Supporting Students with Concussion: Best Practices for Schools

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Objectives

1. Overview concussion
2. Return-to-learn following concussion
3. Concussion Management Team model for monitoring students with concussion
4. Resources to assist school professionals serving children and youth with concussion in the schools

Concussion Definition

“a complex, pathophysiologic process affecting the brain, induced by biomechanical forces”

(Consensus State on Concussion in Sport: The 4th International Conference on Concussion in Sport held in Zurich, November 2012, British Journal of Sports Medicine, 2013)

Concussion

Caused by an “impulsive” force transmitted to the head
Forces may be directly to head or transmitted via body

The Hidden Epidemic

Symptoms may be subtle, may not be connected with the initial injury.

- Concussive symptoms may develop over days
- “Monday Morning Concussions”

- No abnormality on standard structural neuroimaging studies is seen in concussion.
- Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.

A concussion alters the way the brain normally functions.

**Concussions**

Following a CONCUSSION, there are NEUROMETABOLIC CHEMICAL CHANGES that take place in the brain.

- Reduced cerebral blood flow
- Increased glutamate
- Systemic changes that last 7+ days

**Neurometabolic Cascade Following Concussion**

- Blood Flow/Metabolic Rate for Oxygen/Demand for Glucose

**Concussion – Age Effects**

- Neuro-chemical processes appear to differ in developing brains.
- Concussions have a more serious effect on a young, developing brain.

**Incidence of Concussion**

- Between 1.1 and 1.9 million sports and recreation related concussions occur annually in US children aged ≤18 years.

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

- This excludes the numerous children who sustain concussions from non-sports activities, such as motor vehicle crashes, falls and assaults
Concussion Statistics

Between 1.1 and 1.9 million sports and recreation related concussions occur annually in US children aged ≤18 years.

Most children with SRRCs (511,590 to 1,240,972) were not seen in health care settings.

Of children with SRRCs seen in health care settings:
- outpatients visits 377,978
- ED visits between 115,479 - 166,929
- Hospitalizations between 2,886 – 4,936

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

Concussion Statistics

Many Concussions Happen Outside of School

ED-based study of concussions, 53% of Sports and Recreational Related Concussions in adolescents aged 14-19 years were not school sports-related.


Rapid Rise in Concussion Rates

Several studies have shown dramatic increases in the number of concussion treated at EDs across the country.

Blue Cross & Blue Shield reported between 2010-2015 the concussion rates among its members aged 10-19 surged 71% (rates for adults increase 26%).

Colorado specific data shows rates increased from 12.9 diagnoses per 1,000 in 2010 to 23.3 per 1,000 in 2015 (81% increase).

(Smith, Chounthirath, & Xiang, Pediatrics, 138(4), 2016)

Rapid Rise in Concussion Rates

Soccer-Related Injuries Treated in Emergency Departments: 1990–2014

The annual rate of concussions/closed head injuries per 10,000 participants increased significantly, by 1,595.6%, from 1990 to 2014.

(Smith, Chounthirath, & Xiang, Pediatrics, 138(4), 2016)

Largest group of individuals at risk for concussion is high school

“30% of all concussions in individuals between 5-19 years of age are sports-related.”


Concussions don’t only happen to athletes on the playing field!
Concussions can also occur from:
- car crashes
- falls
- assault
- recreational activities

...and at school during:
- PE class
- playground activities
- accidents (falls, horseplay)
- fights

Recognition and proper response to concussions when they first occur can help aid recovery and prevent further injury, or even death.

Recognizing Concussions
- Appears dazed or stunned
- Is confused about events
- Answers questions slowly
- Can’t recall events prior to the hit, bump, or fall
- Can’t recall events after the hit, bump, or fall
- Loses consciousness (even briefly)
- Shows behavior or personality changes

Signs Observed by School Nurses

Symptoms of Concussion Reported by Student
- Physical
  - Headache or “pressure in head
  - Nausea or vomiting
  - Balance problems or dizziness
  - Fatigue or feeling tired
  - Blurry or double vision
  - Sensitivity to light or noise
  - Numbness or tingling
  - Does not “feel right”
### Symptoms of Concussion Reported by Student

#### Thinking/Remembering
- Difficulty thinking clearly
- Difficulty concentrating or remembering
- Feeling more slowed down
- Feeling sluggish, hazy, foggy, or groggy

#### Emotional
- Irritability and low frustration tolerance
- Sad
- More emotional than usual
- Nervous

#### Sleep Disturbances:
- Drowsy
- Sleeps less than usual
- Sleeps more than usual
- Has trouble falling asleep

### Concussion Danger Signs: Medical Emergency

- Is drowsy or cannot be awakened
- A headache that gets worse and does not go away
- Weakness, numbness, or decreased coordination
- Repeated vomiting or nausea
- Slurred speech
- Seizures
- Cannot recognize people or places
- Becomes increasingly confused, restless or agitated
- Has unusual behavior
- Any loss of consciousness

### Concussion is a Clinical Diagnosis

- There is no one tool that can single-handedly diagnose a concussion.
- There are standardized cognitive tests (both computerized and non-computerized) to help diagnose concussion.

### Concussion Assessment Tools

**Paper Pencil Assessments**
- SCAT3 (Sport Concussion Assessment Tool)
- ACE (Acute Concussion Evaluation)

**Computerized Assessments**
- ImPACT
- Automated Neuropsychological Assessment Metrics (ANAM)
- Axon Sports - Cogstate
- Concussion Vital Signs
- Head Minder
Concussion is a Clinical Diagnosis

• Thorough History
  – Previous number of head injuries and severity
  – Frequency, duration, severity, location, alleviating factors of symptoms

• Neurocognitive Testing
  – ImPACT
  – SCAT2
  – ACE

• Physical Exam
  – Observation
  – Cranial nerve assessment
  – Pupil responses
  – Simple tests of memory and concentration
  – Convergence testing
  – Romberg test, tandem stance, balance assessment
  – Finger-to-nose coordination test, gaze stability test

Concussion Management

Pediatric Concussion Treated in ED

F/U phone interviews with parents of 164 patients (5-22 yrs, Mean age = 10.7 yrs) treated in ED of 2 urban pediatric hospitals for concussion 7-10 days post-injury.

• 85% of parents reported receiving concussion discharge instructions.
• 79% reported learning new knowledge about concussion symptoms.
• 77% were instructed to make follow up medical appointment within one week but only 28% complied (36% within 4 weeks).


What is the standard medical treatment for concussions?

Pediatric Concussion Treated in ED

F/U phone interviews with parents of 164 patients (5-22 yrs, Mean age = 10.7 yrs) treated in ED of 2 urban pediatric hospitals for concussion 7-10 days post-injury.

• 62% of patients were instructed to limit physical and sports/recreation activity
• 17% were given cognitive/school-related recommendations


Concussion Treatment aka Management

Should encompass many aspects:
  ✓ Physical
  ✓ Cognitive
  ✓ Emotional
  ✓ Return-to-play and or activity guidelines
  ✓ Return-to-school guidelines
**Key to Concussion Recovery**

Physical Rest

Cognitive Rest (limit TV, texting, video games, computers, reading, schoolwork)

*Gradual* return to full cognitive activities

*Gradual* return to full physical activities upon approval of medical professional

**Concussion Management**

1. Protecting the concussed individual from repeat injury is vital.

2. Cognitive restructuring can significantly reduce the duration of symptoms and anxiety after concussion.

**Concussion Neuropathophysiology**

The time interval between two concussions is the crucial factor determining when two concussive events have no cumulative effects.

**Sometimes...Second Impact Syndrome Can Occur**

Occurs when young athlete (>21) returns to competition before resolution of symptoms from first concussion and receives a second relatively minor impact.

Rare catastrophic increase in intracranial pressure can lead to severe injury, seizures, coma, and/or death.

**Following Concussion...**

Excuse students from:
- Sports
- Physical education
- Physical activity during recess

Until symptom free:
- at rest
- with physical activity
- with cognitive exertion

*Clear by a physician with experience in concussion management.*
A concussion can affect a child’s ability to concentrate, learn, and function at home and in school.

Teachers may observe the student...

- Has difficulty attending to teacher
- Can’t remember instructions, schedule
- Looses papers, homework
- Becomes easily frustrated, unable to cope with stress
- Has slower performance, answers questions slowly
- Doesn’t complete work
- Has conflicts with peers/teachers
- Multiple school absences
- Falling grades
- Exhibits behavior or personality changes
- Repeats self
- More emotional than usual
- Takes longer and more effort to accomplish the same work

Remember...

- Differences may be subtle
- Concussion is an invisible injury
- Student generally looks “normal”
- Standard medical and neurocognitive testing may not show significant impairment
- Expectation from self and others to “get over it” and “get back in the game”

Concussion Recovery

- There is no set timeline for concussion recovery (may take days, weeks, months)
- Generally with simple uncomplicated concussions the majority will recover within the first 3-4 weeks. (70% of concussions in children age 5-18 resolve within 28 days – Zemek et al, 2016.)
- Typically a child can fully recover from a concussion as long as their brain has had time to FULLY REST.

Physical & Cognitive
REST is recommended ACUTELY

Initial time (24-48 hrs) spent at home resting if symptomatic

A gradual introduction to cognitive activity is encouraged

(McCrory et al., British J. of Sports Med. 2013)
Activities that do not worsen symptoms and do not pose a risk for repeat concussion may be part of concussion management.

(Giza, et al., Neurology, 2013)

There is no evidence for pharmacologic interventions to improve recovery after concussion.

(Giza, et al., Neurology, 2013)

Students Should Not Push Through Symptoms While Recovering

- exacerbates symptoms
- prolongs recovery time

Cognitive and physical rest may be a useful means of treating concussion-related symptoms, whether applied soon after a concussion or weeks to months later.


Effect of Cognitive Activity Level on Duration of Post-Concussion Symptoms

Subjects: N= 355. 62% males; ages 8-23 (mean age 15 yrs); 19% reported LOC, 37% reported amnesia at time of injury, 39% sustained a previous concussion; mean number of previous concussions was 0.76.

Methods: a prospective cohort study of patients who presented to a Sports Concussion Clinic within 3 weeks of injury between Oct. ’09 - July ’11. At each visit, patients completed a scale that recorded their average level of cognitive activity since the previous visit.

Results: those reporting the greatest levels of cognitive activity (homework, video games, doing crossword puzzles, text messaging, online activities) after a concussion took the longest to fully recover from their symptoms — approximately 100 days on average, compared to approximately 20-50 days for patients reporting lesser levels of activity.

(Brown, et al., 2014, Pediatrics)

Concussion Management

2. Cognitive restructuring can significantly reduce the duration of symptoms and anxiety after concussion.
Return to Learn

While it is true that an athlete must be 100% symptom-free before RTP, they do NOT need to be 100% symptom-free to RTL.

Return to Learn (RTL)

Striking a balance between the need for rest while keeping up with academic content is the biggest struggle for districts and students.

The Problem

Physical symptoms usually resolve more quickly than neurocognitive deficits.

Students must often perform during recovery of concussion while still feeling very cognitively symptomatic.

Thus, academic accommodations are essential!

Importance of Academic Adjustments

Mental/cognitive strain on the brain during the initial recovery from the concussion will cause an exacerbation of the symptoms and can hamper/delay recovery of the concussion.

Majerske et al., 2008 & Brown, Mannix, et al, 2014

During concussion recovery, the goal in school is to implement academic accommodation and effectively abate symptoms by reducing cognitive demand.

(Sady, Vaughan, & Gioia, 2011, Physical Medicine & Rehab Clinics in North America)

Until fully recovered, students should receive accommodations in all settings to decrease cognitive load and promote recovery.
### Symptom Wheel

**Suggested Academic Adjustments**

**PHYSICAL**
- headache/sick to stomach
- dizziness/balance problems
- light sensitivity/blurred vision
- noise sensitivity
- neck pain

**COGNITIVE**
- Trouble with:
  - concentration
  - memory issues
  - mentally foggy
  - slowed processing

**SLEEP/ENERGY**
- mentally fatigued
- drowsy
- sleeping too much
- sleeping too little
- can’t initiate/maintain sleep

**EMOTIONAL**
- feeling more:
  - emotional
  - nervous
  - sad
  - angry
  - irritable

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### Accommodations

- **Reduced workload is commonly recommended during recovery.** *i.e., The student would be responsible for completing 25 of the 50 math problems assigned.*
- **No standardized testing. Delay tests & quizzes.**

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### Possible Accommodations

- Daily check-in with designated teacher
- Break down assignments into small chunks that can be completed in ~30 minutes.
- Reduce time spent on the computer, reading, or writing
- Provide timelines to plan for projects; outline for large tasks
- Allow water bottle at student’s desk

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### Accommodations for Sensitivity to Light & Noise

- Allow student to wear sunglasses, hat
- Avoid cafeteria, assemblies, shop class, band, chorus, etc.
- Move away from windows
- Warn before tornado drills or fire drills

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### Accommodations for Vestibular Problems

- Allow extra time to get to class before the halls become busy
- Walk with a peer/carry books
- Elevator pass
- Teacher notes or peer note taker to prevent up and down shifting of student’s eyes
Social/Emotional Issues

Early-
• Worry about school in general
• Falling behind in academics
• Not allowed to return to sports

Later-
• Anxiety
• Depression
• Adjustment
• Social isolation

Social/Emotional/Behavioral

• Acknowledge, empathize and reassure!
• If the student is frustrated with failure in one area, redirect to other elements of the curriculum associated with success.
• Provide structure and consistency; make sure all teachers are using the same strategies.
• Establish a cooperative relationship with student, engaging him/her in any decisions regarding schedule changes or task priority setting.
• Set reasonable expectations.

Concussion Recovery

• Majority of concussions resolve during the first 4 weeks.

• In some cases symptoms persist for much longer, 5-10% (?) last a lifetime.

Risk Factors for Prolonged Recovery

Prior Concussion
Headache/Migraine
Learning Disability
ADHD
History of Psychiatric Disorders
Depression
Sleep Disorders

Post-Concussion Syndrome

• May persist for a year or more (Diagnosis made after >1 months of symptoms)
• Decreased mental processing speed, short-term memory and attention span
• Irritability
• Fatigue
• Sleep disturbance
• Persistent headache
• General “foggy” feeling

If concussion symptoms linger they must be properly managed so the student can remain in school, attending classes, fully accommodated.
Post-Concussion Syndrome

“If physicians provide a diagnosis of PCS, the district must take immediate action to consider whether, under all the circumstances, the district has the requisite reasonable suspicion to initiate either the IDEA or the Section 504 evaluation process, depending on the extent of the effects on educational performance as compared with major life activities not directly linked to learning.”

(Zirkel & Brown, 2014, K-12 Students with Concussions: A Legal Perspective, Journal of School Nursing)

If a student experiences lasting symptoms:

Concussion 504 Plan IEP

Academic Accommodations

Wide variation in how schools respond to requests for accommodations

Resistance may be due to
• Lack of knowledge
• Concern that student is faking
• Grades are not that bad
• Poor communication with school and between school and student/parents

(Zirkel & Brown, 2014, Journal of School Nursing)

LEA Concussion Management Protocol

Two Pronged Approach

1. Return to Play
2. Return to School

Protocol for School Re-Entry Following Concussion

1. Hospital/family/student informs school personnel of student’s concussion
2. The school representative (e.g., school nurse, counselor, school psych, etc.): gathers information contacts the student’s teachers notes in the student’s cumulative file
3. Teachers discuss symptoms and put in place temporary accommodations so that academic and social failure is prevented.
4. Student is monitored/data is collected, accommodations fine-tuned. Additional supports implemented if needed.

(Zirkel & Brown, 2014, Journal of School Nursing)
Concussion Management Teams (CMTs)

- Building Level CMTs:
  - provide the district with individual student concussion consultation in an ongoing manner
  - work with the school team, student, and family to assist them in identifying accommodations and modifications to support individual students
  - deliver both general and student specific concussion trainings to school teams

- Districts can determine the number of CMTs that will work best for them (e.g., one in each school building, one in each high school grade, etc.). One CMT Monitor can serve on several CMTs (e.g., a school nurse can sit as Symptom Monitor on more than one CMT).

- Training: CMTs complete a 3.5 hour initial online concussion course and annual follow-up trainings based on current research and best practices

Concussion Management Teams (CMTs):

- Notify the student’s school team of the concussion and ensure the student has academic adjustments put in place across all settings
- Serve as the communication bridge between all parties involved in the student’s recovery (the school team, parent, student, physician, BrainSTEPS CO team)
- Collect student data utilizing academic monitoring tool and student symptom severity checklist
- Monitor data collected from these tools weekly and make adjustments to academic accommodations
- Make a referral to the BrainSTEPS CO team at 6-8 weeks post-concussion if the student has not recovered
- Work collaboratively with the BrainSTEPS CO team.

Concussion Management Team (CMT) Model

- Consequence Management Team (CMT)
  1. Academic Monitor
  2. Symptom Monitor

Utilizes the Return to Learn Concussion Electronic Toolkit

Academic Monitoring Tool
1 page 1 side
Teachers Fill Out
Classwork, Homework, Tests, Assignments, Behaviors

Symptom Monitoring Tool
1 page 1 side
Student Fills Out
Symptom Severity Rating Scale
Concussion Management Team

2 person CMT does NOT take the place of the “Interdisciplinary Team”
(Educational, Medical/Rehab, Parent, Student)
The CMT serves as the “Concussion Coordinators”
*CMTs are the Data Collectors & Information Gatherers

Resources

Concussion Management Guidelines
http://www.cde.state.co.us/healthandwellness/concussionguidelines11-6-14

Colorado Kids – Brain Injury Resource Network
http://cokidswithbraininjury.com/

Colorado Department of Education – Brain Injury Web Page
http://www.cde.state.co.us/healthandwellness/braininjury

Brain Injury Alliance of Colorado – Case Management
http://biacolorado.org/case-management/

CDC – HEADS UP to Schools
http://www.cdc.gov/headsup/schools/index.html

Brainlinekids
http://www.brainline.org/landing_pages/features/bkids.html

Get Schooled on Concussions
http://www.getschooledonconcussions.com/

Questions, Concerns and Support:

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Online CMT training will be available at www.brainsteps.net
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