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## Social norms theory and concussion education

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### Abstract

Secondary prevention of harm from sport-related concussion is contingent on immediate removal from play post-injury. To-date, educational efforts to reduce the prevalent risk behavior of continued play while symptomatic have been largely ineffective. Social norms theory may hold promise as a foundation for more effective concussion education aimed at increasing concussion reporting. The primary objective of this study was to assess whether perceived team concussion reporting norms would be less supportive of an individual's safe concussion symptom reporting behavior than objective team norms. Participants were 328 male and female US collegiate athletes. Written surveys were completed in person during the spring of 2014. Among both male and female athletes, team concussion reporting norms were significantly misperceived, with athletes tending to think that they themselves have safer attitudes about concussion reporting than their teammates. Perceived norms were associated with symptom reporting intention, independent of the team's objective reporting norm. A social norms approach to concussion education, in which misperceived group norms are corrected and shifted in the direction of safety, is an important avenue for program development and evaluation research aimed at the secondary prevention of harm from concussion. Implications for the design of this type of educational programming are discussed.

### Introduction

The high incidence of concussions among participants in organized sport [1–3], combined with growing awareness of the potential health consequences of these injuries, is leading them to be recognized as an important public health priority [4, 5]. At the high school level in the United States alone, more than eight million students participate on at least one organized interscholastic sports team United States every year [6], with nearly 500 000 continuing to compete at the collegiate level [7]. On average, across all sports and both genders, more than five concussions are diagnosed per 10 000 athlete exposures to a game or practice [2].

Symptoms from most concussions resolve in <2 weeks [8]; however, for some athletes the symptoms can persist for longer than 1 month [9]. In that intervening period, athletes may experience a combination of cognitive, somatic and emotional symptoms [9, 10] that can impair their ability to complete school or work obligations [11]. Athletes who sustain more concussions are more likely to experience prolonged symptoms [12–14]. Even if the acute post-injury symptoms resolve there may be risk of harm later in life. Evidence among retired professional and college football players finds that the risk of depression, Alzheimer's disease, and other neurodegenerative conditions such as Chronic Traumatic Encephalopathy increases with the number of concussions sustained during the athlete's playing career [15–18].

Secondary prevention—immediate removal from play of an individual who has sustained a concussion—is an important component of risk reduction. In the symptomatic period post-injury, the athlete’s brain is in a metabolically vulnerable state where an additional impact can result in magnified neurologic consequences [19]. Consequently, athletes are more likely to experience a subsequent concussion while still symptomatic from the initial injury [20–23]. Although rare, there may be an elevated risk of mortality among athletes who sustain additional brain trauma during the neurologically vulnerable period following their initial injury [24].

Despite the importance of timely removal from play, evidence suggests that more than half of all collegiate athletes have continued to participate in their sport while symptomatic after a suspected concussion [25–29]. The gap between concussions sustained and concussions reported is not simply a function of athletes being unable to recognize problematic symptoms [30]. A growing body of evidence suggests that expectancy value cognitions—what the athlete thinks will happen if they report a concussion and how important those outcomes are to them—are significantly associated with reporting intentions and behavior [31–34]. Expected reporting outcomes that are most strongly associated with concussion reporting intentions tend to be proximal and relational: beliefs about what teammates would think about their behavior, and how reporting would impact their team’s athletic performance [33].

Social comparison theory [35] suggests that individuals tend to compare themselves to similar others to get information on whether they are behaving appropriately. Factors facilitating self-appraisal relative to group norms include observing and communicating with others [36]. When an individual performs or does not perform a given behavior, reinforcement from group members can help establish behavioral patterns that are considered desirable within that particular social context [37]. Even if a behavior is considered harmful to the individual, it may be considered desirable if its performance benefits the group [38]; it is possible that playing through injury falls into this category of behavior. This type of seemingly pro-social, but individually costly norm

is thought to be most stable in highly cohesive groups [39, 40]. Sports teams tend to have frequent interactions between members and high cohesion [41], providing many opportunities for observational learning and reinforcement and potentially heightening the influence of team norms.

Consistent with this evidence, concussion-reporting norms have been found to be one of the few cognitions that are associated with concussion reporting intentions and behavior [31–34]. In a sample of male collegiate ice hockey players, pre-season perceptions about what ‘most athletes’ would do when it came to concussion safety were significantly associated with their own in-season concussion symptom reporting behaviors [42]. Notably, the athletes tended to believe that ‘most athletes’ held less safe concussion reporting beliefs than they themselves held, raising the possibility that at least in some populations of athletes concussion-reporting norms may be misperceived.

Misperceived norms tend to persist because group members who believe their preferences are deviant relative to the group norm are less likely than conforming members to express those preferences for fear of social disapproval [43], a self-perpetuating process that has been termed the ‘spiral of silence’ [44]. Irrespective of their accuracy, perceived norms tend to predict behavior. Correcting misperceived norms can present important opportunities for educational intervention. For example, many social norms-correcting educational interventions targeting alcohol consumption among college students have demonstrated effectiveness [45–47].

Despite emerging evidence about the relationship between perceived norms and concussion reporting behavior [31–34, 42], and the promise of social norms interventions in other domains, the most widely used concussion education programs targeted at athletes to-date have tended to focus on increasing an athlete’s ability to identify symptoms of a concussion and their knowledge about what they should do if they are experiencing those symptoms [48]. This programming has been relatively ineffective in changing concussion safety behavior, or in changing cognitions about concussion safety other than knowledge [25, 49–54]. This may, in part, be due to inadequate

attention to perceived norms. Understanding whether concussion safety norms are in fact misperceived among athletes has the potential to inform the development of more effective concussion education programming since it would suggest the potential utility of a norm correcting approach.

In a sample of athletes participating in contact and collision sport at US colleges, the present study tested the hypothesis that perceived team norms about concussion reporting would be less safe than objective team norms. In addition, this study tested the hypothesis that safer perceived concussion reporting norms would be associated with safer concussion reporting intentions.

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## Method

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### Sample and procedure

Participants were 328 US collegiate athletes, from 19 teams, competing at one of four colleges located in the New England region of the United States. Participation rates were 25% at the institutional level, 54% at the team level and 74% at the individual level. There were no significant differences between participating and non-participating institutions in their division of competition mean standardized test scores of entering undergraduate students, number of sports sponsored by the athletic department, undergraduate enrollment or whether the institution was public or private. Seven contact and collision sports in which there is an elevated risk of concussion [1–3] were included in the present sample: soccer (6 teams), lacrosse (3 teams), field hockey (2 teams), basketball (3 teams), volleyball (1 team), baseball (3 teams) and softball (1 team). Written surveys were completed in-person during the spring of 2014. Research activities were approved by Harvard School of Public Health Institutional Review Board and informed consent was obtained from all participants.

### Measures

#### *Perceived team reporting norms*

Participants answered six questions about what their teammates would think about different

concussion reporting scenarios. The scenarios and questions were drawn from Rosenbaum and Arnett's [55] Concussion Attitude Index, changing the referent of 'most athletes' to 'my teammates'. For example, one scenario read: 'Athlete H suffered a concussion and has a game later in the day. He is still experiencing symptoms of concussion. However, Athlete H knows that if he tell is coach about the symptoms, his coach will keep him out of the game'. The question relating to this scenario read: 'My teammates would feel that Athlete H should tell his coach about the symptoms'. Items were scored on a seven-point Likert scale, with higher scores indicating perceived norms that were more supportive of concussion safety (minimum score = 6, maximum score = 42). In the present sample, the internal consistency reliability was adequate (Cronbach's alpha = 0.76).

#### *Individual concussion reporting attitudes*

Participants responded to six questions that were identical to the perceived concussion reporting norm questions in all ways except that the referent 'my teammates' was changed to 'I.' Higher scores indicated individual attitudes that were more supportive of concussion safety. Internal consistency reliability for the measure was adequate (Cronbach's alpha = 0.75).

#### *Objective team reporting norms*

For each team, the average of individual team member concussion reporting attitudes was calculated, with this value representing the team's objective reporting norm.

#### *Misperception of team norms*

The difference between objective and perceived team reporting norms was calculated for each individual by subtracting the derived mean value representing their team's objective reporting norm from their unique score on the perceived team reporting norms measure. Negative values indicate objective team norms that are more supportive of concussion safety than perceived team norms.

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### *Concussion reporting intention*

Symptom reporting intention was assessed by querying intention to report each of the 21 symptoms included in the Sport Concussion Assessment Tool-3rd edition (SCAT-3). The SCAT-3 is one of the most frequently used tools for assessment of concussion symptoms by athlete self-report. Participants responded to the prompt 'In the future, I intend to report my symptoms if I sustain an impact that causes me to have/be...' with response options provided on a seven-point scale, ranging from strongly disagree (1) to strongly agree (7). Responses were summed, and then divided by the total number of symptoms to create a measure with a possible range of one to seven. All 21 items strongly loaded onto a single factor (eigenvalue = 15, all factor loadings > 0.76), suggesting a unidimensional index structure; internal consistency reliability was high (Cronbach's alpha = 0.98).

### *Demographic characteristics*

Participants indicated their sex, age, race/ethnicity, and the number of concussions they had ever had diagnosed by a medical professional.

### **Statistical analysis**

Paired sample *t*-tests were used to compare perceived and objective team concussion reporting norms for the sample as a whole and separately for male and female athletes. A standardized difference score was calculated as the respective group's average misperception divided by the standard deviation of the difference. One-way analysis of variance (ANOVA) with Bonferroni corrections for multiple comparisons were used to assess whether there were differences between teams in objective team norms, perceived team norms, and the magnitude of norm misperception. Two-sample *t*-tests with pooled variance assessed whether there were differences in these measures between male and female participants.

Pairwise Pearson correlations, with Bonferroni corrections for multiple comparisons, were calculated between the following continuous variables: individual attitudes, perceived team norms,

objective team norms, norm misperception, symptom reporting intention, age and lifetime number of diagnosed concussions.

Multivariable linear regression assessed the association between symptom reporting intention and perceived team norms independently (Model 1), and controlling for objective team reporting norms (Model 2). The athlete's sex was included in all models as an additional independent variable. Clustered robust standard errors were used in all analyses to account for possible team-level non-independence. An alpha level of  $P < 0.05$  was adopted as the threshold for significance in all analyses. Missing data were minimal and was handled via listwise deletion. STATA 12.1 (College Station, TX) was used for all analyses.

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## **Results**

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The mean age of participants was 19.80 years (SD = 1.33) and 53.05% were female. Around 1 in 10 (8.64%) had been diagnosed with a concussion during the previous athletic season, while around 4 in 10 (41.05%) had ever been diagnosed with a concussion. The mean symptom reporting intention score for the sample was 5.12 out of 7 (SD = 1.37). Forty-three percent of the sample (43.34%) indicated that they intend or strongly intend to report symptoms of a suspected future concussion. Additional descriptive statistics on key variables are presented in Table I.

For the sample as a whole, mean scores for objective norms were 33.24 out of possible 42 points (SE = 5.91) and perceived team norms were 32.57 out of 42 (SE = 5.76). This difference translated to a standardized difference score of 0.22 (95% CI = 0.11–0.32), indicating that objective team norms were significantly higher (and thus safer) than perceived team norms in this sample (Table II).

Results of ANOVA indicated that objective norms were significantly different between teams [ $F(18, 306) = 2.10, P = 0.006$ ], as were perceived team norms [ $F(18, 305) = 1.97, P = 0.011$ ]. However, the magnitude of norm misperception was not significantly different between teams.

**Table I.** Sample descriptive statistics

Variable	Mean (SD) or <i>n</i> (%)
Sex	
Female	171 (52.78%)
Male	153 (47.22%)
Race/ethnicity	
White	281 (86.20%)
Black or African American	21 (6.44%)
Hispanic/Latino	12 (3.68%)
Age	19.80 (1.33)
One or more concussions diagnosed last season	28 (8.64%)
One or more concussions diagnosed ever	133 (41.05%)
Intention to report concussion symptoms	5.12 (1.37)

Two-sample *t*-tests indicated that perceived team norms were significantly less safe among male athletes as compared with female athletes [ $t(323) = 4.55, P < 0.001$ ], as were objective norms [ $t(322) = 4.10, P < 0.001$ ], and the magnitude of norm misperception [ $t(323) = 16.15, P < 0.001$ ].

Pairwise Pearson correlations are reported in Table III. Concussion reporting attitudes and perceived team reporting norms were highly and significantly correlated ( $r = 0.86$ ). Reporting intention was significantly associated with reporting attitudes ( $r = 0.32$ ), perceived team reporting norms ( $r = 0.36$ ), and the magnitude of norm misperception ( $r = 0.34$ ).

In multivariable linear regression analyses including athlete sex Table IV, safer perceived team norms were significantly associated with greater

**Table II.** Magnitude of concussion reporting norm misperception

Team	Objective norm (SD)	Perceived norm (SD)	Misperception (SD)	<i>t</i>	df	<i>P</i>	<i>Z</i>
All	33.24 (5.91)	32.57 (5.76)	-0.67 (3.09)	-3.88	323	<0.001	-0.216
Female	34.48 (5.47)	33.94 (5.19)	-0.54 (2.99)	-2.38	170	0.019	-0.181
Male	31.93 (6.02)	31.07 (7.21)	-0.80 (3.20)	-3.10	152	0.002	-0.250

Objective norms are the mean value of the individual attitude scale scores for a given group of individuals (minimum score = 6, maximum score = 42). Higher scores indicate safer attitudes; Perceived norms are the mean value for the perceived teammate norm scale scores for a given group of individuals (minimum score = 6, maximum score = 42). Higher scores indicate safer perceived teammate norms.

Misperception calculated as difference between individual's perception of their team norm and the derived objective team norm.

**Table III.** Pairwise Pearson correlations between variables

	1.	2.	3.	4.	5.	6.
1. Intention	1.00					
2. Attitudes	0.32***	1.00				
3. Perceived norms	0.36***	0.86***	1.00			
4. Objective norm	0.11	0.33***	0.30***	1.00		
5. Misperception	0.34***	0.78***	0.94***	-0.04	1.00	
6. Age	0.02	-0.05	-0.04	-0.16	0.00	1.00
7. Diagnosed concussions	0.01	0.01	0.03	0.00	0.08	0.07

Significance levels Bonferroni corrected for multiple comparisons.

Higher scores reflect greater intention to report post-impact SCAT-3 symptoms

Perceived norms are perceived teammate norms about concussion reporting (higher values indicate norms that are more supportive of concussion safety).

Attitudes are the individual's own beliefs about concussion reporting (higher values indicate attitudes that are more supportive of concussion safety).

Misperception reflects the difference between what the individual believes to be team reporting norms and their team's objective concussion reporting norm.

\*\*\* $P < 0.001$

**Table IV.** Multivariable linear regression predicting intention to report symptoms sustained after a head impact

Variable	Model 1 b (95% CI)	Model 2 b (95% CI)
Perceived norms	0.09 (0.06–0.12)***	0.09 (0.06–0.11)***
Objective norm		0.07 (–0.08–0.22)
Sex (Female = 1)	0.257 (–0.17, 0.68)	0.43 (–0.04–0.91)
$R^2$	0.129	0.143

\*\*\* $P < 0.001$ .

Lower intention scores reflect greater intention to report symptoms of a suspected concussion after a head impact.

Perceived norms are perceived teammate norms about concussion reporting (higher values indicate norms that are more supportive of concussion safety).

Team-self discrepancy reflects the difference between what the individual believes to be team reporting norms and their own reporting attitudes.

Clustered robust standard errors used to account for team-level non-independence.

symptom reporting intention (Model 1;  $b = 0.09$ ,  $P < 0.001$ ). This significant association persisted (Model 2,  $b = 0.09$ ,  $P < 0.001$ ) when also controlling for the objective concussion reporting norm of the participant's team.

## Discussion

Given the substantial fraction of athletes who continue playing their sport while symptomatic [25–29], it is imperative that interventions be developed that increase symptom reporting. This study provides support for the potential utility of a norm-correcting educational approach. Among both male and female athletes, team concussion reporting norms were misperceived, with athletes tending to think that they themselves have safer attitudes about concussion reporting than do their teammates.

The magnitude of the difference between perceived and objective norms was moderate, less than one 1 point on a scale with a 36-point range. However, the standardized magnitude of misperception was relatively similar to that found in many studies of alcohol consumption norm discrepancies, a domain in which numerous interventions based on social norms theory have demonstrated effectiveness [45]. Borsari and Carey [56] conducted a meta-analysis of 102 studies of self-other discrepancies with respect to alcohol consumption among college students and found a combined effect of 0.34 (95% CI = 0.28–0.43). Notably, they also found that

the magnitude of the discrepancy varied by the respondent's proximity to the reference group and by the specificity of the question. Reference groups that were more distant tended to have larger effect sizes, suggesting that a reference group of 'most athletes' or 'most people in my sport' might result in a larger effect size than the 'my teammates' reference group used in this study.

However, simply finding that a misperception exists between perceived and objective norms is not sufficient to justify the use of a social norms approach, regardless of the size of the misperception. Berkowitz [57] has outlined a series of questions to help determine whether a social norms intervention is relevant for a given health behavior. One question is whether the majority of individuals in a group hold these misperceptions. More than three-quarters (77.5%) of the participants in this study perceived their own reporting attitudes to be safer than those of their teammates. A second question is whether behavior changes would be predicted if the misperceptions were corrected. Athletes who had safer perceived team concussion reporting norms tended to have greater intentions to report post-impact symptoms. This association was not attenuated even when controlling for objective team reporting norms. This suggests that, to the extent symptom reporting intentions predict reporting behavior, correcting misperceptions and bringing perceived team norms to reflect objective team norms should be associated with an increase in symptom reporting behavior.

Kroshus *et al.* [42] have previously suggested the potential utility of building from the successful work of Labrie and colleagues [58] in correcting misperceived alcohol consumption norms among collegiate student-athletes. Members of participating teams who were attending an educational session used a wireless keypad to respond to questions about their own beliefs and behaviors related to alcohol consumption. All athletes attending were able to see perceived and objective group norms in real-time. Participation in this intervention was associated with persistent change in perceived group alcohol consumption norms. This type of approach, one that engages teams and incorporates real-time feedback using technology commonly accessible in college classrooms, may have potential for correcting misperceived concussion-related norms. Program development and evaluation work is encouraged to explore the efficacy of concussion education interventions that incorporate elements of this approach.

Although norms were significantly misperceived among athletes of both genders, the difference was greater among male athletes. Consistent with Social Role Theory [59], which describes how social role expectations influence behaviors, there may be gender differences in what athletes believe are socially expected attitudes about injury, toughness and help-seeking. Although research suggests that male sports settings are becoming increasingly inclusive of a wider range of masculine behaviors [60], the larger magnitude of norm misperception among male athletes as compared with female athletes raises the possibility that the narrative of toughness and self-reliance in sport may continue to resonate most strongly with male athletes, even when the athletes themselves are becoming more supportive of help-seeking. Consequently, male athletes in particular may benefit from norm correcting interventions.

Misperceived team norms may also have implications for concussion safety behaviors above and beyond an individual's own concussion reporting. In other domains, misperceived norms have negatively impacted an individual's likelihood of engaging as a bystander [61–63]. Correcting misperceived norms could thus benefit individuals both directly and also

indirectly, should appraisals of teammates being more strongly in support of concussion safety result in a greater frequency of bystander behavior to encourage concussion symptom reporting. Exploring the association between perceived norms and bystander behavior in support of concussion safety is an important direction for future research.

Although there was a significant difference between perceived and objective norms, an educational approach that relies solely on correcting misperceived norms is unlikely to be adequately efficacious, particularly since the objective norms were not fully supportive of concussion safety. Kroshus *et al.* [42] have suggested that one strategy for modifying objective team norms could be having teams and coaches collectively clarify their values and expectations about concussion reporting and about how being a good team member means looking out for the health and safety of other team members. This strategy has been employed successfully on collegiate cross-country running teams to encourage healthy team communication about help seeking for suspected disordered eating [64]. A strategy that engages coaches and teammates in setting safe injunctive team norms, and that gives a voice to all team members, could have a benefit of disrupting the spiral of silence that helps perpetuate misperceived norms and could help in shifting true norms in the direction of concussion safety.

Importantly, perceived and objective norms only explained 14% of the variance in symptom reporting intention. There are likely other barriers to reporting that are not included in the present model. These could include perceptions about what stakeholders in the athletic environment other than teammates, such as coaches or parents want them to do when it comes to concussion reporting. Recent research conducted with the same sample of athletes finds that the more stakeholders from whom an athlete experiences pressure to continue play while symptomatic after a concussion the less likely they are to intend to report symptoms of a future concussion [65]. Other explanations could include non-relational expectancies about concussion reporting such as perceptions about whether or not reporting

symptoms will result in improved health outcomes, or whether reporting will cause them to lose valued commodities such as playing time or scholarship money [33]. Although there is utility in concussion education programming to change modifiable cognitions about concussion reporting, including correcting misperceived norms, and, as appropriate, correcting misperceived expectancies about the outcomes of reporting, contextual changes may also be warranted to address expectancies about the outcomes of reporting. For example, a perception that an athlete would lose their scholarship if they report a concussion could represent a misperception on the part of the athlete which could be corrected through well-designed concussion education; alternatively, it could reflect a real contextual constraint on reporting that could be addressed through structural changes related to scholarship policy. In addition to developing more efficacious concussion education for athletes, it is critical that research continue to explore the range of factors that are facilitating or constraining concussion reporting so that appropriate interventions can be developed at the most impactful levels.

### Limitations

A primary limitation of this study is that it is cross sectional, and that consequently reporting intentions, as opposed to actual reporting behaviors, were measured. Prospective studies are needed in which the association between changes in perceived norms and changes in reporting behavior are assessed. Ideally, adequately powered multilevel research is needed to understand the extent to which team level factors, such as perhaps coach attitudes about concussions or communication with athletes about concussion safety, are related to variability in team norms and individual reporting intentions and behaviors.

There are also limitations to the generalizability of the findings, as participants came from a limited subset of contact and collision sports teams from one region of the country, and the sports of football and ice hockey were not included. This can also be viewed as strength, as there is an elevated risk of

concussion in sports that do not receive the same media and research attention as football and ice hockey. Regardless, additional research is also needed to extend this research to other contact and collision sports, levels of competition, ages and geographic locations to understand how broadly applicable a social norms approach would be for concussion education.

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### Conclusion

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Concussion education has the potential to play an important role in reducing the public health burden of concussion by modifying secondary preventive behaviors. A social norms approach to concussion education, in which misperceived group norms are corrected and shifted in the direction of safety, may help increase the effectiveness of concussion education programming. Theory-driven program development and evaluation research is needed to explore the utility of such an approach.

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### Conflict of interest statement

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None declared.

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