Exceptional Children Division

Overview of School-Based Interventions for Students with Concussion

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Webinar Presenters

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Topics Covered:

- Concussion prevalence and existing research
- Symptom Categories
- Intervention
  - Basics
  - Symptom specific
- Return to School Considerations

Definition of Concussion / mTBI

No longer "getting your bell rung"

- A traumatically induced alteration of mental status that may or may not involve loss of consciousness
  -American Academy of Neurology
- A complex pathophysiological process affecting the brain due to traumatic biomechanical forces
  -CDC Heads Up/Concussion program

Scope of the Problem

- 1.1 million to 1.9 million recreational and sport-related concussion occur annually

(Bryan, Rowhani-Rahbar, Comstock, & Rivara, 2016)

- Limitations:
  - Lack of comprehensive surveillance system across youth sports
  - Up to 75% of youth patients seek medical attention through their primary care physician
  - Estimated 45-65% of pediatric concussion patients not seen by heath care provider

(Arbogast, Curry, Pfeiffer, et al., 2016; Bryan, Rowhani-Rahbar, & Comstock, 2016)

Sport-Related Concussion in Children and Adolescents

TABLE 1 Concussion Rates in High School Sports

Sport	Concussions per 1000 AEs
Boys' tackle football	0.54–0.94
Girls' soccer	0.30–0.73
Boys' lacrosse	0.30–0.67
Boys' ice hockey	0.54–0.62
Boys' wrestling	0.17–0.58
Girls' lacrosse	0.20–0.55
Girls' field hockey	0.10–0.44
Girls' basketball	0.16–0.44
Boys' soccer	0.17–0.44
Girls' softball	0.10–0.36
Boys' basketball	0.07–0.25
Girls' volleyball	0.05–0.25
Cheerleading	0.06–0.22
Boys' baseball	0.04–0.14
Girls' gymnastics	0.07
Boys' and girls' track and/or field	0.02
Boys' and girls' swimming and/or diving	0.01–0.02

TBI Incidence and Prevalence

- Varies as a function of injury severity
  - Mild TBI (mTBI) or concussion = 75-90%
  - Moderate TBI = 5-10%
  - Severe TBI = 5-15%
- Base rates are difficult to establish
  - Mild TBIs are likely under-reported
  - Estimated 45-65% of pediatric concussion patients not seen by heath care provider

Signs and Symptoms

- Concussion signs and symptoms include ANY changes in behavior such as:
  - Cognitive impairments
  - Physical symptoms
  - Emotional symptoms
  - Sleep difficulties
  - Not "feeling like themselves."
- Persistent symptoms following the concussion is often referred to as *Post-Concussive Syndrome* (PCS) though this term is not without its own controversies

4 Symptom Categories of mTBI

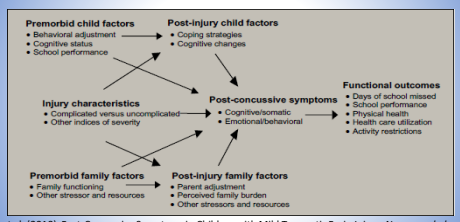
Cognitive
- Difficulty remembering
- Difficulty concentrating
- Feeling slowed down
- Feeling mentally foggy

Emotional
- Irritability
- Sadness
- Feeling more emotional
- Nervousness

Physical
- Headache
- Fatigue
- Dizziness, Nausea
- Sensitivity to light or noise
- Balance Problems

Sleep
- Drowsiness
- Sleeping less than usual
- Sleeping more than usual
- Trouble falling asleep

Biopsychosocial Framework: Neurobehavioral outcomes of mTBI



Taylor et al. (2010). Post-Concussive Symptoms in Children with Mild Traumatic Brain Injury, *Neuropsychology*, 148-159.

Intervention - Basics

1. Educate and prevent further injury
2. Healthy brain activity
   - Hydration / nutrition
   - Good quality nighttime sleep
   - Stress management
   - Finding the right dose of exercise
3. Symptom-specific interventions

Intervention – Psychoeducation

- Key to prevention of long-term symptoms following concussion
- Best initiated as early as possible following concussion

Intervention – Psychoeducation

1. Define the injury and provide context for what it is and isn't
   - Expected time frame for recovery in most concussions or mild TBI
2. Define the TBI symptoms vs other current problems
   - Not all symptoms will be attributable to TBI alone
   - Orthopedic, migraines, developmental issues may have been present beforehand

Intervention – Psychoeducation (cont'd)

3. Help normalize symptoms
   - Individuals who have not sustained TBI commonly struggle with
     - Stress/anxiety
     - Depressed mood
     - Sleep problems
     - Fatigue
   - Individuals who have not sustained TBI often experience daily fluctuations in all of these symptoms

Intervention – Psychoeducation (cont'd)

4. Help understand that symptom-response is individualized
   - Profile of injury
   - Personal history / triggers / sensitivities
   - Context to activity (e.g., trauma from motor vehicle accident versus injury during a preferred sport)

Build a Sense of Control

- Use the student's timeline to help them understand what has made symptoms worse and what has made them better
  - Certain activities or stress can act as "gasoline" on a symptom response
  - Activities to lessen symptom "flare-ups" are critical for self-treatment
    - Symptom management
    - Developing a coping skills plan

Progress Monitoring in Concussion Management

Tracking symptom count each day or week then looking for trends:

- Post Concussion Symptom Inventory (PCSI)
- Looking for gradual decline in total number of different symptoms and severity during recovery
- Symptom-specific interventions can result through the data analysis that occurs with frequent progress monitoring

Progress Monitoring in Concussion Management

Use of Post-Concussion Executive Inventory (PCEI) is a possible opportunity for school psychologists

- Monitors recovery over repeated measures
- Takes pre-injury status into account through use of Retrospective-Adjusted Post-Injury Difference (RAPID) score
- Based on BRIEF2 (Working Memory, Emotional Control, Initiate/Task Comp)

Prescribed physical and cognitive rest

- Brief rest (24-48 hours), then progress to some activity as soon as tolerated
- Limited empirical evidence supports the benefit of strict physical and cognitive rest following mTBI.
- Rest was beneficial for people with positive neurological signs but not for those with only symptoms (Sufrinko et al., 2017, J. Pediatrics, March 29)
- Complete rest/ “cocoon therapy” is not indicated and is actually harmful (Collins et al., 2016, Neurosurgery, 79, 912-29)

Other Restrictions

Considerations for driving

Limit other cognitively demanding activities outside of school

- Texting
- Computer usage
- Watching TV
- Listening to music

Effect of Restrictions on Recovery?

Prolonged Symptom Recovery?

- Somatic – Fatigue, Headaches
- Depressed mood

or, Emotional Response to…

- Isolation from friends
- Overwhelmed by makeup work
- Angry about restriction

Evidence for Hydration?

- "Mild" dehydration can lead to cognitive effects and changes in alertness in children and adolescents
- Can also worsen symptoms of dizziness, nausea, and headaches
- Hydration strategies are first-line treatment approach to help prevent headaches in migraine sufferers.

Allow students to carry a re-usable water bottle in the weeks following return to school post-TBI

Sleep Strategies

- Sleep disturbance and fatigue are an important target for treatment following concussion/TBI
- Poor sleep quality has been associated with variable symptom report and cognitive performance after concussion/TBI
- Clear role for educating student and family on sleep hygiene techniques

Exercise

Research has consistently found decreased symptoms and faster recovery when exercise is implemented in treatment plan

- Improved cerebral blood flow, oxygenation may improve recovery
- Removal from daily activities increases anxiety/depression
- Exercise decreases anxiety, headaches
- Exercise increases self-esteem, sleep quality

Active Rehabilitation Following Concussion

- Concept of sub-threshold exercise (Leddy et al.)
  - Increases cerebral blood flow
  - Potentially aids in neuronal repair and cortical connectivity
  - Changes sensitivity to CO2
- John Leddy (Buffalo Concussion Treadmill Test)
- Potential growth opportunity for PTs, ATCs, (and maybe even in schools)

Returning to Physical Education (PE) class

- No empirically defined guidelines for PE specifically
- Encourage activity to tolerance
- Don't necessarily eliminate PE or recess altogether for students after concussion

Vestibular Rehabilitation

- Exercise-based program by PT designed to:
  - Improve balance
  - Reduce dizziness
  - Decrease risk of falling
  - Stabilize vision/gaze (e.g., due to double vision or visual tracking difficulties)
- Consider allowing students in the early stages of concussion recovery to transfer between classes early to avoid visual chaos
- Request access to copies of presentation materials to avoid rapid shifting of visual focus from table to distant targets
  - Possible role for blue-light filtering glasses?

Cognitive Communication Strategies

- SLPs in acute care / clinic settings are often directly involved in cognitive rehabilitation aiming to:
  - Enhance focus through self-awareness (e.g., when most alert, monitoring for distraction)
  - Advise on environmental modifications to maximize study skills
  - Improve memory through strategic rehearsal of information, use of external aids for better recall
- No definitive timeline for cognitive recovery, making this an important support for students following concussion
- Possible area of growth for school-based SLPs interested in concussion management
- Useful interventions for students who may have been struggling prior to concussion or barely holding it together with ineffective techniques

Assessment as part of concussion management

Role for brief assessment in return to school process:

- Symptom count
- Cognitive screening? Maybe… (SCAT-5, ImPACT)
- Assessment of exertional effects?

Psychological Treatment Considerations

- Treatment can emphasize a cognitive behavioral therapy (CBT) approach
  - Extends discussion of typical recovery course
  - Altering negative thinking and behavioral responses in context of concussion
- Anxiety before and after the concussion can have devastating effects
  - Premorbid psychiatric factors and postinjury anxiety predict persistent post-concussive symptoms >3 months postinjury (Ponsford et al., 2012, 26, 304-13)
  - In youth with persistent symptoms after mTBI, preinjury anxiety was significantly elevated (Peterson et al, 2015, J Neuropsychiatry & Clin Neurosciences, 27, 280-6)

AAP "Returning to Learning" (2013)

- "the goal is to keep disruptions to the student's life to a minimum and to return the recovering student to school as soon as possible."
- "The goal of the multidisciplinary team is to balance the need for the student to be at school with the appropriate adjustments for the cognitive demands at school that have the potential for increasing symptoms."

Halstead et al. (2013). Returning to Learning Following a Concussion. *Pediatrics*. 948-957

Is there such a thing as returning to school too early?

Post-concussive symptoms may impair school performance

Exacerbation of post-concussive symptoms

Increased frustration and anxiety

Do We Need To Dose School? Maybe…

- At least half experience problems in school due to concussion:
  - Headaches disrupt learning
  - Difficulty paying attention
  - Fatigue during class
  - Slower completion of homework
  - Trouble understanding new material
- High School students > Elementary/Middle School students
- Number of school problems correlated with post-concussion symptoms

Ransom, D. M., Vaughan, C. G., Pratson, L., Sady, M. D., McGill, C. A., & Gioia, G. A. (2015). Academic effects of concussion in children and adolescents. *Pediatrics*, peds-2014.

Return to Learn: A Review of Rest vs. Rehab

Eastman & Chang (2015), NeuroRehabilitation

Author (year)	Treatment	Evaluation & Conclusions
Thomas et al., 2015	5 days strict rest vs. 1-2 days plus gradual return	Support for 1-2 days of cognitive rest; no additional benefit to extended rest and may cause harm
Majerske et al., 2008	School attendance and self-reported exercise	Return to school and moderate levels of exercise supported
Brown et al., 2014	Report of cognitive activity divided into quartiles	In support of limiting highest level of cognitive activity
Gibson et al., 2013	Retrospective report of cognitive rest and length of recovery	Refutes that cognitive rest is associated with positive outcomes
Moser et al., 2012	1 week cognitive rest recommended	Supports cognitive rest at all stages of recovery (acute to chronic)
Gagnon et al., 2009	Active rehabilitation cognitive visualization plus physical exercise	Supports cognitive rehab in the chronically symptomatic pediatric population

Factors influencing return to school following concussion

Symptoms: Greater load/severity of symptoms, certain types of symptoms (cognitive and vestibular), and duration of symptoms cause:

- A longer time frame for returning to school
- Require more academic accommodations
- Take longer to recover

Factors influencing return to school following concussion

Age:

- Adolescents have more symptoms, greater severity, and take longer to recover.
- Adolescents also more concerned about the negative academic effects of concussion than younger children

Course Load:

- Certain subjects pose greater problems for students returning to school:
  - Math #1
  - Reading/language arts #2
  - Science and social studies #3

Recommendations for Return to School

Effective communication among clinic, family, school

- Medical letter to support return to school
- Individualized, symptom-based academic support plan
- Early and ongoing medical follow-up

Recommendations for Return to School (cont.)

All schools should have a concussion policy (NC Policy SHLT-001)

- Prevention and management
- Offer appropriate academic accommodations to support students

Recommendations for Return to School (cont.)

- Intervention and prevention of secondary symptoms
  - Absence from school (individualized to recovery trajectory)
  - Incorporating cognitive "challenges" and educating ahead of time
- Assessment of risk factors/modifiers that may prolong recovery
  - Particularly for adolescents
  - History of prior concussions
  - Pre-existing neurodevelopmental, psychiatric conditions
  - Family functioning: pre-injury stressors, resources, response to injury

Symptom Specific Academic Supports

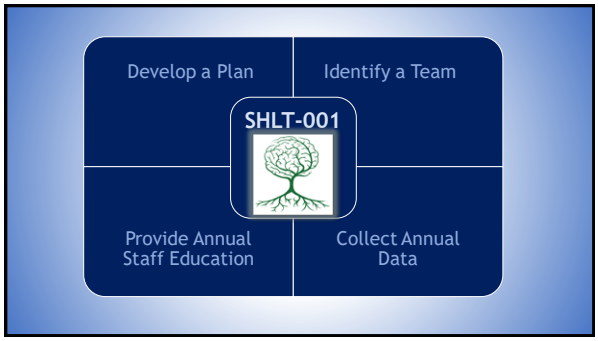
Neuropsych Deficit	School Problem	Support / Strategy
Poor focus/concentration	Short attention span during class lecture, assignments, homework	Shorter assignments, break down tasks, lighter work load
Working memory	Trouble holding instructions in mind, poor reading comprehension, difficulty taking notes	Repetition, written instructions, access to executive summaries for reading passages, note-taking help
Memory consolidation / retrieval	Difficulty retaining new information, accessing learned information when needed	Smaller chunks to learn, recognition cues, limit high-stakes exams
Processing speed	Cannot keep pace with work demand, trouble processing verbal info effectively	Extended time, clarification / slow down presentation of verbal info, comprehension checks
Fatigue	Decreased arousal to engage basic attention and working memory	Rest breaks during classes, homework, and exams

Sady, M. D., Vaughan, C. G., & Gioia, G. A. (2011). School and the concussed youth: recommendations for concussion education and management. *Physical Medicine and Rehabilitation Clinics*, *22*(4), 701-719.

Symptom Specific Academic Supports

Symptom	School Problem	Support / Strategy
Headaches	Disrupts concentration	Rest breaks
Light/noise sensitivity	Symptoms worsen in bright or loud environments	Wear hat/sunglasses, seated away from sunlight; avoid noisy/crowded hallways, cafeteria, assemblies
Dizziness/balance	Unsteadiness when walking	Elevator pass, class transition prior to bell
Sleep disturbance	Decreased arousal, shifted sleep schedule	Later start time, shortened school day
Anxiety	Interfere with concentration, student may push through symptoms	Reassurance, workload reduction, alternate forms of testing
Depression/withdrawal	Avoidance of school or friends because of stigma or activity restrictions	Time built in for socialization

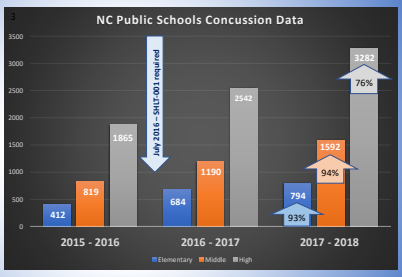
Sady, M. D., Vaughan, C. G., & Gioia, G. A. (2011). School and the concussed youth: recommendations for concussion education and management. *Physical Medicine and Rehabilitation Clinics*, *22*(4), 701-719.



OUTCOME DATA:

Return-to-Learn Policy SHLT-001

SHLT-001 Implementation
2016-2017: 96/115 LEAs
2017-2018: 111/115 LEAs



https://www.surveygizmo.com/s3/4536303/School-Health-Services-Resource

Information/Resources

NC DPI Concussion Webpage

Developed to support effective concussion management and monitoring for **ALL** NC public school students who sustain a concussion, in accordance with State Board of Education Policy SHLT-001.

Return-to-Learn Implementation Guide – This resource was developed to support teams of professionals in establishing and delivering their response, support and monitoring protocol to ensure a student's healthy and safe return to the school environment after sustaining a concussion.

Concussion Information Brochures (English and Spanish versions available) These educational resources were developed in partnership with the *NC Brain Injury Advisory Council, Children and Youth Committee*.

Information/Resources

CDC Heads Up and Pediatric mTBI Guidelines:
https://www.cdc.gov/traumaticbraininjury/PediatricmTBIGuideline.html

Mike Evans: Concussion Management and Return to Learn:
https://www.youtube.com/watch?v=_55YmblG9YM