

Shifting Responsibilities: A Multi-Level Approach to Concussion Management within Adolescent Sport

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An estimated 1.6 to 3.8 million sports-related concussions occur each year in the United States (Langlois et al., 2006). Following a concussive injury, the brain is left in a vulnerable state whereby returning to sports activities before complete recovery could put an individual at an increased risk for subsequent concussions (Grady, 2010), prolonged recovery from concussion symptoms (Halstead & Walter, 2010), and even catastrophic consequences such as long-term disability (Iverson et al., 2004; McCreary et al., 2009). Thus, sports-related concussions constitute a particularly significant public health concern that sport organizations and sport organization stakeholders (e.g., administrators, educators, athletic directors, coaches, parents and athletes) need to be aware of and prepared to address. Increased media attention and litigation regarding concussions has heightened public awareness about the prevalence and potential for concussion-related complications later in life. Consequently, a number of governmental agencies including the National Institutes of Health (NIH) and Centers for Disease Control and Prevention (CDC) and several prominent sports governing bodies such as the National Football League (NFL), the National Collegiate Athletic Association (NCAA), and the National Federation of State High School Associations (NFHS) have strongly encouraged increased regulation and oversight of the medical management and return-to-play decision-making following concussive injuries. In the spring of 2010, NFL Commissioner Roger Goodell sent a letter to U.S. Governors that encouraged a push for concussion legislation to protect young athletes in their states. According to The Center for Sports Concussions at Idaho State University, 39 states have since passed concussion legislation and six additional states have concussion legislation currently pending. Many of these state legislative acts require increased educational outreach efforts for coaches, parents and athletes, mandates for immediate removal from play of any athlete who sustains a concussion and written clearance from a health care provider who is trained in concussion management.

As suggested by Emery and colleagues' (2006) theoretical model, the most effective injury prevention-intervention models necessitate a hierarchy of responsibility that reduces the responsibility and accountability of the children and parents and transfers regulation to higher-level organizational and policy-building entities. The reasons for this include, the (a) limited evidence for the success of interventions that are dependent upon self-imposed behavior changes on the parts of parents/children, (b) unknown awareness and understanding of the risk factors, consequences and prevention strategies amongst parents and children and (c) belief that interventions established on the part of higher level regulatory entities can set a tone about safety that triggers a socio-cultural environment that can ultimately support and sustain changes. The purpose of this study was to test Emery and colleagues' theoretical model relative to concussion management by evaluating if the increased engagement on the part of sport governing bodies with concussion awareness education and the introduction of new state-level legislation have made an impact on concussion management practices at the high school level. A secondary goal of this study was to determine if practices differ between male and female sports teams.

Data were extracted from the National High School Sports-related Injury Surveillance System, High School RIO™ (Reporting Information Online) for the 2008/09, 2009/10, 2010/11 and 2011/12 academic years. High School RIO is an Internet-based system that surveys athletic trainers (AT) across the United States for weekly reports on injury incidence and athletic exposure data (described previously in detail: see Centers for Disease Control and Prevention, 2006 and Mararr, et al. 2012). Data was available for 18 sports (boys' football, boys' and girls' soccer, girls' volleyball, boys' and girls' basketball, wrestling, baseball, softball, girls' field hockey, girls' gymnastics, boys' ice hockey, boys' and girls' lacrosse, boys' and girls' swimming and diving and boys' and girls' track and field) for all academic years. Additional data for boys' volleyball and cheerleading were available for the 2009/10, 2010/11 and 2011/12

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academic years. High School RIO tracks all injuries that occur as a result of participation in practice or competition. This study focused on concussions and the decision-making processes regarding return-to-play. To determine if progress with regard to concussion management has been made, we evaluated athletic trainers' perception of if they believed an athlete returned to play before recovery was complete for 2008/09-2011/12 academic years. Items regarding specific details about the removal of concussed athletes were not added to the surveillance system until 2010/11. Responses to this item were evaluated in relation to the hierarchy of responsibility proposed by Emery and colleagues (2006).

Cumulatively, a total of 4,626 concussions were reported across all available sports during the 2008/09-2011/12 academic years. ATs reported that they believed an athlete returned to play too soon for 14.8% of concussed athletes (14.7% of athletes from boys' teams and 15.3% of athletes from girls' teams) in 2008/09, 13.1% of athletes (12.8% from boys' teams and 14.2% from girls' teams) in 2009/10, 6.9% of athletes (5.5% boys' teams, 10.8% girls' teams) in 2010/11 and 4.5% of athletes (3.1% boys' teams, 7.8% from girls' teams) in 2011/12. The data was split into 2008/09-2009/10 compared to 2010/11-2011/12 to determine if a difference in the proportion of athletes that ATs perceived to return to play before full recovery had changed relative to the implementation of state level legislation initiatives that occurred in 2010. Chi-square tests for independence (with Yates Continuity Correction) indicated that the proportion of athletes that ATs perceived to return to play before full recovery was not the same between the 2008/09-2009/10 academic years and the 2010/11-2011/12 academic years, $X^2 = (1, n = 3229) = 62.12, p = 0.00, \phi = 0.14$. Chi-square tests for independence indicate that the proportion of athletes that ATs believed returned to play before complete recovery were similar for boys' and girls' teams for the 2008/09-2009/10 academic years, $X^2 = (1, n = 1440) = 0.22, p = 0.00, \phi = 0.14$. However, the proportion of athletes that ATs believed returned to play before complete recovery were different for boys' and girls' teams for the 2010/11-2011/12 academic years, $X^2 = (1, n = 1789) = 15.73, p = 0.00, \phi = 0.10$. For the 2010/11 and 2011/12 academic years, ATs reported that the decision to remove an athlete from play after a concussion was most often made by certified ATs or other healthcare professionals (61.9% of the time), followed by coaches (15.9% of the time) and athletes (4.9% of the time). ATs reported that athletes were not removed from the competition/practice immediately after a concussion occurred 15.5% of the time.

Our results indicate that in alignment with Emery and colleague's theoretical model, the increased attention on the part of prominent sport organizations and the initiation of concussion management legislation at the state levels may have helped initiate a socio-cultural change that that has decreased the number of athletes that return to participation prior to full recovery from a concussion. However, this change appears to be slower for girls' sports teams than for boys' sports teams. Therefore, further progress may necessitate additional targeted strategies to ensure continued progress in concussion management for girls' sports. These results also indicate that a sizable proportion of athletes may still be permitted to continue to play immediately following a concussion injury. This is disconcerting, as symptoms may not emerge until hours or even days after a concussion occurs (Halstead, 2010). As such, stricter oversight regarding protocols for removing athletes from play following a suspected concussive injury may be necessary.