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"It was only a mild concussion": Exploring the description of sports concussion in online news articles

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ABSTRACT

Background/aims

Concussion is widely discussed in online sports news articles, but the terms used to report this injury vary. This study aimed to use a systematic search strategy and explore the description of sports concussion in online sports news articles.

Methods

A systematic approach was employed to obtain online articles related to sports concussion from four sports associated with concussion (hockey, football, soccer, and rugby). Included articles were evaluated for the descriptors used in relation to concussion and possible consequences associated with concussion. Data was analysed to determine trends between each sport as well between the countries of origin of the articles.

Results

From 200 articles retrieved, 153 were included for analysis. The terms "Head injury" (30.1%) and "Brain injury" (20.9%) were most used to describe a concussive injury, and the most frequently mentioned consequence of concussion was "Chronic Traumatic Encephalopathy" (15%). Modifiers which potentially play down the importance of the injury were noted in 9.8% of the articles, with journalists the primary source of these terms.

Conclusions

The variability in reporting of concussion by online news articles may limit the transmission of correct concussion information to the public. To improve the consistency of this reporting, the "Media Concussion Checklist" was developed.

1. Introduction

Sports concussion has been the subject of much discourse in the scientific literature and mainstream media for many years (Burns, 2014; Provvidenza et al., 2013). Major national and international sporting events are extensively covered by the media, with vast numbers of column inches and webpages dedicated to summarising these events. The frequency of concussion in some of the world's biggest sports such as soccer, football, and rugby means that many of these concussive events which occur in high-profile competitions are also the focus of this reporting (Fraas, Coughlan, Hart, & McCarthy, 2014; Nilsson, Hagglund, Ekstrand, & Walden, 2013; Yengo-Kahn, Johnson, Zuckerman, & Solomon, 2016).

A recent paper by Sharp and Jenkins (2015) suggests that the use of the term "concussion" should be avoided as it "lacks any diagnostic precision and at worst encourages a lazy diagnostic approach". The authors argue that based on signs and symptoms such as headaches, dizziness, sleep disturbance and cognitive impairments, this injury should instead be called a "traumatic brain injury" or specifically a "mild traumatic brain injury". The use of misleading terms such as "mild concussion", "minor concussion" and "slight concussion" are commonplace in the media (Goff, 2015). Although media articles are often written by individuals (i.e. journalists) who are not medically trained, these articles have the potential to influence perceptions regarding concussion for a wide audience due to the global reach of the internet.

Allied to these possibly inaccurate descriptions in the media, many major stakeholder groups have been shown to have inconsistent levels of knowledge regarding concussion despite the dissemination of relatively high-profile consensus statements (McCrory et al., 2009, 2013). These stakeholders include coaches, players, parents/caregivers and medical professionals (Sullivan et al., 2009, 2012a,b; Sye, Sullivan, & McCrory, 2006; Valovich McLeod, Schwartz, & Bay, 2007). A comprehensive review of misconceptions about traumatic brain injury by Block, West, and Goldin (2016) discusses this in detail, and makes reference to the "information cascade" whereby individuals base their beliefs on those of others (Bikhchandani, Hirshleifer, & Welch, 1998). One example of perpetuating these misconceptions is the interchangeable use of the terms "concussion" and "mild traumatic brain injury" by health professionals. Due to the ap-

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parent global misunderstanding of concussions, the media could be an important ally for clinicians in educating the general public and may have an influential role in mediating these misconceptions and increasing knowledge of this condition amongst the general population.

Although limited, there is research which has assessed the effect the media has on public opinion regarding sports medicine related issues such as stem cell research, genetic research, and genetics and medicine (Geller, Bernhardt, & Holtzman, 2002; Ho, Brossard, & Scheufele, 2008; Petersen, 2001). There has also been some examination of the impact of the media with regards to obesity (Gollust, Eboh, & Barry, 2012) and the findings of this work indicates that the media may be able to assist education on other health issues (including concussion). Prior research has shown that the media portrayal of concussion can affect the public perception of this injury, and the potential exists for terms which are perceived as "softer" (e.g. "knock on the head") to lessen the severity of the perception of this injury (McLellan & McKinlay, 2011). There has been some discussion regarding how the mainstream media can be used to assist concussion awareness; however, the current use of the media for concussion awareness purposes is fragmented and not cohesive in its approach (Ahmed, Lee, Schneiders, McCrory, & Sullivan, 2014).

Despite some country-specific analysis of online concussion news being undertaken, to date there has been no analysis of the descriptors associated with sports concussion in online news stories on a global scale (Croker, Horne, Phillips, & Sullivan, 2015). Given the significance of concussion at both a sporting and public health level, as well as the influence that the media has in influencing the opinions of the general public, the intersection between concussion and the mainstream media warrants further investigation. This study aimed to take a systematic, non-exhaustive strategy to explore the description of sports concussion in the mainstream media. Further analysis sought to identify geographical patterns associated with different descriptions of sports concussion.

2. Methods

A systematic review of the internet was employed to explore the descriptions of sports concussion in the mainstream media. The search examined the descriptions of sports concussion in four major, internationally-played sports: hockey, football, soccer, and rugby. These sports were selected as they are widely played and viewed, and are also associated with high levels of concussion (Benson, Meeuwisse, Rizos, Kang, & Burke, 2011; Colvin et al., 2009; Mc Fie et al., 2015; McNamee, 2014). In keeping with similar studies evaluating online concussion information, a snapshot approach was adopted to provide a window for analysis of online news stories (Sullivan et al., 2012a,b; Williams et al., 2014). Ethical approval from a recognized ethics committee was not sought for this study as no interaction with participants occurred, and all information collected was freely available on the internet.

2.1. Pilot testing

Initial pilot testing (3 July 2014) was undertaken on two sports not included in the main analysis (Lacrosse and Australian Football). These sports were chosen because of the potential for a high amount of concussion articles, but lower worldwide visibility. Both members of the research team (EH and OHA) sampled the pilot terms ("Lacrosse concussion" and "Australian Football concussion") by entering these terms into www.google.com and selected the "News" filter. The first 20 results for each search were retrieved and analysed. The link (URL) of each article was retained, and the webpage was saved as a PDF to enable further analysis. In those cases where there was disagreement in the assignment of categories between the two reviewers after scrutinizing the articles, verbal discussions were undertaken in order to reach consensus. This process enabled the evaluation categories to be refined and this generated the final list of categories used in this study (see *"Data analysis"*).

2.2. Search strategy for study

A systematic strategy was used to determine the appropriate articles at the time of search (1pm GMT on 9 July 2014). For data collection the search engine www.google.com was employed and the "News" filter was selected with the intention to retrieve news articles only (as opposed to blogs or other sources of online information). The following terms were then entered as Google search items:

- "Hockey concussion"
- "Football concussion"
- "Soccer concussion"
- "Rugby concussion"

The first 50 news articles from each search term combination were retrieved for analysis. The link (URL) of each article was retained, and the webpage was saved as a PDF to enable further analysis.

2.3. Inclusion and exclusion criteria

The inclusion criteria for this study stipulated that articles must be published in English and discuss sports-related concussion. The exclusion criteria were: any article which was not written for a mainstream news outlet (e.g. personal blog posts); any article which was not written in English; articles which did not describe concussion incidents originating from sports (e.g. car crashes, domestic abuse); and any satirical/spoof articles. Duplicate articles were also excluded.

2.4. Data analysis

The authors undertook multiple readings of all the articles retrieved in order to identify the descriptions of sports concussion. As per the pilot testing, evaluation categories (listed in Table 1) were applied to each of the retrieved articles.

Articles with "comments" sections did not have these comments included for analysis. It was anticipated that as these comments were likely to be written by individuals which were not the author of the article, these comments would not be a reflection of the article itself. The originating country of each article was identified, and where a modifier was used in conjunction with a concussion it was noted (e.g.

Table 1
Descriptors related to concussion and consequences of concussion.

Descriptor of concussion	Consequences of concussion
Concussion; concussive; concussed	Second impact syndrome (SIS)
Head injury; head knock; head clash; head trauma	Chronic traumatic encephalopathy (CTE)
Blow to the head	Amyotrophic lateral sclerosis
Brain injury, brain trauma, brain damage	Alzheimer's disease, dementia, other neurocognitive problems
	Depression or suicide
	Parkinson's; other neurological conditions/ diseases

"severe concussion" or "mild concussion") along with the individual who made reference to the modifier (i.e. journalist, player, coach, etc.). In order to ensure consistency in category allocation and to strengthen internal validity, member checking of the data was conducted by both members of the research team following the allocation of categories to each article by the other researcher.

3. Results

Following the systematic search strategy, 153 articles were identified and included for analysis. As shown in Fig. 1 the majority of articles which were excluded were duplicate articles (n = 27), followed by articles where there was no discussion of sports concussion (n = 10). Lesser number of articles also required registration (n = 4), were irrelevant (n = 3), had links which contained video only (n = 2) and were dead links (n = 1).

The frequency of descriptors related to concussions and/or the consequences of concussion are shown in Table 2, with related terms grouped together for analysis. Of the 153 articles examined, 60.8% included the word "Concussion" in the title of the article. "Head injury" (30.1%) and "Brain injury" (20.9%) were the most commonly used descriptors related to concussions, whilst the least common descriptors used were "Head clash" (1.2%) and "Brain trauma" (5.2%). When discussing the consequences of concussion, the two most frequently mentioned terms were "Chronic Traumatic Encephalopathy" (15%) and "Alzheimer's disease, Dementia or other neurocognitive problems" (11.1%). Lesser-mentioned terms related to consequences of concussion included "Second Impact Syndrome" (4.6%), and "Depression and suicide" (5.9%).

Table 3 presents the findings from each sport included in this study. Football saw the descriptor "concussion" used most frequently (97.6%), followed by the terms "brain injury" (31.7%), "head injury" (26.8%), "head trauma" (17.1%), and "blow to head" (14.6%). Rugby had the highest usage for the descriptors "head injury" (38.2%), "head knock" (29.4%) and "brain injury" (11.8%). The descriptors "head knock" and "head clash" were exclusively used in articles from the rugby search, with articles on other sports not mentioning these descriptors. In examining the consequences of concussion, football reported the highest usage for "Chronic Traumatic Encephalopathy" (19.5%), "Alzheimer's, dementia, and neurocognitive problems" (19.5%), "depression and suicide" (14.6%), and "Amyotrophic Lateral Sclerosis" (12.2%). Hockey predominantly made reference to "Parkinson's disease and other neurological conditions" (15.4%) while rugby was the sport seen to mention "Second Impact Syndrome" most often (8.8%).

The geographical analysis showed Australia to have the highest usage of the descriptors "head injury" (57.1%), and "brain injury" (28.6%) while New Zealand was highest for "head knock" (46.7%), "head clash" (13.3%), and "brain damage" (13.3%) (see Table 4 for all results related to country). New Zealand was also the only country that used the descriptor "head clash" in relation to concussion. The USA was the country which used the descriptors "head trauma" (11.7%) and "brain trauma" (6.8%) the most, while articles from the UK and Ireland primarily mentioned the descriptor "blow to head"(22.2%). For the consequences of concussion, the UK and Ireland mentioned "Second Impact Syndrome "(22.2%), "Chronic Traumatic Encephalopathy" (22.2%) and "Parkinson's disease and other neurological conditions" (11.1%) more than any of the other included countries. The USA most commonly mentioned "Alzheimer's, dementia and neurocognitive problems" (13.6%) and "Amyotrophic Lateral Sclerosis" (11.7%), while Canada saw the most frequent mention of "depression and suicide" (10.5%). Articles retrieved from Australia and New Zealand saw very few examples of the consequences of concussion, with only one reference each to "Second Impact Syndrome" (Australia) and "Alzheimer's, dementia, and neurocognitive problems" (New Zealand).

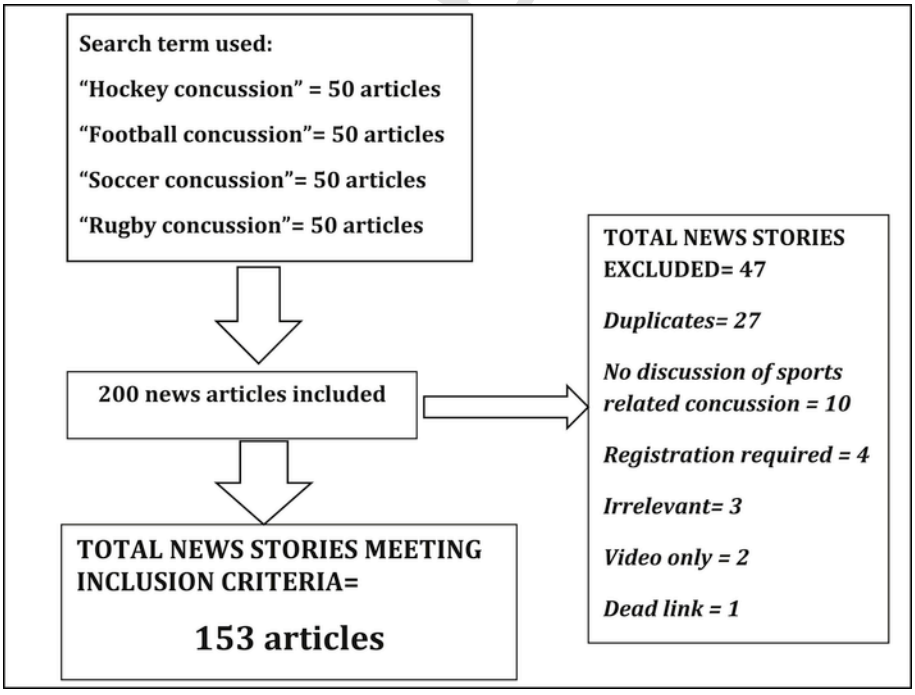

Fig. 1. Flowchart showing inclusion/exclusion criteria.

Table 2
Frequency of concussion descriptors and consequences across articles.

Descriptor/consequence of concussion	# Of articles	% Of articles
Concussion(s)	152	99.3
Head injury	46	30.1
Head knock	10	6.5
Brain trauma	8	5.2
Head clash	2	1.3
Brain damage	11	7.2
Blow to head	16	10.5
Head trauma	16	10.5
Brain injury	32	20.9
Second Impact Syndrome	7	4.6
Chronic Traumatic Encephalopathy	23	15
Amyotrophic lateral sclerosis	13	8.5
Alzheimer's, dementia, and neurocognitive problems	17	11.1
Depression and suicide	9	5.9
Parkinson's disease and other neurological conditions	11	7.2

Table 3
Number of uses of descriptors and consequences of concussion.

Descriptor/consequence of concussion	Hockey (n = 39)	Football (n = 41)	Soccer (n = 39)	Rugby (n = 34)
	# Of articles (%)	# Of articles (%)	# Of articles (%)	# Of articles (%)
Concussion(s)	39 (100%)	40 (97.6%)	39 (100%)	34 (100%)
Head injury	8 (20.5%)	11 (26.8%)	14 (35.9%)	13 (38.2%)
Head knock	0	0	0	10 (29.4%)
Brain trauma	0	5 (12.2%)	3 (7.7%)	0
Head clash	0	0	0	2 (5.9%)
Brain damage	1 (2.6%)	4 (9.8%)	3 (7.7%)	3 (8.8%)
Blow to head	5 (12.8%)	6 (14.6%)	3 (7.7%)	2 (5.9%)
Head trauma	2 (5.1%)	7 (17.1%)	5 (12.8%)	2 (5.9%)
Brain injury	7 (17.9%)	13 (31.7%)	8 (20.5%)	4 (11.8%)
Second Impact Syndrome	0	2 (4.9%)	2 (5.1%)	3 (8.8%)
Chronic Traumatic Encephalopathy	5 (12.8%)	8 (19.5%)	7 (17.9%)	3 (8.8%)
Amyotrophic Lateral Sclerosis	4 (10.3%)	5 (12.2%)	3 (7.7%)	1 (2.9%)
Alzheimer's, dementia, and neurocognitive problems	3 (7.7%)	8 (19.5%)	3 (7.7%)	3 (8.8%)
Depression and suicide	2 (5.1%)	6 (14.6%)	1 (2.6%)	0
Parkinson's disease and other neurological conditions	6 (15.4%)	5 (12.2%)	0	0

Table 5 shows the examples of modifiers that were used when describing concussions. Fifteen different articles (9.8% of the total) were found to use inappropriate modifiers of concussion, and the modifiers were primarily employed by journalists (80% or 12 out of 15). These 15 articles used 20 different examples of modifiers, with 60% of these discussing a "major", "debilitating", "serious" or "severe" concussion. Hockey and rugby had the highest representation of modifiers (n = 5), with football (n = 2) and soccer (n = 1) having the fewest reports. The USA was the country that had the most modifiers used (8 out of 15 articles) while the UK had the fewest (1 out of 15).

4. Discussion

At the time of writing, this was the first study which has attempted to evaluate the media's role in proliferating misconceptions regarding concussion in sport. By examining online news websites (which have a large readership and are a regular source of information for many), this study provides a preliminary understanding of how the mainstream media supports discourse relating to concussion. Although there were several examples of inaccurate descriptions of

Table 4
Country-by-country analysis of descriptors and consequences of concussion.

Descriptor/consequence of concussion	Australia (n = 7)	Canada (n = 19)	New Zealand (n = 15)	USA (n = 103)	UK & Ireland (n = 9)
	# Of articles (%)	# Of articles (%)	# Of articles (%)	# Of articles (%)	# Of articles (%)
Concussion(s)	7 (100%)	19 (100%)	15 (100%)	102 (99.0%)	9 (100%)
Head injury	4 (57.1%)	4 (21.1%)	7 (46.7%)	28 (27.2%)	3 (33.3%)
Head knock	2 (28.6%)	1 (5.3%)	7 (46.7%)	0	0
Brain trauma	0	1 (5.3%)	0	7 (6.8%)	0
Head clash	0	0	2 (13.3%)	0	0
Brain damage	0	1 (5.3%)	2 (13.3%)	8 (7.8%)	0
Blow to head	0	1 (5.3%)	1 (6.7%)	12 (11.7%)	2 (22.2%)
Head trauma	0	2 (10.5%)	1 (6.7%)	12 (11.7%)	1 (11.1%)
Brain injury	2 (28.6%)	5 (26.3%)	1 (6.7%)	24 (23.3%)	1 (11.1%)
SIS	1 (14.3%)	1 (5.3%)	0	3 (2.9%)	2 (22.2%)
CTE	0	3 (15.8%)	0	18 (17.4%)	2 (22.2%)
ALS	0	1 (5.3%)	0	12 (11.7%)	0
Alzheimer's, dementia, and neurocognitive problems	0	1 (5.3%)	1 (6.7%)	14 (13.6%)	1 (11.1%)
Depression and suicide	0	2 (10.5%)	0	7 (6.8%)	0
Parkinson's disease and other neurological conditions	0	1 (5.3%)	0	9 (8.7%)	1 (11.1%)

Table 5
Modifiers used in articles.

Example of modifier	Country of report	Sport	Designation of person quoting
"mild concussion"	USA	Hockey	Journalist
"debilitating concussion"	USA	Baseball	Journalist
"major concussion"	USA	Hockey	Journalist
"minor concussion" and "moderate concussion" and "severe concussion"	USA	Hockey	Journalist
"severe concussion"	Canada	Hockey	Journalist
"minor concussion" and "mild concussion" and "serious concussion"	USA	Hockey	Journalist
"severe concussion"	USA	Football	Journalist
"serious concussion"	USA	Football	Journalist
"light concussion"	Ireland	Gaelic Football	Player (referencing medical staff)
"mild concussion"	USA	Soccer	Journalist quoting President Obama
"serious concussion"	New Zealand	Rugby Union	Journalist
"serious concussion issues"	New Zealand	Rugby Union	Journalist
"serious head knock"	New Zealand	Rugby Union	Journalist
"pretty bad concussion" "severe knock"	New Zealand	Rugby Union	Former professional rugby player Grandfather of injured player
"mild concussion"	Canada	Rugby	Journalist

concussion, the websites examined (and hundreds like them) have the potential to educate a very wide audience and to positively influence concussion knowledge on an extensive scale.

Knowledge transfer has been identified in the literature as a key process in concussion education, and to prevent the spread of incorrect information it is important that messages which are regularly being transmitted to the general public via online media channels are in keeping with best-practice knowledge relating to concussion (Provvidenza & Johnston, 2009; Provvidenza et al., 2013). Historically, news articles relating to concussion in the mainstream media were in paper (print) format. The evolution and the emergence of the internet has radically altered this, meaning that news articles are now able to be archived, have a wider reach, and are able to be disseminated quickly using tools such as Twitter (Sullivan et al., 2012a,b). This heightens the potential impact that negative reporting of concussion can have, but conversely also increases the number of individuals that could be benefit from insightful and factually correct reporting.

As shown in Tables 3 and 4, the terms used to describe concussion that are "softer" in nature and could potentially downplay the severity of an injury (e.g. "blow to the head" and "head knock") were used less frequently than terms such as "brain injury" (which could imply that the injury needs to be taken more seriously). The modifiers of concussion shown in Table 5 primarily originate from journalists (in 12 of the 15 instances), and it was encouraging that there were no examples of direct quotes from medical staff using such modifiers. Given the inconsistencies seen in the modifiers used in the reporting of sports concussion however, it can be argued that the mainstream media still has scope for improvement to help generate a culture of responsible journalism towards the description of these often high-profile sporting injuries.

A controversial recent editorial suggested that CTE is a North American "export" and that there is an agenda to manipulate the media to heighten awareness of the disease throughout the rest of the world (Andrikopoulos, 2015). Our study showed that the term "Chronic Traumatic Encephalopathy" was used to a similar extent in articles originating from the USA (17.4%), Canada (15.8%), and the UK and Ireland (22.2%), suggesting that there is not one predominating region where the media is discussing CTE. The term CTE was seen to be used more than SIS in the articles retrieved, possibly because the discourse related to CTE is more contemporary than that of SIS (which was discussed more heavily in the 1990s; Cantu, 1998; McCrory & Berkovic, 1998). References to other neuropsychological consequences of cumulative concussion (including ALS, Alzheimer's disease, and Parkinson's disease) were mixed, with Table 4 highlighting that most of the discussion related to these pathologies was from articles originating from Canada and the USA. Depression was only mentioned in 6% (n = 9) of all articles retrieved which is in keeping with it currently being a lesser-understood consequence of sports concussion, although it is starting to receive more attention in both the mainstream media and in the scientific literature (Kontos, Covassin, Elbin, & Parker, 2012; Maese, 2014).

The work of Chapman et al. (2014) has highlighted the role that the mainstream media can play in the field of public health, and the authors commented that "a willingness and capacity to engage with the mass media was seen as an essential attribute of influential public health researchers". Given that concussion has been identified as a public health issue it is reasonable to infer that the "concussion community" (i.e. leading researchers and clinicians in the field of sports concussion) need to engage with the mass media to lead the discussion correctly, and better inform the media about this injury (Wiebe, Comstock, & Nance, 2011). Despite the best efforts of dedicated individuals in selected countries, at present this process of engagement with the media is not extensively and consistently undertaken on an international scale.

The use of social media in the field of sports concussion has already been explored and patterns in the usage of various social media platforms have been identified (Ahmed et al., 2014; Sullivan et al., 2012a,b; Williams et al., 2014). This current study has analysed a different sector of online concussion information, however alternative data may have been gleaned from the analysis of concussion news stories which were shared through social media sites (e.g. Facebook and Twitter). In contrast to social media, the mainstream press constitutes a more established media format, with online news stories representing a modern day incarnation of the traditional mainstream press. In order for clinicians and researchers to take a co-ordinated approach to concussion awareness and education across these platforms, the nuances of each of these platforms should be identified and attempts made to tailor knowledge transfer methods for each platform.

Several limitations of this exploratory study are acknowledged. In the absence of a formal and established methodology for evaluating this type of media, we adopted an innovative approach which allowed us to retrieve and analyse this data set. Many of the websites retrieved had comments allowed on the article which constituted a separate source of data. Although these comments were not formally evaluated a wide variety of comments were observed, with some showing some worrying attitudes and opinions towards sports concussion. Further exploration of these comments is warranted in order to better understand these opinions. The snapshot approach adopted in this study means that other patterns and trends in the data may have emerged if the analysis was conducted at a different time (e.g. around the same time as a high profile sporting incident), and this needs to be considered with the interpretation of the results. This study only explored one area of the media (news articles from websites) and therefore it may be that other forms of media (including television/radio commentary of sporting events) have different patterns with regards to the descriptors of concussion. Future studies related to this area could examine the media coverage of live sporting events on television/radio in order to identify the use of concussion descriptors in audio and visual formats.

The potential use of the media via comedy for concussion has been discussed, and the media represents a powerful tool for concussion education (Ahmed et al., 2014). There have been reported examples of concussion education initiatives for coaches and players, however, we also suggest the creation of an international, cross-sport guidelines for journalists reporting concussion events in the mainstream media (Bagley et al., 2012; Sarmiento, Mitchko, Klein, & Wong, 2010). By facilitating the accurate reporting of sports concussion, it is hoped that the mainstream media and sports media can assist the knowledge transfer process highlighted as key in concussion awareness (Provvidenza et al., 2013). The "Media Concussion Checklist" was created as a product of this research and is outlined in Table 6, and we hope that it will be adopted/endorsed by sports and mainstream media companies to assist the accurate and safe reporting of sports concussion.

Conflicts of interests

None declared.

Ethical statements

None declared.

Table 6
Media concussion reporting checklist.

As a journalist, you are in an influential position to educate a wide audience by reporting injuries in the most accurate fashion. If your news article discusses sports concussion, please consider these points before publication:

1. All concussions are serious injuries and would be better described medically as a "brain injury". Does your article make light of the injury? If so then reconsider the language you use.
2. Since all concussions are brain injuries, modifiers such as "mild concussion" or "serious concussion" are misleading.
3. Many colloquial and inaccurate terms such as "head knock", "head clash", "ding" or "bump to the head" diminish the severity of a concussion and can detract from the fact that all are brain injuries. If your article contains such terms then consider removing them and using the term "brain injury" instead.
4. When reporting quotes from athletes or coaches, if any of the colloquial terms or modifiers in points 2 or 3 are used then consider the effect that they might have on public perception regarding the severity of all brain injuries, and whether you need to use these quotes verbatim.
5. A concussion cannot be "shaken off" during a game. The minimum return-to-play duration according to current medical guidelines is 5 days. Ensure that you do not mislead your audience with timescales of return to play following concussion.
6. Losing consciousness is not required to be diagnosed with a brain injury. However, any athlete that does lose consciousness must be removed from play immediately and cannot return until the athlete has complied with return to play medical guidelines.

These steps are intended to guide you towards helping the public to have a better understanding of sports concussion. For more information, please reference the Consensus Statement on Concussion in Sport from the 4th International Conference on Concussion in Sport 2012.

Uncited reference

Ahmed et al., 2010.

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