



# Youth Sport-Related Concussions: Perceived and Measured Baseline Knowledge of Concussions Among Community Coaches, Athletes, and Parents

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## Abstract

**Objective:** To assess concussion knowledge of athletes, coaches, and parents/guardians in a community setting and to understand trends/gaps in knowledge among subgroups to tailor efforts toward creating educational interventions.

**Participants and Methods:** This prospective cross-sectional study involved 262 individuals (142 [55%] female): 115 athletes participating in noncontact and contact sports (ages 13-19 years), 15 coaches, and 132 parents. Recruitment occurred from August 30, 2015, through August 30, 2016, at 3 local high schools. Participants completed a questionnaire developed by the investigators to assess concussion experience and basic knowledge.

**Results:** Females, health care employees, and parents showed stronger concern for potential long-term sequelae of concussion, whereas athletes were most concerned about not being able to return to sport. Those with higher perceived concussion knowledge were slightly older (median age, 42.5 vs 33 years), more educated (college or higher: 42 [70%] vs 100 [50%]), and more likely to be health care workers (22 [37.9%] vs 34 [17.7%]) and scored higher on knowledge questions (average correct: 75.5% vs 60%). Most participants could identify potential concussion sequelae, but only 86 (34.3%) identified a concussion as a brain injury. Of the subgroups, coaches scored highest on knowledge questions. Those with a concussion history tended to consider themselves more knowledgeable but were also less concerned about sequelae. Overall, those with a concussion history scored slightly higher on knowledge questions (average correct: 69.8% vs 61.9%). Participants involved in contact sports were more likely to have had a concussion vs those in noncontact sports (57 [26%] vs 4 [10.3%]).

**Conclusion:** Significant differences in perceived and actual concussion knowledge across different subgroups of study participants involved in high school sports were identified.

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A concussion is a form of mild traumatic brain injury that can have physical, cognitive, and psychological implications in both the short- and long-term. On a biochemical level, a concussion results in a neurometabolic cascade that causes the brain to be more sensitive to stress and further injury until it has fully recovered. From a symptom perspective, concussions can lead to headaches, dizziness, fatigue, memory and concentration deficits, irritability, mood changes, and loss of consciousness in 10% of those affected.<sup>1</sup> Concussions are often referred to as the “invisible injury” because

people can outwardly appear “normal” while still experiencing substantial sequelae internally.

According to the Centers for Disease Control and Prevention, 1.6 million to 3.8 million sport-related concussions are sustained in the United States per year across all competitive sports and recreational activities,<sup>1</sup> with more than 62,000 concussions occurring annually at the high school level.<sup>2</sup> Although contact sports such as football, hockey, rugby, and soccer have the highest incidences of concussion, athletes across all sports are at risk for head injury.<sup>2,3</sup>

According to the 2014 American Medical Society for Sports Medicine position statement on concussion, the greatest risk factor for concussion is a history of concussion, which increases the athlete's likelihood of repeated concussions by 2 to 5.8 times. Additional risk factors include (1) sex—females are more at risk than their male counterparts in sports with similar rules and experience longer/more severe symptoms; (2) age—physiologic differences leave children more susceptible to catastrophic injury; (3) player position—those with increased player-to-player contact have higher risk; and (4) history of learning disorders, mood disorders, attention-deficit/hyperactivity disorder, or migraine.<sup>4</sup> It has been previously shown that most concussed athletes see symptom resolution within 7 to 10 days, but more recent work has shown an average of 22 days between date of injury and medical clearance,<sup>5</sup> optimized by immediate removal from play when a concussion is suspected.

A large part of the concussion recovery process is avoiding premature return to play (RTP).<sup>6,7</sup> Successful RTP protocols involve a stepwise increase in activity, focusing on progressive exertion without excessive provocation of symptoms. Proper RTP progression allows the vulnerable brain the appropriate time to heal to help avoid prolongation of symptoms.<sup>6,7</sup> Incomplete recovery and premature RTP puts an athlete at risk for second impact syndrome, a rare phenomenon involving a rapid course of neurologic deterioration that can result in coma or death.<sup>8</sup> Ideally, RTP incorporates clearance from a licensed health care provider trained in the evaluation and management of concussions.<sup>9</sup>

It is estimated that 50% to 70% of sport-related concussions continue to go unreported or undetected,<sup>5</sup> most commonly secondary to a lack of knowledge of concussion symptoms and poor awareness of concussions overall.<sup>10</sup> Per the literature, increasing a coach's knowledge of concussions influences the reporting of concussive injuries to medical personnel.<sup>10,11</sup> This knowledge is critically important because the underreporting of concussions is a major barrier to their proper management. Several studies have surveyed players, coaches, trainers, or parents to assess their knowledge of sport-related concussions

and their management. Findings revealed widely inaccurate knowledge of symptoms, a poor sense of when it is appropriate to remove an athlete from play, and premature or improper RTP.<sup>8,10,12,13</sup>

As of 2014, all 50 states have legislation in place addressing pertinent issues in sport-related concussion. Educational programs and initiatives exist as well, although most are sport specific or are infrequently accessed.<sup>14-16</sup> To date, the literature includes few to no concussion studies comparing contact and noncontact sport athletes and male and female athletes. In addition, to our knowledge, no studies to date have examined correlations between coaches', parents', and athletes' concussion knowledge in these contexts.

This study aimed to collect questionnaire data from athletes involved in contact and noncontact sports on male and female teams at the high school level, coaches, and parents/guardians to assess baseline knowledge regarding the definition of concussion and concussion risk factors, potential long-term effects, and basic management. These data will help identify gaps, trends, and inconsistencies in concussion knowledge in an effort to tailor the creation and implementation of future educational interventions to improve understanding of concussion.

## METHODS

Each author certifies that his or her institution approved the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research.

## Participant Population

For this prospective, cross-sectional study, athletes, parents, and coaches were recruited through 3 local high schools during preparticipation meetings held before the commencement of fall, winter, and spring sports from August 30, 2015, through August 30, 2016. Eligible individuals included athletes (ages 13-19 years), coaches, and parents/guardians involved in the football, soccer, volleyball, hockey, basketball, wrestling, dance, gymnastics, lacrosse, baseball, and softball teams at 3 large Rochester, Minnesota, area high schools. Those excluded were players, coaches, and parents/guardians who did not consent to

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