician grade	
Consultant	61 (54.9%)
Higher specialty trainee	11 (10.0%)
Specialty, associate specialist or staff grade (SASG) doctor	17 (15.3%)
Emergency & advanced nurse practitioner	9 (8.1%)
Acute care common stem (ACCS) doctor	5 (4.5%)
Clinical fellow	8 (7.2%)
Type of Emergency Department	
Major trauma center (MTC)	52 (46.8%)
Trauma unit (TU)	38 (34.2%)
Non-trauma receiving emergency department	18 (16.2%)
Urgent care center	3 (2.7%)
Number of sport-related concussions diagnosed per month	
0	8 (7.2%)
1–10	91 (82.0%)
11–20	7 (6.3%)
>20	5 (5.4)

Management and recommendations

Just over half of respondents (63; 57%) were aware of clinical guidelines to manage SRC, though only 30 (27%) knew of the 5th International Conference on Concussion Consensus Statement (Figure 1). Physical rest following an SRC was advised by almost all respondents, although there was inconsistency in the amount of physical rest advised (Figure 2). Approximately, two thirds (68; 61%) of respondents advised concomitant cognitive rest, and of those, 28 (25%) and 26 (23%) advised cognitive rest for either 48 hours or until symptom-free, respectively. A total of 63 (57%) respondents were aware of the graduated return-to-sport and 47 (42%) respondents provided specific written SRC discharge advice. There was no significant difference between clinician grades for awareness of current guidelines ($H = -1.925$, $p = .540$), physical rest advice ($H = 2.907$, $p = .234$), cognitive rest advice ($H = 5.992$, $p = .050$) and awareness of the graduated return-to-sport protocol ($H = 2.400$, $p = .301$).

The advice given to patients following SRC varied considerably, specifically regarding alcohol consumption, driving, seeking medical advice prior to returning to sport and on whether headgear is recommended (Figure 3).

Clinical experience and training

Seven (6.4%) EDCs said they had received any specific training in SRC management as part of their emergency medicine training with a further 15 (13.6%) receiving training outside of their emergency medicine training (Figure 4). In all, 95

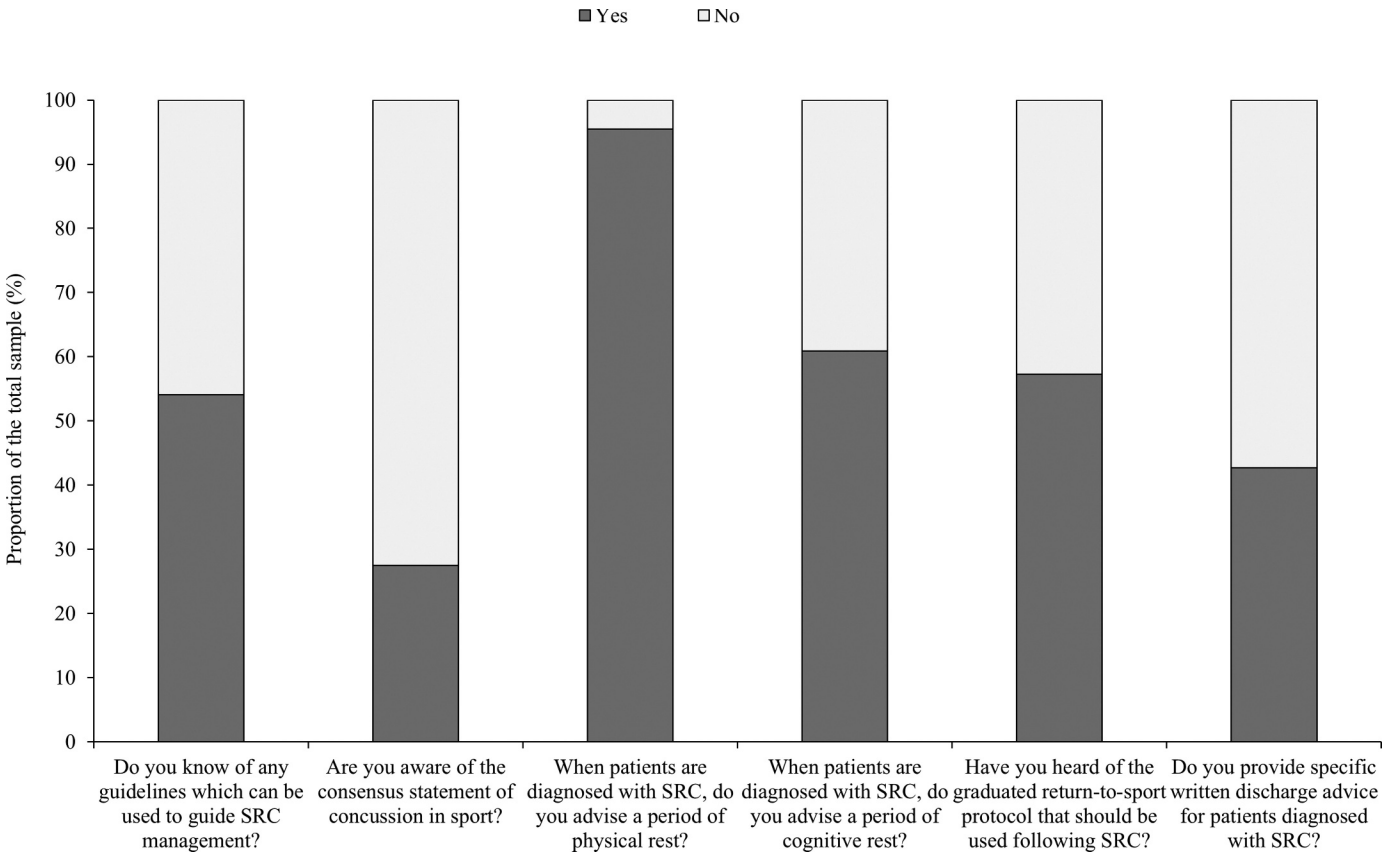

Figure 1. Proportion of sample reporting on current sport-related concussion (SRC) knowledge and advice given to patients.

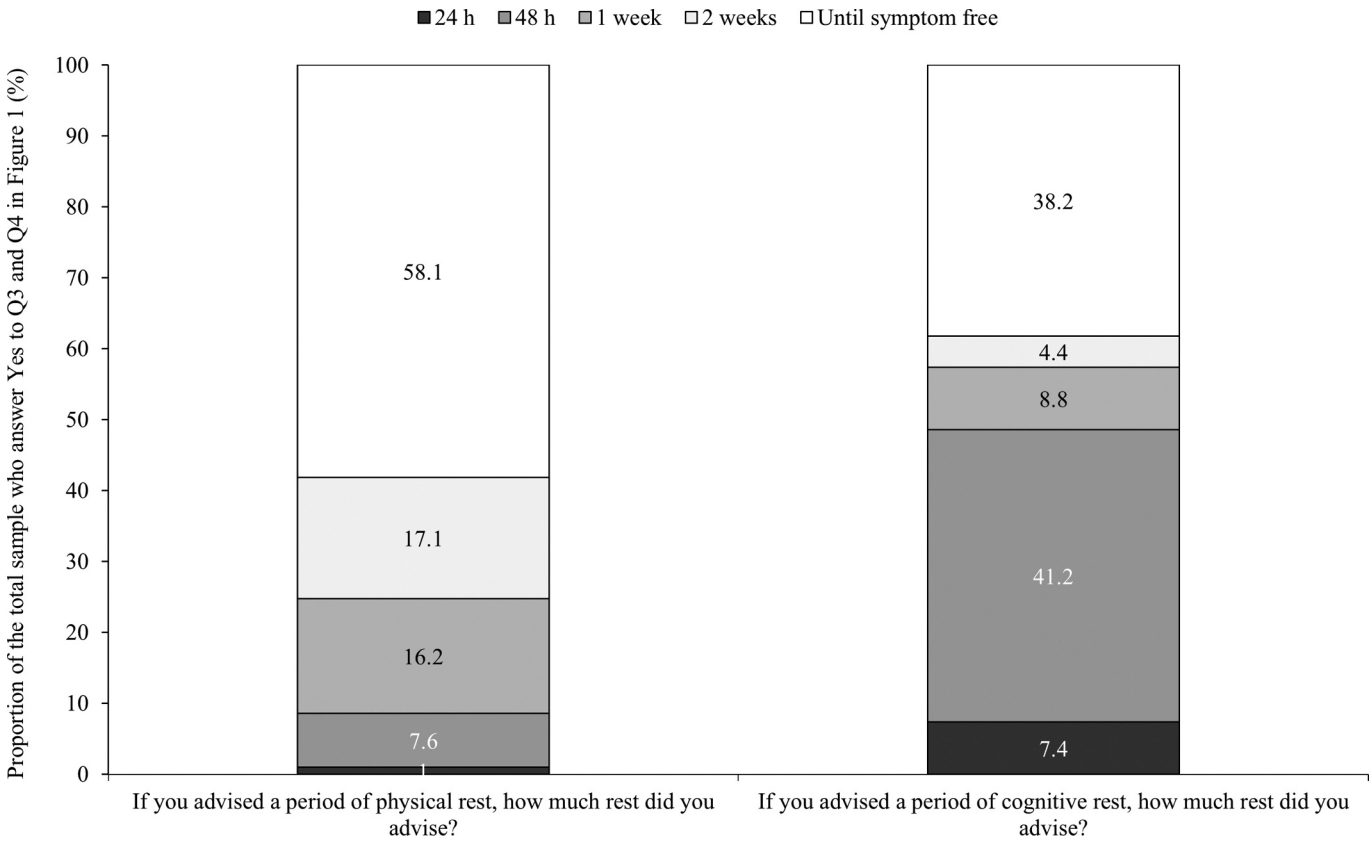

Figure 2. The advised duration of physical and cognitive rest following a sport-related concussion.

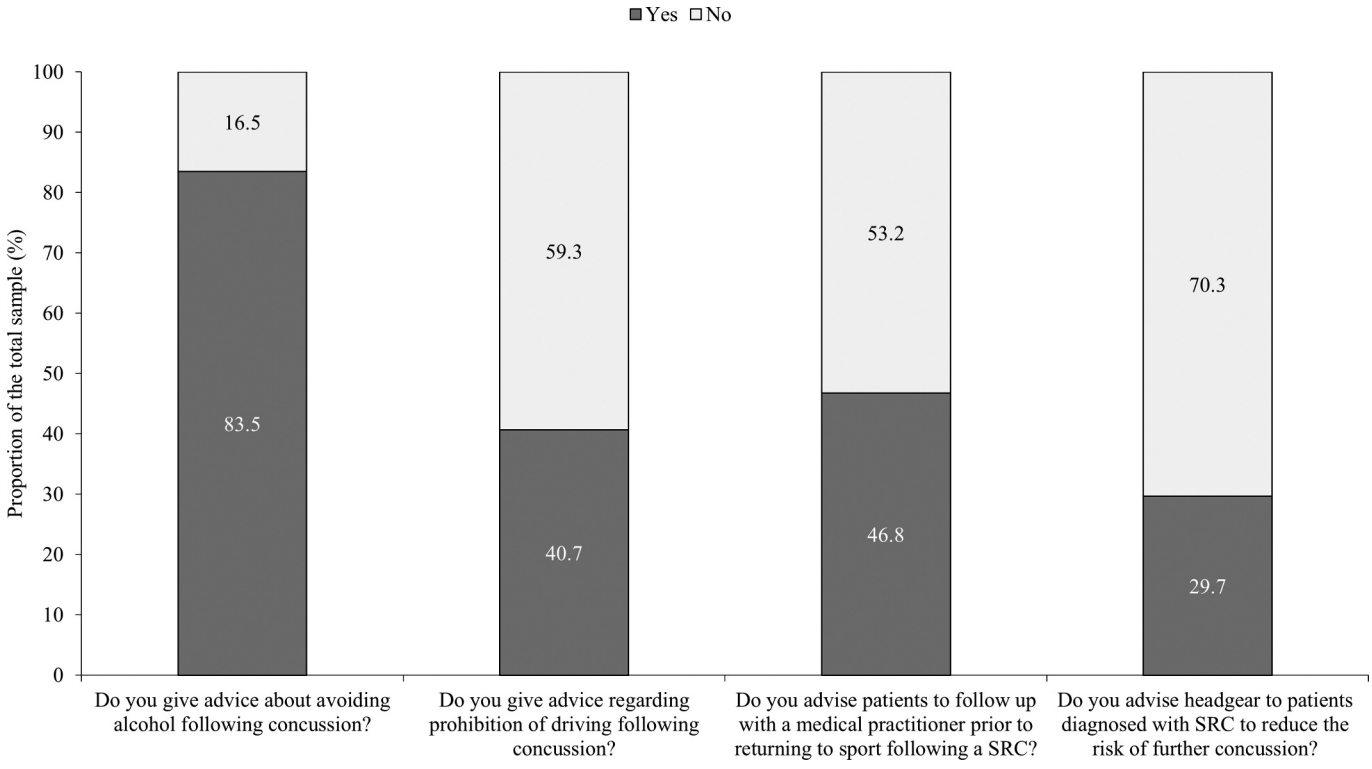

Figure 3. Proportion of sample reporting on sport-related concussion advice given to patients.

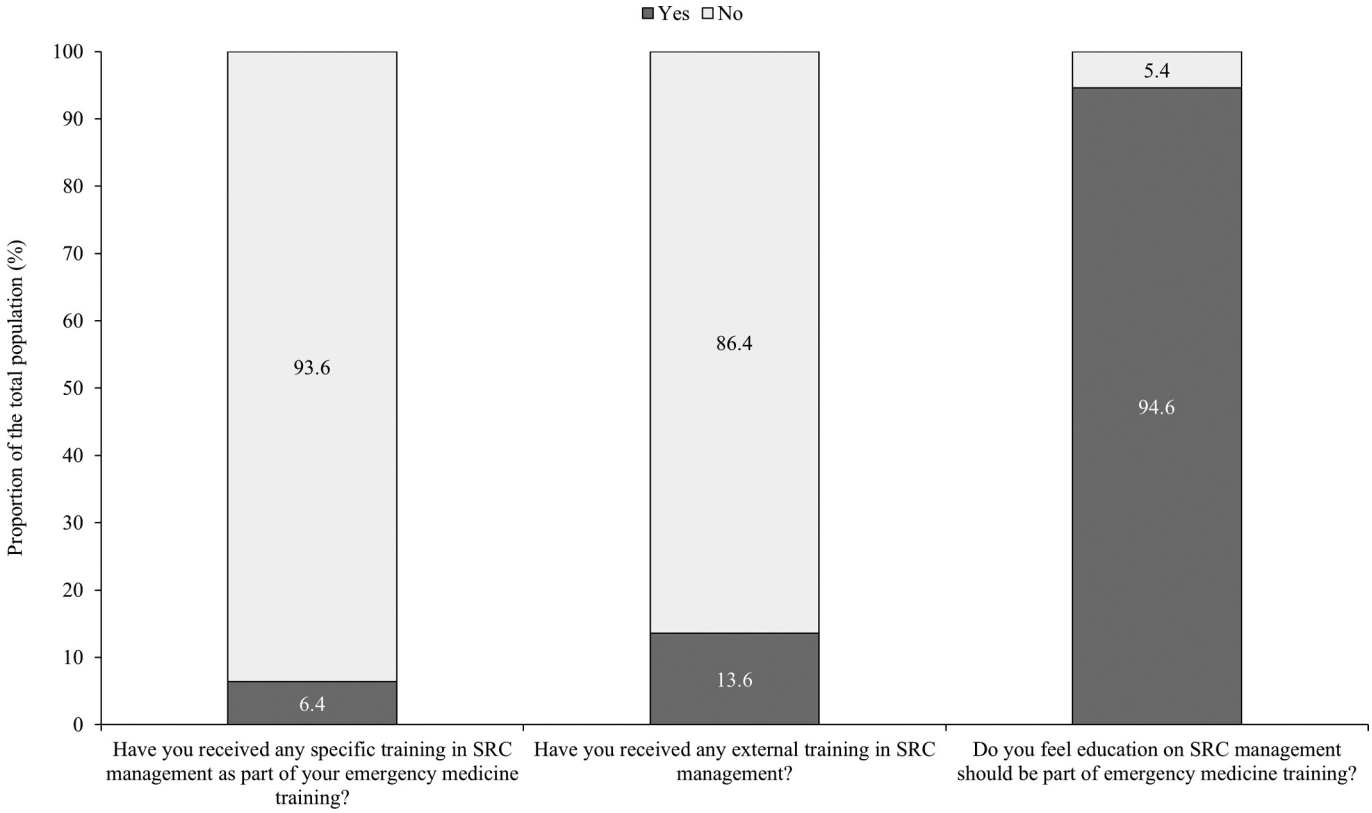

Figure 4. Proportion of sample reporting on sport-related concussion training, education and confidence in giving discharge advice.

(86.4%) respondents had not received training in managing SRC, yet 105 (95%) felt that education on SRC management should be part of their training. 50 (45%) participants reported they were "very confident" giving SRC advice on discharge, whilst 55 (50%) responded with "somewhat confident." Six participants stated they were "not at all confident" in giving discharge advice to a patient diagnosed with SRC. There was no significant difference in perceived confidence in concussion management between clinician grades ($H = 3.664$, $p = .160$).

Discussion

The aims of the study were to assess the knowledge of SRC management of emergency medicine trained clinicians and their views and experience of SRC in EDs. This study found several knowledge gaps for EDCs in the North West of England in the awareness of and adherence to the 5th International Conference on Concussion Consensus Statement. Furthermore, the advice given to patients on discharge varied considerably between clinicians as did their views and experiences in managing SRC.

Just under half of the clinicians in this study had no knowledge of any SRC management guidelines, with fewer being aware of the 5th International Conference on Concussion Consensus Statement. This is surprising considering most said that they diagnose at least one SRC every month and that almost all clinicians said that they were at least 'somewhat confident' in managing SRC. Despite this, the majority do not adhere to a particular guideline when providing SRC advice. A number of studies in the US and Canada have explored evidence-based guidelines , with results supporting the findings of this study. In the US, Stern et al. (17) noted that 35% of senior administrators followed no concussion guidelines, whilst in Canada, Carson et al. (18) found that 41% of emergency department physicians were unaware of the 5th International Conference on Concussion Consensus Statement, which was much lower than sport and exercise medicine physicians (3%). Furthermore, Stoller et al. (6) compared pediatricians, family physicians and emergency department physicians at two teaching hospitals in the greater Toronto area. They found that only 48% of emergency department physicians had knowledge of the 5th International Conference on Concussion Consensus Statement. In the study by Stern et al. (17) it was suggested that their findings might reflect the fact that a variety of guidelines currently exist as well as the lack of a 'gold standard.' Our study, and those of Carson et al. (18) and Stoller et al. (6), used the 5th International Conference on Concussion Consensus Statement as the best practice guideline for SRC management and care, with our results suggesting that EDs in the North West of England have limited awareness of the consensus statement and that there is a proportion who are aware but don't not use it in clinical practice.

Early iterations of the SRC guidelines suggested that patients should rest until symptom-free, however the 5th International Conference on Concussion Consensus Statement (12) indicates that insufficient evidence for this exists and that encouraging patients to become gradually and progressively more active should the focus whilst ensuring it does not exacerbate symptoms. Furthermore, a recent

randomized controlled by Leddy et al. (26) demonstrated that the inclusion of sub-threshold aerobic exercise significantly reduced the recovery time compared to a control group (median = 13 *vs*. 17 days), supporting the 5th International Conference on Concussion Consensus Statement. In this study, most emergency department clinicians advised physical rest following an SRC which agrees with the work of Carson et al. (18) who reported between ~95% of respondents prescribe physical rest. Interestingly, the largest proportion of our respondents recommended physical rest until symptom-free with a further 33% recommending one to two weeks. In this study only few respondents recommend a rest period that concurs with the 5th International Conference on Concussion Consensus Statement (12) and recent empirical evidence (26). This finding reaffirms a lack of knowledge amongst EDCs in the graduated return-to-sport protocol that is not reflected in the NICE guidelines (24) given its broad coverage of TBIs. Ultimately, the finding around physical rest suggests that most individuals attending an ED following an SRC may return to sporting activity later than that achieved if subthreshold aerobic activity is recommended after an initial 48 hours of physical rest.

Considerably less respondents in this study advised cognitive rest when compared to physical rest. Our results also revealed a lower proportion of respondents recommending cognitive rest than that of Carson et al. (80%) and Stoller et al. (76%) (6,18). The results also show inconsistency in the amount of cognitive rest advised, with most selecting either 48 hours or until symptoms-free. The current guidelines and a recent systematic review (27) suggest that 48 hours rest should be recommended and that, for children, a graduated return-to-school protocol be followed post-SRC. Whilst further research is required, data from Thomas et al. (28) suggested that a rest period of 5 days compared to the recommend 24–48 hours resulted in a greater post-concussion symptom scale score and time until symptom-free. As such, our results suggest that over 50% of respondents may be providing discharge advice that results in a longer than necessary period away from school or work and that this could have important implications for the patient (e.g., loss of education time/loss of income). Therefore, further education on the current guidelines around cognitive rest is required within the ED.

The variation in advice for physical and cognitive rest can be explained by a number of factors such as paucity of knowledge and lack of training in SRC management (29). In support, Tavender et al. (30) reported a lack of knowledge was the main factor influencing the management of SRC, whilst other factors included beliefs about consequences of concussion, lack of resources, high workload and a perception that adhering to SRC guidelines was not their role. Another study concluded that time constraints and the idea that an emergency department clinician's primary role was to focus on excluding more severe TBI may have been potential 'barrier' for SRC management (18). These findings are consistent with previous work and cement the hypothesis that EDCs lack the knowledge to adequately manage SRCs and that further research should be undertaken to understand the local 'barriers' for appropriate implementation of 5th International Conference on Concussion Consensus Statement. Furthermore, research might consider investigating if, and to what extent, improving the knowledge of clinicians can improve outcomes for athletes presenting to ED with SRC.

Although training in emergency medicine mandates trainees to be familiar with the management of severe TBI, the same cannot be said for SRC. The significant knowledge gaps of these clinicians can also be explained by the fact that 93.6% of respondents to this study had not received specific teaching in SRC management as part of their training and that few (13.5%) had sought external training. Hornby et al. (22) surveyed 60 emergency medicine trainees and demonstrated that 70% of trainees were not aware of any concussion guidelines. Their survey also found that only 10% of respondents had received concussion training and yet 91% would have liked further education on concussion management. Emergency department clinicians in this study also overwhelmingly recognized the need for concussion training in medicine with 94.6% stating education on SRC should be part of the curriculum. Clearly, clinicians of all grades would benefit from SRC-specific training and education to improve standards of SRC care in the ED with the use of an online learning module being reported as a favorable method (22). Additionally, the Royal College of Emergency Medicine could include SRC management training into the curriculum for post-graduate emergency medicine training, thereby making it a mandatory requirement for all those training in emergency medicine. Whether the availability of online learning resources would improve discharge advice needs to be determined as well as whether this translates to effective concussion advice and improved outcomes for patients with SRC.

Limitations

There were several limitations to this study. Firstly, non-trauma receiving departments and urgent care centres are underrepresented in our sample, and so the results may not be generalizable to these centres. Secondly, we did not collect data on which participants were from each EDs, thus meaning we were unable to comment on SRC knowledge, awareness of guidelines and discharge advice at an ED level, and cannot comment on the variation across the centres. Not collecting this also raises a validity issue and there is a chance our data was influenced by nonindependence, whereby the consultant lead's knowledge of SRC and the sharing of this information to colleagues, could have exerted an influence on the responses of individuals causing greater within-ED agreement relative to between-ED agreement. Thirdly, only 15 out of the 24 EDs contacted for participation in this study emailed back to participate, therefore 9 hospitals in the region were not involved in the study. We are unable to comment on the reason 9 EDs did not reply to our initial contact. We are not aware of any factors that discriminate between those that did and those that did not reply, though we speculate that interest in the topic from the consultant leads who distributed the questionnaire might have played a part. The survey was only open for a four-week period, potentially limiting the response rate. Results may also be subject to recall bias, especially when answering questions on the number of SRC diagnosed and managed. Finally, we

highlight that we only focused on SRC in this study and did not explore the similarities or difference in management when compared to other causes of a TBI.

Conclusion

This study demonstrates that EDCs in the North West of England have insufficient knowledge in managing and advising patients who are diagnosed with SRC. Despite most clinicians advising physical rest for their patients, the duration does not agree with current guidelines or the latest evidence. Furthermore, a large proportion do not advise cognitive rest, and for those who do, over 50% recommend a duration greater than the current recommendations. The findings in this study could stem from a lack of awareness of best practice guidance from the 5th International Conference on Concussion Consensus Statement, which is likely to be a direct consequence of the dearth of training opportunities that these clinicians have been exposed to. Further work needs to be undertaken to educate EDCs on up-to-date SRC management guidance as well as tackling 'barriers' to improve knowledge transfer.

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Disclosure Statement

All authors report no conflicts of interests.

Data availability statement

The data that support the findings of this study are available from the corresponding author, [HR], upon reasonable request.

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