

NH State Advisory Council on Sport-Related Concussion  
Sport-Related Concussion Consensus Statement

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# Sport-Related Concussion Consensus Statement

## Preamble

The New Hampshire State Advisory Council on Sport-Related Concussion was created to provide guidance for school and youth league administrators, coaches, parents and athletes on this very important topic. The purpose of this consensus statement is to guide the creation and implementation of a best-practice model for sport-related concussion management including safe return to sports and return to school. Medical science concerning sport-related concussion is a rapidly growing field; the most recent research was used in the preparation of this statement. Statements are based on evidence but users should be aware that there are still many areas of controversy in this relatively young research field. Because of this fact, this document will be reviewed at least yearly to take advantage advances in our knowledge about concussions.

## Consensus Topics

Definition of concussion; Signs and symptoms of concussion

Concussion grading scales

Significance of loss of consciousness & amnesia in determining the severity of concussion

Special considerations associated with pediatric concussion

Multiple concussions, second impact syndrome

Role of baseline testing (neurocognitive performance, balance, concussion signs and symptoms) in management of concussion

Return to sport after concussion

Return to school after concussion

Certified athletic trainers at the high school level

Education of coaches, parents and athletes (s/s, ding/bell ringer, need to report)

Education of physicians

## Feasibility

The Council recognizes that schools and youth leagues have varying degrees of resources for implementing the recommendations contained herein. However, it is important for administrators to express and demonstrate support for adherence to best-practice sports medicine to the extent possible.

**NOTE: Throughout the document, citations within quoted material are references from the source article.**

## Executive Summary

- A concussion is a serious injury. Colloquial terms such as "ding" or "bell ringer" minimize and trivialize an injury that may have lasting consequences. Those terms should be eliminated from the concussion vocabulary. All injuries to the brain, regardless of how apparently minor they seem, should be managed appropriately.
- Neither loss of consciousness nor amnesia is a required element for the diagnosis of a concussion. In the majority of concussions, neither is present.
- A young athlete (through high school) who experiences concussion signs or symptoms after a direct or indirect blow to the head should not return to activity on the same day. Some brain injuries evolve slowly and the true severity of an injury may not be apparent initially.
- Signs and symptoms of concussion may fall into multiple categories in somatic, cognitive and emotional domains. Headache, fatigue, irritability, difficulty concentrating and sleep disturbance are a few examples. Coaches, athletes, parents and school officials should be familiar with common signs and symptoms so concussions and/or their sequelae do not go unrecognized.
- Each concussion is unique. Concussion grading scales fail to account for the individuality of this injury and may result in an athlete being sent back to activity too soon or held out too long. In place of concussion grading scales, healthcare providers are advised to manage concussions on an individual basis including careful monitoring of clinical symptoms, physical signs, behavior, balance, sleep and cognition in the assessment and monitoring of concussion. Once all signs and symptoms have resolved, a monitored gradual, structured return to activity is recommended.
- School personnel (nurse, guidance, teachers) should be informed of the occurrence of a concussion and student-athletes who have suffered a concussion should be monitored at school for academic performance difficulties and behavior changes.
- Evidence suggests that pediatric athletes may be more vulnerable to concussion, may require a longer recovery period and may suffer more long-term sequelae than adults. There may also be an increased risk of second-impact syndrome, an often-fatal brain swelling, which has almost exclusively been documented in young athletes.
- Neurocognitive baseline assessment of athletes who participate in collision or contact sports is recommended whenever it is feasible as it can be used by healthcare providers as objective evidence of an injured athlete's return to cognitive normalcy. However, neurocognitive testing is only one element of what should be a multipronged approach to assessing and managing sport concussion.
- Athletic programs, both school and community-based, should adopt a sport concussion management protocol. The NH Council has developed a template for such a program that should be adapted according to each program's resources and in consultation with team physicians.
- Coaches, athletes and interested parties (parents, administrators, etc.) should receive current basic education on the topic of sport-related concussion.
- Physicians must stay abreast of current practice guidelines and topics regarding the appropriate management of athletes who have suffered a concussion, especially return-to-play decision-making.

## Definition of Concussion

Experts present at the First International Conference on Concussion in Sport (2001)<sup>1</sup> agreed on the following components of the definition of concussion. Major statements published since that date<sup>2-5</sup> have agreed and provided minor updates. The definition from the recent 3<sup>rd</sup> International Conference on Concussion in Sport (Zurich, 2008) is:

Concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include:

1. Concussion may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an “impulsive” force transmitted to the head.
2. Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.
3. Concussion may result in neuropathological changes but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.
4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course however it is important to note that in a small percentage of cases however, postconcussive symptoms may be prolonged.
5. No abnormality on standard structural neuroimaging studies is seen in isolated concussion.

## Signs and Symptoms of Concussion

The diagnosis of acute concussion usually involves the assessment of a range of domains including clinical symptoms, physical signs, behavior, balance, sleep and cognition (3). A detailed concussion history is an important part of the evaluation both in the injured athlete and when conducting a pre-participation examination. The suspected diagnosis of concussion can include one or more of the following clinical domains:

- (a) Symptoms—somatic (e.g. headache), cognitive (e.g. feeling like in a fog) and/or emotional symptoms (e.g. emotional lability);
- (b) Physical signs (e.g. loss of consciousness, amnesia);
- (c) Behavioral changes (e.g. irritability);
- (d) Cognitive impairment (e.g. slowed reaction times);
- (e) Sleep disturbance (e.g. drowsiness);

If any one or more of these components is present, a concussion should be suspected and the appropriate management strategy instituted.

Several symptom checklists or scales exist and are useful; all are very similar. The following list was published in the National Athletic Trainers' Association Position Statement: Management of Sport Related Concussion.<sup>2</sup>

Blurred Vision	Dizziness
Drowsiness	Excess Sleep
Easily Distracted	Fatigue
Feel "In a Fog"	Feel "Slowed down"
Headache	Inappropriate Emotions
Irritability	Loss of Consciousness
Loss of Orientation	Memory Problems
Nausea	Nervousness
Personality Change	Poor Balance/Coordination
Poor Concentration	Ringing in Ears
Sadness	Seeing "Stars"
Sensitivity to Light	Sensitivity to Noise
Sleep Disturbance	Vacant Stare/Glassy Eyes
Vomiting	

## Concussion Grading Scales

More than 20 concussion grading scales have been devised to date.<sup>6</sup> One significant motivation for the creation of these scales was to provide guidance regarding return-to-play decision-making (e.g., the worse the concussion "grade," the longer athletes would be held out of sports). Knowledgeable experts in the field have been responsible for most of the scales; however, it is important to note that these scales are based on experience and anecdotal evidence rather than research-based evidence. Further, many make grading decisions based on the occurrence of loss of consciousness. However, research published since the development of these scales has shown that loss of consciousness is not always predictive of post-concussion sequelae. (See sections on the significance of loss of consciousness and amnesia.) A consensus of experts at the Vienna<sup>1</sup> and Prague<sup>5</sup> international conventions on sport-related concussion experts stated, "... that injury grading scales be abandoned in favor of combined measures of recovery to determine injury severity (and/or prognosis) and hence individually guide return to play decisions received continued support."<sup>5</sup>

Dr. Robert Cantu, creator of one of the more widely used grading scales and an internationally-recognized expert on sport-related concussion has stated regarding the Vienna<sup>1</sup> consensus, "In place of a single grading scale and in the absence of any scientifically validated return-to-play guidelines, the participants recommended the use of a clinical construct based on an assessment of recovery from injury and graded return to play... **I believe that these recommendations are sound and are not controversial.**"<sup>7</sup> The authors of a review article published in Pediatrics also expressed their agreement with this concept, "Given the substantial individual variation in responses to concussions, most experts would now agree that the initial "grade" of a concussion is less important than the systematic tracking of each athlete's recovery course over time."

Demonstrating true international consensus on this issue, the Zürich statement<sup>3</sup> makes no mention whatsoever of concussion grading scales.

**The NH State Advisory Council on Sport-Related Concussion agrees with the individual-athlete management and decision-making approach and supports the use of careful monitoring of clinical symptoms (somatic, cognitive, emotional), physical signs, behavior, balance, sleep and cognition in the assessment and monitoring of concussion.**

## Significance of Loss of Consciousness & Amnesia in Determining the Severity of Concussion\*

Arguably, the two most readily identifiable signs of concussion are loss of consciousness and amnesia. Recognition that neither is required for an injury to be diagnosed as a concussion is very important. In fact, research has shown they actually present rather infrequently, in 9% and 27% respectively, in one study.<sup>8</sup> That study found that symptoms such as headache, dizziness, confusion and disorientation were much more common. Further, when brief loss of consciousness does occur in sport related concussion it appears to be a weak predictor of outcome as evident in research cited in the NATA position statement<sup>2</sup>:

Studies involving high school and collegiate athletes with concussion revealed no association between (1) [loss of consciousness] and duration of symptoms or (2) [loss of consciousness] and neuropsychological and balance tests at 3, 24, 48, 72, and 96 hours postinjury.<sup>21,28,29</sup> In other words, athletes experiencing [loss of consciousness] were similar to athletes without [loss of consciousness] on these same injury severity markers.

There is continuing support in the Zürich statement<sup>3</sup> for the concept that there is limited value associated with using the presence or absence of loss of consciousness of less than one minute in length as a predictor of outcome. (They did, however, suggest that loss of consciousness for more than one minute should be considered in the management of concussion.)

In the overall management of moderate to severe traumatic brain injury, duration of [loss of consciousness] is an acknowledged predictor of outcome.<sup>79</sup> While published findings in concussion describe [loss of consciousness] associated with specific early cognitive deficits it has not been noted as a measure of injury severity.<sup>80,81</sup>

Because of this, the experts at the Zürich (2008)<sup>3</sup> Conference recommended that, despite its association with early neuropsychological deficits, loss of consciousness not be relied on as a measure of acute concussion severity.

Experts in Zürich made a similar recommendation regarding amnesia:

Published evidence suggests that the nature, burden and duration of the clinical post-concussive symptoms may be more important than the presence or duration of amnesia alone.<sup>8,15,17</sup>

It is important to note, however, that while loss of consciousness and amnesia may not be good predictors of ultimate injury severity, they must still be respected. The NATA<sup>2</sup> advised that, "Athletes who experience loss of consciousness or amnesia should be disqualified from participating on the day of the injury." This recommendation was expanded in the Zürich statement<sup>3</sup> which concluded that pediatric athletes (through high school) experiencing *any* signs or symptoms of concussion should not return to play on the day of injury.

**The NH State Advisory Council believes it is important for all concerned to realize that loss of consciousness and amnesia, although often apparent and sometimes dramatic, are present in**

**only a small percentage of concussions. Concussions characterized by other signs and symptoms may be equally or more significant and warrant appropriate care.**

\*References within quoted material are from the original text.

## Special Considerations Associated with Pediatric Concussion\*

A general tenet of pediatrics is that children should not be treated as or considered to be small adults. This concept extends to the management of concussion, though not without some controversy. Until the facts of pediatric concussion risk are elucidated by research, the NH Council considers it best to err on the side of caution. The Zurich<sup>3</sup> consensus includes this general statement:

The panel strongly endorsed the view that children should not be returned to practice or play until clinically completely symptom free, which may require a longer time frame than for adults. In addition, the concept of 'cognitive rest' was highlighted with special reference to a child's need to limit exertion with activities of daily living and to limit scholastic and other cognitive stressors (e.g. text messaging, videogames, etc.) while symptomatic. School attendance and activities may also need to be modified to avoid provocation of symptoms.

Specific areas of concern regarding pediatric concussion are noted below. There is some evidence that concussion is more prevalent among younger athletes<sup>8,9</sup> and concern exists that their injuries have the potential to be of greater severity and take longer to resolve. Kirkwood, et al's<sup>6</sup> review of the management of pediatric concussion provides a nice summary about the possibility of increased vulnerability:

Traditionally, young age at the time of brain injury has been thought to have protective benefits; the "Kennard principle" holds that the young brain's plasticity would allow for more recovery after insult.<sup>56</sup> However, a growing literature, including studies of more severe TBI, strongly indicates that the immature brain is more vulnerable, not more plastic, to diffuse injury.<sup>57-67</sup> Several hypotheses have been put forth to help explain this increased vulnerability: skills not yet well established at the time of insult could be more susceptible to disruption than well-established ones; the brain systems responsible for skill acquisition could be affected directly by diffuse injury; functional recovery may be restricted by the injured child's smaller repertoire of existing skills; and an injury to the immature brain could interfere neurobiologically with the intricate sequence of chemical and anatomic events necessary for normal development.<sup>44,68-70</sup>

In addition to increased vulnerability, there is concern that children suffering concussion may require longer recovery periods. Field, et al<sup>10</sup> compared concussed high school and collegiate athletes and found that the high school athletes demonstrated prolonged memory dysfunction compared with the collegiate athletes. Lovell, et al<sup>11</sup> have found that high school athletes sustaining mild injuries may experience symptoms that can last for days post-injury.

Another area of concern relates to the heightened demands of school and learning. This was recognized during the Second International Conference on Concussion in Sport<sup>5</sup> where the, "... concept of "cognitive rest" was introduced with special reference to a child's need to limit exertion with activities of daily living and to limit scholastic activities while symptomatic." This area of concern is also nicely summarized by Kirkwood, et al.<sup>6</sup>

The contextual or environmental demands faced by children and adults differ as well. Adults have already learned and mastered much of the knowledge and many of the skills they need to function successfully in everyday settings. In contrast, children are continually expected to acquire new information and skills, especially during the school months. Thus, they are often expected to use a set of neurobehavioral skills that are vulnerable to [mild traumatic brain injury], such as the ability to focus and sustain attention, rapidly process information, and hold information in mind while generating a response.<sup>16,72,73</sup> As a result, clinical management of pediatric concussion requires an understanding of the contextual demands that children face across development<sup>74</sup> to allow for the provision of suitable assistance.

Finally, several reasons exist for increased conservatism in making the return-to-play decision concerning concussed pediatric athletes. Once again, Kirkwood<sup>6</sup> provides a nice summary:

In the pediatric athlete, a number of additional reasons exist to suggest that the return-to-play decision should be made with ample care. First, we do not yet have a clear understanding of how repeated brain insult could change neurobiological or neurobehavioral development over the long run. Second, the risk-benefit analysis in younger athletes is often considerably different from that in adults, weighted much more heavily toward potential loss or future functional disruption as opposed to immediate gain from returning to competition. Third, although extremely rare, second-impact syndrome has been documented almost exclusively in immature brains, suggesting that the young athlete is at heightened risk for the potentially catastrophic consequences that have been reported after repeated injury.

Authors of the NATA Statement<sup>2</sup> agree that the potential for second-impact syndrome is of concern and they have included the following recommendation. “Because damage to the maturing brain of a young athlete can be catastrophic (i.e., almost all reported cases of second-impact syndrome are in young athletes), athletes under age 18 years should be managed more conservatively, using stricter [return-to-play] guidelines than those used to manage concussion in the more mature athlete.”

**The NH State Advisory Council on Sport-Related Concussion agrees that school personnel and primary-care physicians need to be informed of the occurrence of a concussion. Further, student-athletes who have suffered a concussion should be monitored at school for academic-performance difficulties in addition to monitoring for return to play.**

\*References within quoted material are from the original text.

## Multiple Concussions\*

Research on athletes at both the high school and college levels has demonstrated that a history of previous concussions lowers the threshold for sustaining a subsequent concussion. Recovery may also be slower in those with a history of previous concussions. Guskiewicz et al provided an excellent review of this research in the NATA Position Statement.<sup>2</sup>

Once an athlete has suffered a concussion, he or she is at increased risk for subsequent head injuries.<sup>21,43,86</sup> Guskiewicz et al<sup>21,23</sup> found that collegiate athletes had a 3-fold greater risk of suffering a concussion if they had sustained 3 or more previous concussions [self-reported] ... and that players with 2 or more previous concussions required a longer time for total symptom resolution after subsequent injuries.<sup>21</sup> Players also had a 3-fold greater risk for subsequent concussions in the same season,<sup>23</sup> whereas recurrent, in-season injuries occurred within 10 days of the initial injury 92% of the time.<sup>21</sup> In a similar study of high school athletes, Collins et al<sup>82</sup> found that athletes with 3 or more prior concussions were at an increased risk of experiencing LOC (8-fold greater risk), anterograde amnesia (5.5-fold greater risk), and confusion (5.1-fold greater risk) after subsequent concussion...Most important is that these data provide evidence for exercising caution when managing younger athletes with concussion and athletes with a history of previous concussions.

Increased susceptibility to subsequent concussions and prolonged recovery (e.g. post-concussion syndrome) are also concerns related to multiple *current* concussions (i.e., a second trauma prior to resolution of an existing concussion). Athletes who suffer a second blow to the head prior to resolution of the first are at risk for more severe acute problems and longer recovery periods. The most dramatic potential consequence, though rare, of continuing or returning to play prior to concussion resolution is second impact syndrome.

## Second Impact Syndrome\*

Second Impact Syndrome is defined as: a condition where the brain swells rapidly after receiving a second concussion before the symptoms/sequelae of the first concussion have subsided. This extremely rare condition has most often been reported in adolescents, and is thought to be related to failure of the neurological control of blood flow to the brain. The time from second impact to critical, life-threatening brain swelling is reported to be quite short, taking two to five minutes. If swelling of the brain leads to critically high pressure on the centers that regulate respiration in the brain stem, respiratory failure occurs and leads to death without life support. Despite its extreme rarity, the dramatically life-threatening nature of Second Impact Syndrome is enough to cause concern and heightened awareness of the need to insure complete resolution of concussion before exposure to further risk. The Council espouses this approach.

From Kirkwood et al:<sup>6</sup>

Clinical evidence also suggests that physiologic responses are age-dependent after [mild traumatic brain injury]. Most prominently, age-based differences are seen in “second-impact syndrome,” which, as commonly described, results from a second blow to the head while a youth is still symptomatic from a previous concussion.<sup>47,48</sup> Disruption to autoregulation of the brain’s blood supply is thought to underlie second-impact syndrome, the symptoms of which may include vascular engorgement, diffuse cerebral swelling, increased intracranial pressure, brain herniation, and ultimately coma and death.<sup>49</sup> Although controversy continues about whether the second impact actually plays a role in triggering the neurologic consequences,<sup>50,51</sup> agreement exists that diffuse cerebral swelling or malignant cerebral edema does occur in very rare cases after [mild traumatic brain injury] and that immaturity of the brain is a clear risk factor.<sup>52-55</sup>

**The NH State Advisory Council on Sport-Related Concussion recognizes that insuring resolution of concussion prior to allowing return to sport activity is the basis of safe management of sport concussion. The Council further recognizes that a history of multiple concussions should prompt more conservative management and may warrant consideration of the advisability of continued participation in contact or collision sports.**

\*References within quoted material are from the original text.

## **Role of Baseline Testing (Neurocognitive Performance, Balance, Concussion Signs and Symptoms) in Management of Concussion**

The body of literature in this area is growing rapidly. Briefly, the theory behind baseline testing is that examining an athlete prior to injury (i.e., at baseline) will allow healthcare providers to compare post-injury to pre-injury performance. This would provide an objective assessment to help identify resolution of concussion effects. Other current means of assessing the progression and resolution of a concussion are subjective, and are unfortunately therefore vulnerable to the [misguided] efforts of those motivated to return an athlete as soon as possible regardless of the risk (or perhaps in ignorance of the risk). Certainly the clinical impression of experienced healthcare providers is an important factor, but in the absence of other objective means (e.g., a molecular marker) the Council believes that athletes are best served by this approach. When logistically feasible, school-based sports medicine providers (certified athletic trainers) should be trained in, and implement a multi-faceted baseline testing program for contact/collision sports with high concussion risk. The addition of this data to the healthcare provider's clinical impression only serves to enhance the decision-making process.

**The NH State Advisory Council on Sport-Related Concussion recommends baseline assessment of all relevant athletes with validated assessment tools. Training and supervision in the use of these tools is a critical component of best practice standards. Baseline assessments should be repeated every two years. Baseline testing results should be reviewed to screen for effects of poor effort or other suspicious results.**

**The Council recognizes that schools and youth leagues have varying degrees of resources for implementing the recommendations contained herein. However, it is important for administrators to express and demonstrate support for adherence to best-practice sports medicine to the extent possible.**

## Return to Sport after Concussion

There is expert consensus<sup>3</sup> that for injured children and adolescents, a more conservative return-to-play approach is recommended. One specific area of conservative management is the recommendation that it is not appropriate to return a young athlete to play on the day of the concussive injury.<sup>3</sup> Experts<sup>1, 2, 5</sup> further agree that the earliest any athlete should return to play is when:

- no concussion-related signs or symptoms of any kind are apparent at rest or during exertion (no athlete should return to play while still symptomatic in any way); and
- neurologic examination is normal.

Experts<sup>1, 2, 5</sup> also agree that once all signs and symptoms have resolved (including test results back to/near baseline), a stepwise progression beginning with light aerobic activity and culminating with a return to game play should be employed. Progression through this protocol should take several days; athletes who experience a return of symptoms during the protocol should stop exercising and resume the protocol the next day or after the subsequent resolution of symptom, whichever is LATER.

- Schools (and their associated healthcare providers) that employ baseline testing should seek guidance from published research regarding the basing of return-to-play decisions on follow-up test scores. Further, schools should endeavor to insure that their team physician has appropriate training and knowledge in the management of sport-related concussion. Physicians and other healthcare providers who assume responsibility for managing athletes who have suffered a concussion, must stay abreast of current practice guidelines and topics, especially return-to-play decision-making.

**The NH State Advisory Council on Sport-Related Concussion recommends that athletes be returned to play only after symptoms and objective test results have returned to their baselines, and an appropriate sequence of graded exertional exercises is completed with no return of signs or symptoms. In cases where involved medical professionals cannot reach agreement on return-to-play status, the more conservative opinion should take precedence.**

## **Return to School after Concussion**

Experts convened at the international concussion in sport meetings<sup>3,5</sup> agreed that the scholastic demands regularly place on school-age children are cause for concern during concussion recovery. Kirkwood<sup>6</sup> points out several non-sport related considerations that should be implemented when dealing with concussed athletes:

- Provide general concussion education to patient, parents, and school personnel
- Ensure appropriate support in place for transition back to school
- Treat each medical problem symptomatically
- Expect positive outcome for most children
- When recovery is not proceeding as expected, promptly refer to specialists (e.g., in neuropsychology, neurology, rehabilitation, sports medicine, pain management, education, behavioral health)

There are several modifications that might be made to ease the transition back to school including a gradual return, reduced workload and adequate rest/breaks.<sup>6</sup> Temporary accommodations may be needed to allow for 'cognitive rest.' While it is possible that some students could use this as an excuse for reducing expectations, the Advisory Council believes it is better to err on the side of caution. Ongoing monitoring and communication with school personnel should reduce risks to the athlete.

**The NH State Advisory Council on Sport-Related Concussion recommends systematic involvement of school personnel such as nurse, counselor, and/or psychologist to advocate for and support appropriate accommodations for athletes who have suffered a concussion.**

## Medical Personnel in the Schools

### Certified Athletic Trainers

There should be a qualified allied healthcare provider available to student athletes at the school on a daily basis. A qualified healthcare provider is educated in the prevention, immediate care, treatment and rehabilitation of athletic injuries. The IDEAL choice would be a Certified Athletic Trainer.<sup>12</sup> The American Medical Association believes that school administrators, athletic directors, and coaches should work with local physicians, medical societies, and medical specialty societies, as well as government officials and community groups to undertake appropriate measures to ensure funding to provide the services of a certified athletic trainer to all high school athletes. The Council agrees with this statement.

**Athletic training is not the same profession as personal training.** Athletic trainers are healthcare professionals who collaborate with physicians to optimize activity and participation of patients and clients. Athletic training encompasses the prevention, diagnosis, and intervention of emergency, acute, and chronic medical conditions involving impairment, functional limitations, and disabilities.

To become certified athletic trainers, students must graduate with bachelors or masters degree from an accredited professional athletic training education program and pass a comprehensive test administered by the Board of Certification. Once certified, they must meet ongoing continuing education requirements in order to remain certified. More than 70 percent of certified athletic trainers hold at least a master's degree.

**The NH State Advisory Council on Sport-Related Concussion recommends schools have appropriate coverage by AT's for all athletic teams, and contact/collision teams in particular. As part of their role, the AT will identify and assess concussions, and manage the return-to-play protocols.**

### Team Physicians

All certified athletic trainers are required to work under the supervision of a physician. Generally this physician assumes the role of team physician and provides direction to the AT regarding the management of injuries, including concussion. Frequently there are written standing orders regarding management of specific types of injuries. The management of concussion should be discussed and included in management directives. In schools or programs with no AT, the school administration should enlist the services of a qualified (preferably one with sports medicine and/or team physician training) physician to provide direction for their

athletic programs. Physicians and other healthcare providers who assume responsibility for managing athletes who have suffered a concussion must stay abreast of current practice guidelines and topics, especially return-to-play decision-making.

**The NH State Advisory Council on Sport-Related Concussion recommends that team physicians have appropriate training and knowledge in the management of sport-related concussion.**

### **School Nurses**

School nurses have long been the front-line of medical care in the schools. In the context of sports-related concussions, schools can provide important monitoring and communication functions as a liaison between the AT and the school faculty. Nurses can also serve as advocates for obtaining accommodations for students who have academic or behavioral difficulty as a consequence of concussion.

**The NH State Advisory Council on Sport-Related Concussion recommends involvement and training of school nurses.**

### **Neuropsychologists**

Neuropsychologists are licensed as clinical psychologists and have additional training in neurology, neuroanatomy, brain-behavior relationships, psychometrics and treatment. Neuropsychology is a specialty recognized by the American Psychological Association and requires specific course work, pre-doctoral and post-doctoral training. Neuropsychological tests should be interpreted and supervised by neuropsychologists.

**The NH State Advisory Council on Sport-Related Concussion recommends that neuropsychologists review and supervise neuropsychological and cognitive testing as part of the best-practice protocol.**

### **Education of Coaches, Parents and Athletes**

Research has demonstrated a significant general lack of knowledge about the signs and symptoms and potential sequelae of concussion. Significant risk is attached to that ignorance because injuries that are not recognized by the athlete or those around him cannot be properly managed; the injured athlete cannot be protected from potential second impact if he is still playing. Athletes, coaches and parents should all be educated about the signs and symptoms and about the importance of reporting them to appropriate medical personnel.

Another education effort should focus around updating the language of concussion to ensure appropriate respect for the injury. For example, the NATA recommends elimination of the use of words like "ding" and "bell ringer" to describe concussive episodes because they tend to minimize the importance of the injury, which may preclude appropriate management.<sup>2</sup> In light of the recent tragic death of Natasha Richardson, one of the NATA's recommendations is particularly timely: "It is essential that this injury be reevaluated frequently to determine if a more serious injury has occurred, because often the evolving signs and symptoms of a concussion are not evident until several minutes to hours later."

**The NH State Advisory Council on Sport-Related Concussion recommends that coaches, athletes and interested parties (parents, administrators, etc.) receive current basic education on the topic of sport-related concussion.**

### **Education of Physicians**

It is sometimes difficult for busy physicians to stay abreast of rapidly changing research in a very specific area like sport-related concussion. This is especially true of physicians with broad responsibility for healthcare (e.g., pediatricians, primary care physicians) but is also true of specialists like neurologists whose daily practice may be largely filled with the management of traumatic brain injuries which have different characteristics and management requirements. Physicians who accept the responsibility of determining appropriate return-to-play timing for athletes who have suffered concussions must educate themselves and stay abreast of current practice guidelines on this topic.

**The NH State Advisory Council on Sport-Related Concussion recommends that physicians who accept the responsibility of caring for concussed athletes stay up-to-date on current practice guidelines and consensus statements (e.g., Zurich) released on the topic of sport-related concussion.**

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