

Concussions Among Youth: Past, Present, & Bright Future

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Disclosure

- Test Author
 - ◆ Behavior Rating Inventory of Executive Function (BRIEF) Psychological Assessment Resources, Inc.
 - ◆ Tasks of Executive Control (TEC)
 - ◆ Pediatric Immediate Post-Concussion Assessment and Cognitive Testing (Pediatric ImPACT)



Silence on Concussions Raises Risks of Injury



Todd Heister/The New York Times

Kelby Jasmon, left, like many high school teammates, said he would not tell his coach if he thought he had a concussion.

By ALAN SCHWARZ

Published: September 15, 2007

To Kelby Jasmon, there was only one answer. The question: If he received yet another concussion this football season, while playing offensive and defensive line for his high school in Springfield, Ill.,

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Girls Are Often Neglected Victims of Concussions

Alan Schwarz (NY Times Oct. 2, 2007)



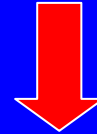
The New York Times

State of Youth Concussion Management

Lack of education and awareness



Under-identification & under-recognition



Poor/ incomplete management



Increased risks → Poor Outcomes



Realities of Youth Concussion Systems Need Improvement!

- Reality: The medical, athletic/recreation and school systems ill-equipped to identify, diagnose and manage these injuries.
 - ◆ Medical: Emergency Dept., Primary Care Pediatricians
 - ◆ Specialty medical care: Neurology, Neurosurgery, Neuropsychology, Sports Medicine
 - ◆ Schools: Elementary, Middle, High School
 - ◆ Athletics: Scholastic, Youth sports leagues



Concussion/ mTBI Definition

- **A concussion (or mild traumatic brain injury)** is defined as a
 - ◆ complex pathophysiologic process affecting the brain,
 - ◆ induced by traumatic biomechanical forces secondary to direct or indirect forces to the head.



CDC Heads Up: Brain Injury in Your Practice (2007)



Concussion/ mTBI

Definition

- Disturbance of brain function is (largely) related to:
 - ◆ neurometabolic dysfunction, rather than structural injury
 - ◆ typically associated with normal structural neuroimaging findings (i.e., CT scan, MRI).
- Concussion may or may not involve a loss of consciousness (LOC). (< 10-20%)



CDC Heads Up: Brain Injury in Your Practice (2007)



Concussion/ mTBI Definition

- Concussion results in a constellation of symptoms:
 - ◆ physical, cognitive, emotional and sleep-related.
- Duration of symptoms are variable may last for as short as several minutes and last as long as several days, weeks, months or even longer in some cases.



CDC Heads Up: Brain Injury in Your Practice (2007)



Concussion = mTBI
Mild Traumatic Brain Injury



Mild TBI / Concussion: “Facts & Figures”

- Annually, millions of children sustain a TBI
- 80-90% “mild”
- 435,000 average annual ED visits age 0-14, 564,000 age 0-19 (Langlois et al., 2004)
- New CDC estimates of sports/ recreation TBI alone (adults and children): 1.6 – 3.8 million per year (revised from previous estimate of 300K)

Dirty little secret – We really don’t know the numbers!



4 Goals for Transforming Youth Concussion Management

1. Prevention: Primary & Secondary
2. Improve concussion care & services to maximize recovery & development
 - a. Improve recognition, protection & return
3. Increase capacity of medical, schools, athletics, community agencies to deliver services and support
4. Research to improve understanding & outcomes
 - a. better understand genetic, neurometabolic and recovery outcomes of concussion
 - b. factors influencing recovery
 - c. effective treatments

New Rules

**Public Health/ Policy
Advocacy**

Consensus Statement on Concussion in Sport: the 3rd International Conference on Concussion in Sport held in Zurich, November 2008



P McCrory,¹ W Meeuwisse,² K Johnston,³
J Dvorak,⁴ M Aubry,⁵ M Molloy,⁶ R Cantu⁷

This paper is a revision and update of the recommendations developed following the 1st (Vienna) and 2nd (Prague) International Symposia on Concussion in Sport.^{1,2} The Zurich Consensus statement is designed to build on the principles outlined in the original Vienna and Prague documents and to develop further conceptual understanding of this problem using a formal consensus-based approach. A detailed description of the consensus process is outlined at the end of this document. This document is developed for use by physicians, therapists, certified athletic trainers, health professionals, coaches and other people involved in the care of injured athletes, whether at the recreational, elite or professional level.

The authors request, however that the document and/or the SCAT2 card be distributed in their full and complete format.

The following focus questions formed the foundation for the Zurich concussion consensus statement:

Acute simple concussion

- ▶ Which symptom scale and which sideline assessment tool is best for diagnosis and/or follow up?
- ▶ How extensive should the cognitive assessment be in elite athletes?
- ▶ How extensive should clinical and neuropsychological (NP) testing be at non-elite level?

- ▶ Should athletes with persistent symptoms be screened for depression/anxiety?

Paediatric concussion

- ▶ Which symptoms scale is appropriate for this age group?
- ▶ Which tests are useful and how often should baseline testing be performed in this age group?
- ▶ What is the most appropriate RTP guideline for elite and non-elite child and adolescent athletes?

Future directions

- ▶ What is the best method of knowledge transfer and education?
- ▶ Is there evidence that new and novel injury prevention strategies work (eg, changes to rules of the game, fair play strategies, etc)?

The Zurich document additionally examines the management issues raised in the previous Prague and Vienna documents and applies the consensus questions to these areas.

SPECIFIC RESEARCH QUESTIONS AND CONSENSUS DISCUSSION

1. Concussion

1.1 Definition of concussion

PEDIATRICS[®]

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

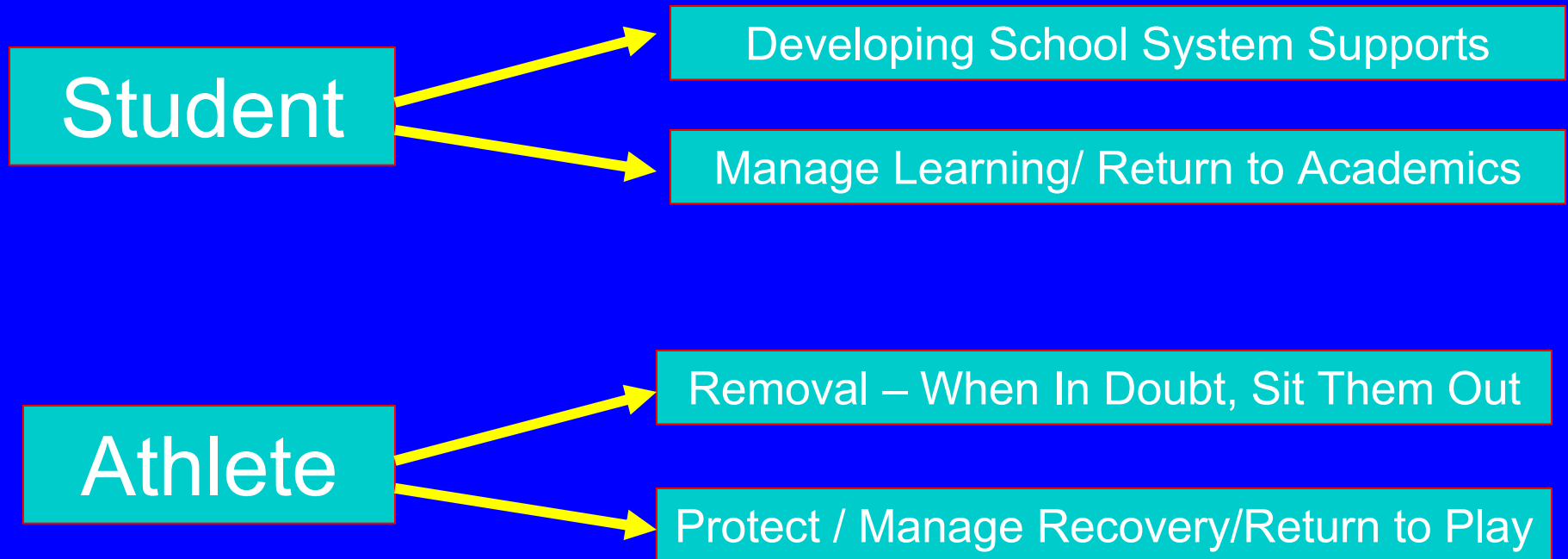
Clinical Report Sport-Related Concussion in Children and Adolescents
Mark E. Halstead, Kevin D. Walter and THE COUNCIL ON SPORTS MEDICINE
AND FITNESS

Pediatrics published online Aug 30, 2010;
DOI: 10.1542/peds.2010-2005

The online version of this article, along with updated information and services, is
located on the World Wide Web at:

<http://www.pediatrics.org>

Treating the Student-Athlete



State Legislative Action for the Youth Athlete: Zackery Lystedt Law & 3 Core Principles

- 1) Concussion Education
- 2) Identification-Removal /Protection
- 3) Medical Evaluation & Written Clearance



Federal Legislation

Miller Bill, ConTACT Act

- Focus efforts on the "student" (Miller) and "athlete" (ConTACT)
- Asks schools to support the academic return of the injured/ recovering student.
- Reinforces the "Response to Concussion" - i.e., sport Removal and Return provisions of Lystedt/ Zurich



**“Tough new return-to-play guidelines
won't really have teeth until resources
keep pace with rules”**

Peter Keating, Dec. 2, 2010

Realities of Mild TBI / Concussion in Youth Sports: Not Enough People

Few on-field athletic health professionals



Elite



Youth

For everyone 1 concussion in the NFL, there are 50,000+ at the youth level.

30-45 million non-scholastic sports participants (NAYS, NCYS)

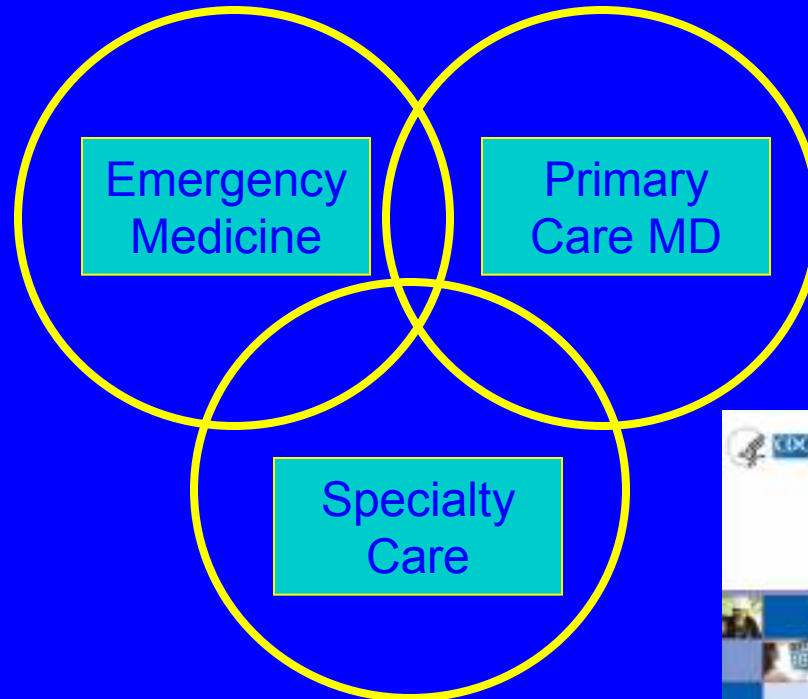
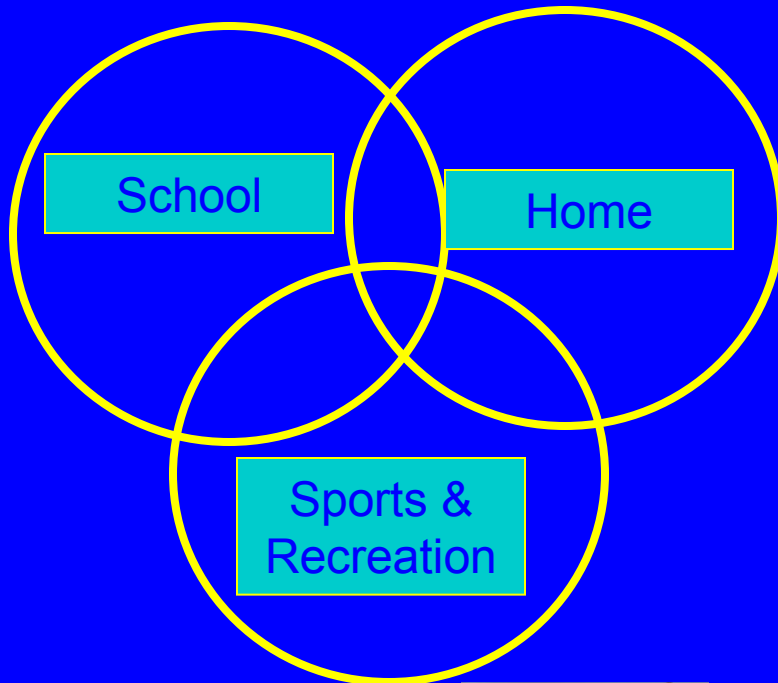
Concussion Care systems

People & Places

School Nurses/
 Guidance Counselor
 Toolkit

Parent & Student-
 athlete Fact Sheets
 Home Instructions

ACE-ED
 ACE-ED Discharge
 Instructions



Heads Up:
 Concussion in HS/
 Youth Sports

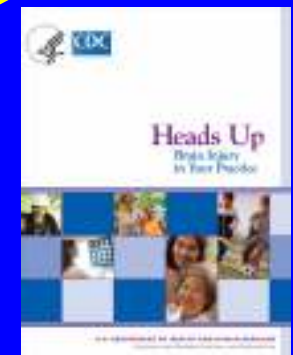
ACTive Training for
 Coaches



Heads Up: Brain Injury in
 Your Practice

ACE, ACE Care Plan

[ACTive Training for MDs?]



Concussion/ mTBI Educational Materials

CDC Heads Up: Concussion in High School Sports

CDC Heads Up: Concussion in Youth Sports

CDC Heads Up: Concussion in Your Practice

CDC Heads Up to Schools: Know Your Concussion ABCs

www.cdc.gov/concussion

NATA-NAN Concussion Videos

ACTive Concussion Education

USA Football

New Tools

**Assessment
Treatment**

Concussion System

Clinical Tools – Assessment

- ◆ Early Recognition, Identification & Diagnosis
- ◆ Developmentally-sensitive Neurocognitive tests sensitive to injury and recovery
- ◆ Symptom assessments: Child, Parent, Teacher

Improving Identification and Diagnosis of Mild Traumatic Brain Injury With Evidence: Psychometric Support for the Acute Concussion Evaluation

ACUTE CONCUSSION EVALUATION (ACE)

Physician/Clinician Office Version

Gerard Gioia, PhD¹ & Micky Collins, PhD²

¹Children's National Medical Center

²University of Pittsburgh Medical Center

Patient Name _____
 DOB: _____ Age: _____
 Date: _____ ID/MR# _____

A. Injury Characteristics Date/Time of Injury _____ Reporter: Patient Parent Spouse Other _____

1. Injury Description _____

1a. Is there evidence of a forcible blow to the head (direct or indirect)? Yes No Unknown

1b. Is there evidence of intracranial injury or skull fracture? Yes No Unknown

1c. Location of Impact: Frontal Lt Temporal Rt Temporal Lt Parietal Rt Parietal Occipital Neck Indirect Force

2. Cause: MVC Pedestrian-MVC Fall Assault Sports (specify) _____ Other _____

3. **Amnesia Before (Retrograde)** Are there any events just BEFORE the injury that you/ person has no memory of (even brief)? Yes No Duration _____

4. **Amnesia After (Anterograde)** Are there any events just AFTER the injury that you/ person has no memory of (even brief)? Yes No Duration _____

5. **Loss of Consciousness:** Did you/ person lose consciousness? Yes No Duration _____

6. **EARLY SIGNS:** Appears dazed or stunned Is confused about events Answers questions slowly Repeats Questions Forgetful (recent info)

7. **Seizures:** Were seizures observed? No Yes Detail _____

B. Symptom Check List* Since the injury, has the person experienced any of these symptoms any more than usual today or in the past day?

Indicate presence of each symptom (0=No, 1=Yes).

*Lovell & Collins, 1998 JHTR

PHYSICAL (10)		COGNITIVE (4)		SLEEP (4)	
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SCAT2



FIFA®



Sport Concussion Assessment Tool 2

Name _____

Sport/team _____

Date/time of injury _____

Date/time of assessment _____

Age _____ Gender M F

Years of education completed _____

Examiner _____

What is the SCAT2?¹

This tool represents a standardized method of evaluating injured athletes for concussion and can be used in athletes aged from 10 years and older. It supersedes the original SCAT published in 2005². This tool also enables the calculation of the Standardized Assessment of Concussion (SAC)^{3,4} score and the Maddocks questions⁵ for sideline concussion assessment.

Instructions for using the SCAT2

The SCAT2 is designed for the use of medical and health

Symptom Evaluation

How do you feel?

You should score yourself on the following symptoms, based on how you feel now.

	none	mild	moderate	severe			
Headache	0	1	2	3	4	5	6
Pressure in head	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like *In a fog*	0	1	2	3	4	5	6
Don't feel right	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6

Concussion System

Clinical Tools – Assessment

- Developmentally-sensitive Neurocognitive tests sensitive to injury and recovery
- Symptom assessments: Child, Parent, Teacher

New Assessment Methods

- Computerized testing of specific cognitive skills
 - Learning & Memory
 - Processing Speed
- Standardized symptom rating
 - Child/teen self-report
 - Parent
 - Teacher

*** All of these methods allow for monitoring of & guiding recovery over time ***



Symptom Assessment

Which symptom assessments and approaches are uniquely appropriate for paediatric concussion?

G A Gioia,¹ J C Schneider,¹ C G Vaughan,¹ P K Isquith²

ABSTRACT

Objective: To (a) identify post-concussion symptom scales appropriate for children and adolescents in sports; (b) review evidence for reliability and validity; and (c) recommend future directions for scale development.

Design: Quantitative and qualitative literature review of symptom rating scales appropriate for children and adolescents aged 5 to 22 years.

Intervention: Literature identified via search of Medline, Ovid-Medline and PsycInfo databases; review of reference lists in identified articles; querying sports concussion specialists. 29 articles met study inclusion criteria.

Results: 5 symptom scales examined in 11 studies for ages 5–12 years and in 25 studies for ages 13–22. 10 of 11 studies for 5–12-year-olds presented validity evidence for three scales; 7 studies provided reliability evidence for two scales; 7 studies used serial

that requires early recognition and effective management to reduce serious or catastrophic outcomes.⁵

To effectively manage concussion in younger student-athletes, they must be understood differently than older, more neurologically mature, athletes.⁶⁻⁸ To do so, it is necessary to use age-appropriate clinical assessment measures and developmentally-appropriate evidence-based management guidelines. In their review of the clinical management of sport-related mild traumatic brain injury in younger children, Kirkwood, Yeates & Wilson⁶ assert that this age group has not received adequate attention. Younger athletes may be distinguished from older athletes along several dimensions, including biomechanical properties of injury, variations in pathophysiological responses

4 Symptom Categories

☐ Physical

- Headache
- Fatigue
- Dizziness
- Sensitivity to light and/or noise
- Nausea
- Balance problems

☐ Cognitive

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

☐ Emotional

- Irritability
- Sadness
- Feeling more emotional
- Nervousness

☐ Sleep

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



Post-Concussion Symptom Inventory (PCSI-P)
Post-Injury Assessment
Parent Report

Student's Name: _____ Today's date: _____ Date of Concussion: _____

Birthdate: _____ Age/ Grade: _____

Person Completing Form: _____ Relation: Mother ___ Father ___ Other ___

Instructions: We would like to know whether your child had any of these problems over the past day. Please answer all the items the best that you can. Do not skip any items. Circle the degree to which it has been a problem.

0 = Not a problem 3 = Moderate problem 6 = Severe problem

1	Complains of headaches	0	1	2	3	4	5	6
2	Complains of nausea	0	1	2	3	4	5	6
3	Vomiting	0	1	2	3	4	5	6
4	Has balance problems	0	1	2	3	4	5	6
5	Appears or complains of dizziness	0	1	2	3	4	5	6
6	Has trouble falling asleep	0	1	2	3	4	5	6

7	Sleeping <u>more than usual</u>	0	1	2	3	4	5	6
8	Sleeping <u>less than usual</u>	0	1	2	3	4	5	6
9	Appears drowsy	0	1	2	3	4	5	6
10	Sensitivity to light	0	1	2	3	4	5	6
11	Sensitivity to noise	0	1	2	3	4	5	6
12	Acts irritable	0	1	2	3	4	5	6

13	Appears sad	0	1	2	3	4	5	6
14	Acts nervous	0	1	2	3	4	5	6
15	Acts more emotional	0	1	2	3	4	5	6
16	Has or complains of numbness or tingling	0	1	2	3	4	5	6
17	Acts or appears slowed down	0	1	2	3	4	5	6
18	Acts or appears mentally "foggy"	0	1	2	3	4	5	6

19	Has difficulty concentrating	0	1	2	3	4	5	6
20	Has difficulty remembering	0	1	2	3	4	5	6
21	Has or complains of visual problems (blurry, double vision)	0	1	2	3	4	5	6
22	Appears more tired or fatigued	0	1	2	3	4	5	6



Symptom Assessment with Children

Over the past day...

**Have you had headaches?
Has your head hurt?**

YES

NO

Over the past day...

**Have you had headaches?
Has your head hurt?**

How much?



A Little?

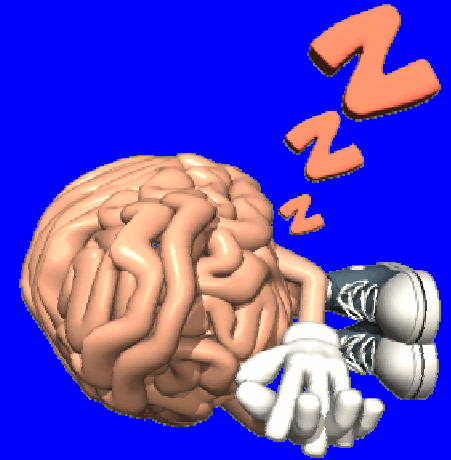


A Lot?

Concussion System Clinical Tools – Treatment

- Symptom Management
 - Physical and cognitive activity
 - Management of Exertional Effects
 - Active Rehabilitation for Slow to Recover
- Follow Up Tracking until recovery

Keys to Recovery



- Resting the brain & getting good sleep
- No additional forces to head/ brain
- Managing/ facilitating physiological recovery
 - ◆ Avoid activities that produce symptoms
 - ◆ Not over-exerting body or brain

Ways to over-exert

- Physical
- Emotional
- Cognitive! (concentration, learning, memory)

Exertional Effects

- Increase or re-emergence of post-concussion symptoms following significant exertional activity
 - ◆ Physical activity
 - ◆ **Cognitive activity**



Focus on Cognitive Exertion



Sources of Mental/ Cognitive Activity?

- Prolonged concentration
- Prolonged homework
- Prolonged classes (block scheduling)
- Prolonged days
- Excessive TV, computer, socializing...

These sources and degrees of activity are likely to vary from person to person

Cognitive Rest: The Often Neglected Aspect of Concussion Management

Tamara C. Valovich McLeod, PhD, ATC • A.T. Still University and Gerard A. Gioia, PhD • Children's National Medical Center

I

“Physical rest alone fails to address another key aspect of brain function in youth – mental exertion associated with school activities.”

Concussion, the National Football League has been under extensive scrutiny in both the media and in Congress. Interest of the reports admit that problem for the NFL, but also for the thousands of high school and youth student-athletes who look up to professional athletes. Unlike their NFL counterparts, however, these young athletes face many unique challenges, including the cogni-

Athletic Therapy March, 2010

knowledge of neurometabolic dysfunction has greatly improved management of concussive injuries; on management often as a student. It is now well-accepted that excessive neurometabolic activity can interfere with recovery from a concussion and that physical rest is needed. Athletes are typically withheld from physical activities until they become asymptomatic and then are progressed

Physical rest alone fails to

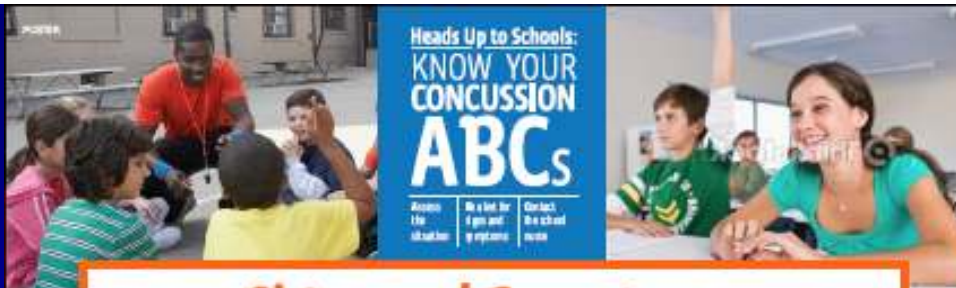
CDC School Toolkit for Concussions

Heads Up to Schools: KNOW YOUR CONCUSSION ABCs

Assess
the
situation

Be alert for
signs and
symptoms

Contact a
health care
professional



**Heads Up to Schools:
KNOW YOUR
CONCUSSION
ABCs**

Assess the situation. Be alert for signs and symptoms. Contact the school nurse.

Signs and Symptoms of a Concussion

A concussion is caused by a bump, blow, or jolt to the head. Concussions can also occur from a fall or blow to the body that causes the head to move rapidly back and forth. Even what seems to be a mild bump to the head can be serious. Be alert for any of the following signs and symptoms.

SIGNS OBSERVED BY TEACHERS

- Appears dazed or stunned
- Is confused about events
- Answers questions slowly
- Repeats questions
- Can't recall events prior to hit, bump, or fall
- Can't recall events after hit, bump, or fall
- Loses consciousness (even briefly)
- Shows behavior or personality changes
- Forgets class schedule or assignments

SYMPTOMS REPORTED BY THE STUDENT

Thinking/Remembering

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

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"

Emotional

- Irritable
- Sad
- More emotional than usual
- Nervous

Sleep*

- Drowsy
- Sleeps less than usual
- Sleeps more than usual
- Has trouble falling asleep

*Only ask about sleep symptoms if the injury occurred on a prior day.

What can teachers and other school professionals do?



The signs and symptoms of concussion can take time to show up and can become noticeable during thinking and learning activities in the classroom.

Send a student to the school nurse if you notice or suspect that a student has

1. Any kind of forceful blow to the head or to the body that results in rapid movement of the head
- and-

2. Any change in the student's behavior, thinking, or physical functioning. (See the signs and symptoms of concussion.)

For more information and to order additional materials
FREE OF CHARGE, visit: www.cdc.gov/Concussion

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION



Concussion Symptom Monitor

Name _____

Date _____

Instructions: Rate your symptoms at the beginning of each hour.
Use the 0 to 10 scale below. (0=None 10=Highest)

0 1 2 3 4 5 6 7 8 9 10

Symptom	7:30	8:30	9:30	10:30	11:30	12:30	1:30	2:30
Headache								
Fatigue								
Concentration								
Irritability								

If any symptom increases **2 points or more**, stop and take a rest break.



Screen images simulated.

Concussion Symptom Monitor

Instructions: Rate your symptoms.

Use the 0 to 10 scale below. (0=None 10=Highest)

Symptom	7:30am										
Headache	0	1	2	3	4	5	6	7	8	9	10
Fatigue	0	1	2	3	4	5	6	7	8	9	10
Concentration	0	1	2	3	4	5	6	7	8	9	10
Irritability	0	1	2	3	4	5	6	7	8	9	10
Other _____	0	1	2	3	4	5	6	7	8	9	10



Concussion Symptom Monitor

Instructions: Rate your symptoms.

Use the 0 to 10 scale below. (0=None 10=Highest)

Symptom	9:30am										
Headache	0	1	2	3	4	5					
Fatigue	0	1	2	3	4	5					
Concentration	0	1	2	3	4	5					
Irritability	0	1	2	3	4	5	6	7	8	9	10
Other _____	0	1	2	3	4	5	6	7	8	9	10

Alert: Your symptoms are worsening. Time for a rest break.



Summary

- Concussions are serious injuries to the brain
- They are manageable if identified early & managed actively; most kids recover
- Concussion Systems must continue to improve
- New Rules are being implemented
 - Improve Recognition, Removal & Protection
- Increase Resources to Enact Rules Effectively
 - People & Places
- New Tools becoming available
 - Careful individualized clinical assessment and tracking from time of injury
 - Implement active treatment in home & school

“New” State of Concussion Management

Knowledge, awareness, skill



Early Identification & Recognition



Complete, individualized management



Decreased risks → Improved Outcomes

