Concussion disclosure in middle and high school youth: Who gets the message and are they trained to receive it?

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Abstract

Background: Disclosure of concussion is vital for proper diagnosis and treatment. Youth have many stakeholders to whom they may disclose concussion, including parents, peers, coaches, and school personnel. We examined whom high school and middle school youth report concussion and the level of concussion education of the recipients of the disclosure.

Methods: Data were analyzed from 2362 students, 680 parents, and 150 school personnel who completed an online survey about concussion reporting, education, and training.

Results: Youth were most likely to disclose concussions to parents, particularly mothers, and their peer group. Middle school youth reported to teachers and school nurses at higher rates than high school youth. High school youth were more likely to disclose concussion to coaches and athletic trainers than middle school youth. While mothers were the most likely recipient of youths’ reporting, they were least likely to have received concussion education.

Conclusions: Recipients of youth concussion disclosure differs by school level. Parents are the most common recipients of disclosure. The role of school personnel and coaches changes as youth enter high school. Youth primarily report concussions to parents, yet parents receive the least amount of concussion training. These findings highlight the need for targeted concussion training for stakeholder groups as their role in disclosure may differ by school age.

Keywords

Concussion, concussion reporting, youth sports, youth stakeholders

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Introduction

Sport-related concussion affects approximately 9–13% of high school and middle school athletes. Educational efforts have improved the knowledge of concussion signs, symptoms, and reporting through community-based programs, and are effective in increasing concussion knowledge in the short term. However, this knowledge does not necessarily translate into long-term change in behavior, as athletes still fail to report symptoms or seek medical attention after a suspected concussion. Approximately 30–50% of sport-related concussions may go unreported in the high school and collegiate setting. Athletes may underreport concussion due to perceived negative outcomes such as not wanting to be removed from play, not thinking the injury is serious and lack of knowledge of concussion symptoms, among others. Social pressures such as feeling embarrassed, letting the team down, or being perceived as weak may also influence an individual’s intention to report concussion symptoms. Furthermore, an athlete’s relationship with coaches, parents, and peers and the perceived level of pressure from these stakeholders can influence reporting behavior.

Disclosure of concussion is a critical initial step in a sequence of proper diagnosis, treatment and return to
activity and sport. Sports-related concussion may present with visible signs such as loss of consciousness, balance instability, confusion, and vomiting. However, the majority of concussions occur without visible signs, such as headache, dizziness, fatigue, or nausea. When visible signs are not apparent, it is critical for athletes to disclose symptoms to a recipient who can acutely assess concussion or to a stakeholder in their environment who can triage to proper healthcare professionals trained in the diagnosis and management of concussion. Thus, the recipients’ knowledge of concussion signs and symptoms is important to help the individual obtain appropriate medical assessment.

To whom youth disclose concussion is likely influenced by social-contextual factors such as relationships with parents, school personnel, coaches, certified athletic trainers (ATCs), and peers. Kroshus et al. demonstrated that college athletes who perceived pressure to continue to play after head impact from teammates, parents, and fans would be less likely to intend to report concussion symptoms in the future. In contrast, athletes who believe that their teammates would support disclosure of symptoms of concussion are more likely to report.9

Concussion reporting behaviors have primarily been examined in high school and collegiate level athletes. Less is known about concussion disclosure at the middle school level. Organized athletics become more central to youth at the middle school level. This is often the first opportunity for youth to participate in school sponsored sports, versus recreational or club teams for younger school age children. Recipients of concussion disclosure may in fact differ for middle school and high school athletes given differences in developmental understanding of topics related to concussion, as well as different weights of importance of individuals in their social–ecological context. For example, peer relationships become increasingly important in adolescence and can influence positive social behavior.11

The present study examined concussion disclosure in middle school and high school youth to determine whether concussion educational efforts are targeting the correct stakeholders when youth disclose concussion. The goals were to examine (1) whom are youth most likely to disclose concussion signs and symptoms and (2) what is the level of training on concussion for the identified recipients. Disclosure of concussion symptoms has been shown to vary across school level (middle vs. high school) with one study showing higher rates of concussion reported in middle school athletes.12 Studies examining gender differences in reporting are mixed, with some studies showing girls as more likely to disclose concussion, while other studies show boys more likely to report than girls.13,14 As such, we tested for these differences in each of our goals.

Methods

Procedure

The study was conducted in collaboration with a medium size school district in the Western Region of the United States. Approval was obtained through the school district and use of human subjects was obtained through the local university IRB. The athletic director at five high schools and two middle schools distributed a URL link to all parents and school personnel via e-mail to access an on-line survey (Qualtrics, Provo, UT). Students completed the online survey via a URL link during a school gym class or freshman orientation class. Response rate for students was 32% of the 7477 students enrolled in the participating schools. Responses were anonymous and allowed for passive consent for youth. Parents were given the option to decline participation for their child. Separate surveys were constructed for students, parents, and school personnel.

Basic demographic information was collected from all participants. Youth reported their school, grade, gender, and sports played in-and-outside of school. Parents reported their own gender, and their youth’s gender, school, and grade. Parent and youth data were not matched as responses were anonymous. The online survey was comprised of questions drawn from reliable and validated measures within the concussion literature to assess concussion knowledge, norms, values, intentions, attitudes, and reporting behavior.7,15,16

Youth were asked to indicate whether they had ever (1) experienced any of eight concussion symptoms following an impact in sports (dizziness, “bell rung”, lost consciousness, saw stars, vomited/nausea, difficulty remembering, headache, problems studying/concentrating),7,15 (2) to whom they reported symptoms, (3) how many times they reported (on a three point Likert scale (every time, some of the time, never) and for analysis responses were recoded into a dichotomous indicator of any reporting (every time or some of the time) versus no reporting (never)), and (4) were they ever diagnosed with a concussion by a healthcare professional.

Parents and school personnel were also asked about their experience with education on topics related to concussion. They responded yes, no or “I don’t know” to whether they received training about concussion signs and symptoms, reporting, management, and proper concussion prevention. These items were recoded into dichotomous variables indicating Yes or No (No and I don’t know).
Participants

The sample comprised 2362 students, 680 parents, and 150 school personnel. Eighty-seven percent of students identified themselves as an athlete playing a school sport, club sport, or both. Parents were primarily mothers (77.5%) reporting about sons (58.8%) who were athletes (83.5%) from high school (56.7%). School personnel included teachers (60%), administrators (8%), and staff (29.3%), primarily from high schools (72.7%). Thirty-one percent identified as coaches. Because we asked youth to whom they did report, rather than to whom they would report, our final sample included only youth who reported having experienced any symptoms of concussion (N=1430; 60.5% of original sample). Among the youth who reported ever experiencing any symptoms, 34.2% reported being diagnosed with a concussion (Table 1).

Data analysis

Survey data were analyzed using SPSS 25.0. Chi-square tests were used to compare number or reporters/rates (e.g., youth, parents, school personnel) on variables of interest (e.g., ever reported, to whom they reported) and across specific groups (e.g., middle school vs. high school; boys, vs. girls).

Results

To whom are youth disclosing concussion? The highest percentage of youth reported symptoms to mothers, fathers, and their peer group. Far fewer youth reported to a teacher, school nurse, or ATC (Figure 1).

Chi-square tests indicated no significant differences between middle and high school students in rates of reporting to mother, father, or peer group. A higher percentage of high school youth than middle school youth reported to an ATC (55.7.0% vs. 43.2%; $\chi^2 (1) = 15.36, P < 0.000$) or coach (80.4.0% vs. 71.0%; $\chi^2 (1) = 13.54, P < 0.000$). Middle school youth reported at higher rates to teachers (42.9% vs. 31.6%; $\chi^2 (1) = 13.48, P < 0.001$) and school nurses (48.9% vs. 34.1%; $\chi^2 (1) = 23.0, P < 0.000$) when compared to high school youth. The only effect for gender was that girls were slightly more likely to report to a peer than boys (91.5% vs. 88.6%; $\chi^2 (1) = 6.4, P < 0.01$). There were a few notable grades by gender interactions. Boys in middle or high school did not differ in rates of reporting to coaches, but high school girls reported to coaches at a higher rate than middle school girls (82.7% vs. 69.1%; $\chi^2 (1) = 11.6$,

![Figure 1](image-url)

**Figure 1.** Recipients of youth concussion disclosure.

*High school > Middle school; P < 0.000

**Middle school > High school; P < 0.001, P < 0.000, respectively
Middle school boys were more likely than high school boys to report to a teacher (42.0% vs. 30.9%, \( \chi^2 (1) = 7.09, P < 0.008 \)) or school nurse (52.1% vs. 33.5%, \( \chi^2 (1) = 19.63, P < 0.000 \)). Similarly, middle school girls were more likely than high school girls to report to a teacher (44.4% vs. 32.4%, \( \chi^2 (1) = 6.33, P < 0.01 \)) or school nurse (47.5% vs. 35.5%, \( \chi^2 (1) = 6.1, P < 0.01 \)).

What kind of concussion training do the recipients have? Coaches report being educated on topics of signs and symptoms of concussion, reporting, management, and prevention at higher rates than school personnel or parents (Table 2).

Mothers receive the least amount of education on any topic. Fathers reported more training on all aspects of concussion; recognizing concussion signs, and symptoms (\( \chi^2 (1) = 13.27, P < 0.000 \)), concussion reporting (\( \chi^2 (1) = 21.7, P < 0.000 \)), management (\( \chi^2 (1) = 16.8, P < 0.000 \)), and prevention (\( \chi^2 (1) = 20.8, P < 0.000 \)) than mothers. Follow-up analyses by school level indicated that these differences were evident in both middle and high school, but were slightly stronger in parents of high school students. Across reporters, the least amount of education for all groups occurred on the topic of proper techniques to prevent concussion.

Discussion

The present study examined to whom high school and middle school youth disclose concussion symptoms and the level of training those recipients have regarding concussion. Stakeholders including mothers, fathers, and peer group play an important role when youth report concussion symptoms. Our study demonstrates that parents are the most common recipients of disclosure of concussion for both middle and high school youth. Results also indicate differences between high school and middle school youth reporting practices. For example, the role of school personnel and coaches as recipients of concussion disclosure changes as youth enter high school. Middle school youth report concussion symptoms to school personnel such as teachers and school nurses, at a higher rate than high school youth. In high school, the impact of athletic resources is apparent, with youth disclosing at higher rates to coaches and ATCs than middle school youth. Differences in concussion training for stakeholders is also apparent, with coaches and school personnel more educated than parents on topics of recognizing signs and symptoms of concussion, concussion reporting and management and proper techniques to prevent concussion.

Parents and peers are the most common recipients of disclosure of concussion for both middle and high school youth. Socio-ecological models that examine concussion reporting at multiple levels of societal relationships suggest that with increasing age for children, the role of the parent interaction changes.\(^{18}\) In early childhood, parents directly choose their child’s sports and can control exposure to contact or risk for concussion, for example. The role of the parent becomes more indirect as the child ages and makes more autonomous choices on sports participation. Parents are then less able to control or prevent exposure to concussion. Parents become more of a bystander, supporter, and fan. Yet, our study would indicate that while there may be a shift in the parent interaction, and reporting behavior from middle school to high school for other stakeholders, parents remain a constant recipient of reporting.

Knowledge of to whom youth are reporting allows for more targeted educational or interventional programs to the correct audience of recipients. Middle school youth reported concussion to teachers or school nurses at higher rates than high school youth, emphasizing the importance of educating school personnel on concussion. Other studies have shown that only 12% of teachers reported feeling “very knowledgeable” about concussion and desired more formal training on topics related to concussion.\(^{19}\)

Increasing disclosure of concussion for middle school youth is of particular interest moving forward for several reasons. First, middle school youth participate in scholastic and nonscholastic sports in greater numbers than high school age youth.\(^{20}\) Second, influencing reporting attitudes and establishing behavioral patterns that are reinforced early in childhood may carry forward to new contexts (i.e., improving concussion disclosure for those youth in high school and beyond).\(^{21}\) Most research on concussion knowledge and reporting in youth is currently conducted on high school age youth, so greater attention needs to be directed toward understanding the development of youth concussion attitudes and behaviors in middle school.

| Types of concussion training (%) | Concussion signs and symptoms | Concussion reporting | Concussion management | Concussion prevention |
|---------------------------------|-----------------------------|----------------------|----------------------|----------------------|
| Coaches                         | 95.2                        | 90.5                 | 92.9                 | 75.6                 |
| Non-coach school personnel      | 53.9                        | 38.9                 | 45.5                 | 29.5                 |
| Mothers                         | 39.0                        | 27.5                 | 33.7                 | 23.9                 |
| Fathers                         | 57.5                        | 50.0                 | 54.2                 | 45.3                 |
school and the various socio-ecological factors that influence concussion disclosure.22

At the high school level, in addition to educating parents, educating peer groups and coaches may be a more relevant strategy given high school youth reporting behavior. High school students were more likely to report symptoms to a source knowledgeable on concussion (i.e., ATC or coach) than middle school students. In our sample, high school youth reported symptoms to ATCs at lower rates than reported in other studies.6 Previous studies have primarily included teams from single sports (i.e., football) that have consistent ATC coverage, while our study included athletes from a wider variety of sports.

A large percentage of high school and middle school youth in our study also reported concussion symptoms to peers. One study showed that athletes who believe their teammates are likely to report concussion are more likely to model that behavior.9 Thus, exploring the peer-to-peer relationships and the efficacy of programs to encourage concussion reporting among teammates is an important area for future research.

Gender differences are also apparent in concussion disclosure behavior. While there was no main effect of gender when examining disclosure behavior overall, gender differences in reporting behavior emerged within specific relationships between stakeholders and youth. Middle school girls were less likely to report to coaches than high school girls, and middle school boys were more likely to report to a teacher or school nurse than high school boys. Likewise, middle school girls were more likely to disclose to school personnel than their high school counterparts. Previous research has suggested that adolescent females are more likely to disclose concussion than adolescent males.13,23 Our research suggests that in addition to gender, the relationship to the stakeholder at different levels of sport participation and age may also play a role in disclosure behavior. Other studies have demonstrated effect of relationships, such as coaches approachability influencing reporting behavior in youth athletes.4 Future studies are needed to examine the role of stakeholder relationships and how they influence youth athletes’ decisions to disclose concussion symptoms. This may additionally inform targeted education techniques based on the influence level of various stakeholders in youth’s socio-ecological environment.

Our results also indicate that parents, the most common stakeholders to receive the disclosure of concussion signs and symptoms from youth, are the least educated on topics related to concussion. Mothers in particular are not consistently educated on concussion signs and symptoms, reporting, management, or prevention techniques. In addition, in our study, teachers who are not involved in coaching are an important recipient at the middle school level, yet only 30–50% reported being educated on topics related to concussion. State laws mandate concussion education for most coaches and school personnel but requirements vary by state for athletes and parents.24 Implementation of educational programs has been shown to improve concussion knowledge for coaches, while exposure to concussion information was more limited for parents and athletes in a sample of high school athletes.4,25 Parents’ knowledge and ability to identify concussion varies across studies, with parents of younger children being less educated on concussion.26,27 Furthermore, it may be important to take into account the practicality and feasibility of the kinds of concussion knowledge that parents require at different phases, such as at pre-season, in-season, for acute injury management and during the injury recovery period.

This disparity between to whom youth disclose concussion signs and symptoms and who is educated most effectively may be a critical gap in the steps to effective diagnosis, management and return to safe play and activity. Parents often do not suspect concussion until informed by medical personnel.28 Moreover, parents may be more likely to receive information about concussions from pediatricians, coaches, or media, than educational courses designed specifically to teach about concussion.26,28 It is unclear whether readily available sources, such as online sources, provide sufficient education that parents can use effectively. Although resources are becoming more easily available for parents, access alone may not be enough. For example, video resources available on the popular source YouTube, are primarily anecdotal, present some causes of concussion, with few that can be classified as “professional.”29 As such, easy access can quickly spread misinformation. Greater understanding about what kind of media-based concussion information parents access and whether and how they use it to influence their child’s, and their own, behavior is needed. Because parents can play a critical role in helping to shape youth concussion disclosure behaviors, identifying ways to increase parent education and providing concrete guidance to parents about their role in youth concussion disclosure may be helpful to changing the culture of concussion nonreporting.30

Across the stakeholders surveyed in this study, the least frequent type of training was in primary prevention of concussion, including proper techniques to prevent concussion. This is consistent with how educational efforts to date have focused on secondary prevention, meaning reducing the impact of symptoms after an athlete has sustained a concussion.22 It is important to explore policies, practices, and programs that may decrease the occurrence of concussion,
including the type of equipment being used, coaching practices to teach youth proper techniques, and rules and policies around sporting behaviors, as well as how symptoms are reported and managed.\(^\text{31}\)

**Limitations**

Several limitations of this study should be noted. First, our sample is drawn from two school districts and may not represent the population of middle and high school athletes nationally. It is also school-based, but because it was voluntary, not all students were assessed. Thus, our sample over-represents athletes and under-represents students who do not play sports at school. Because club sports are a popular activity for youth, assessing youth from club and community leagues will be an important future direction. In addition, it is likely that schools within a district vary in the resources they have to offer to sports programs including ATCs and resources for educating athletes, coaches and parents about concussion. In the present study, each high school employed a part time athletic trainer, while the middle schools had an ATC come during the lunch hour one day per week to offer services. Last, although our sample is fairly large for a study of this kind, it is still underpowered to explore critical questions about concussion rates and reporting across sport types (e.g., contact vs. noncontact) and school grades.

**Conclusions**

The present study adds to a growing body of literature regarding concussion disclosure for youth, parents, and school personnel. In particular, it expands the focus of reporting to youth in middle school, an age-group that is understudied. Changing the culture of concussion disclosure requires an approach that changes attitudes, knowledge, and behaviors in all youths’ social contexts, including family, peers, and schools. Although most current concussion education is directed toward coaches, stakeholders including parents, peers and school personnel play an important role in helping to cultivate the expectation that youth will disclose concussion. With regard to educational efforts, we should also be cognizant that the kind of education and messaging that is needed for parents, peers, and school personnel is likely to be different and knowing how to effectively match the concussion education message to the recipient of youth disclosure may be key to changing the culture of concussion reporting.

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