Assessment and Monitoring of Cognitive and Emotional Functioning in Students following Concussion

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Disclosure Statement

Psychological Assessment Resources, Inc.

- Test Author (royalties)
  - Behavior Rating Inventory of Executive Function (BRIEF)
  - Tasks of Executive Control (TEC)

Many other tests & measures (no royalties)

Acute Concussion Evaluation (ACE) – office, ED
ACE Care Plan; Home/School Instructions
Post-Concussion Symptom Inventory (PCSI) 5-7, 8-12, 13-18; Parent
BRIEF – Concussion Monitoring – Parent, Self-Report
Children's Exertional Effects Rating Scale (ChEERS)
Concussion Learning Assessment & School Survey (CLASS) – Parent, Self-Report
Progressive Activities of Controlled Exertion (PACE)-Self Efficacy (Child, Parent)
Multimodal Assessment of Cognition & Symptoms (MACS)
Concussion Recognition & Response (CRR) –Parent/Coach app
Concussion Assessment & Response (CARE)- Medical app

Objectives

This session will help participants:

- State common effects of concussion on student functioning
- Describe the expected course of recovery and complicating risk factors
- List common assessment tools and describe their use
- Describe methods for detecting meaningful change in scores
- Use newer assessment & monitoring tools to track executive functions

NASP Data-Based Decision Making and Accountability

Relevance:

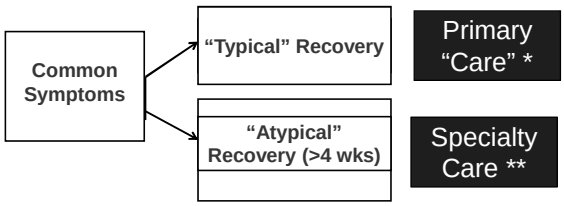
- Knowledge of varied models and methods of assessment and data collection for identifying strengths and needs
- Systematically collecting data form multiple sources and using ecological factors as context for all assessment & intervention decisions
- Using assessment data to understand students' problems and implement evidence-based instructional, behavioral & mental health services
- Measuring progress & outcomes
- Evaluate effectiveness and need for modification to school-based interventions

4

Concussion as ADHD in 1980

ADHD	Concussion
1980: Most kids were evaluated and treated by specialists – or not at all	2001: Most kids are evaluated and treated by specialists – or not at all
2018: Most kids are evaluated/ treated by pediatricians and within schools ◆ Refer Complex Cases	2020?: Most kids are evaluated and treated by pediatricians and within schools ◆ Refer Complex Cases

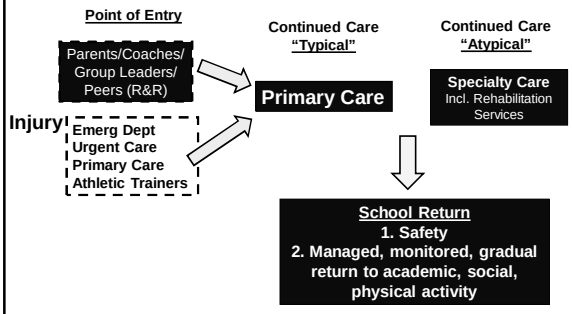
Concussion as the "new" ADHD



*School as a "primary care" setting

**School psychologist as a "specialist"

Concussion's Medical Neighborhood Connected Care



Rewards of Working with Concussion

Typically:

- Not a long-term issue
- Not a lot of testing
- Intervention/ consultation oriented
- Kids get better! In direct proportion to:
  - How early their needs are identified
  - How early interventions are put in place
  - Their needs being monitored regularly and interventions modified through recovery

BUILT FOR THE SCHOOL PSYCHOLOGIST!

Vienna/ Prague/Zurich/Berlin

What is the difference in concussion management in children as compared with adults? A systematic review

Gavin A Davis,[1] Vicki Anderson,[1] Franz E Babl,[1] Gerard A Gioia,[2] Christopher C Giza,[3] William Meehan,[4] Rosemarie Scolaro Moser,[5] Laura Purcell,[6] Philip Schatz,[7] Kathryn J Schneider,[8] Michael Takagi,[1] Keith Owen Yeates,[9] Roger Zemek[10]

ABSTRACT

Aim To evaluate the evidence regarding the management of sport-related concussion (SRC) in children and adolescents. The eight subquestions included the effects of age on symptoms and outcome, normal and prolonged duration, the role of computerised neuropsychological tests (CNTs), the role of rest, and strategies for return to school and return to sport (RTSp).

Design Systematic review.

statement on the management of SRC in 2001,[2] but this paper did not include any child-specific recommendations. The CISG meeting in Prague in 2004 briefly referred to the paediatric population,[6] and the Zurich 2008 meeting expanded the consensus statement to include a section devoted to '*the child and adolescent athlete*'.[7] This statement included an age limit of 10 years for application of the recommendations, recommended a conser-

BJSM 2017

Berlin 2016

Review

What is the difference in concussion management in children as compared to adults? a systematic review

Gavin A Davis,[1] Vicki Anderson,[1] Franz E Babl,[1] Gerard A Gioia,[2] Christopher C Giza,[3] William Meehan,[4] Rosemarie Scolaro Moser,[5] Laura Purcell,[6] Philip Schatz,[7] Kathryn J Schneider,[8] Michael Takagi,[1] Keith Owen Yeates,[9] Roger Zemek[10]

keypoints

What is already known?

- The effects of sport-related concussion in children are different from adults.
- Children may take longer to recover from sport-related concussion than adults.
- Return to school is a priority in the management of children following sport-related concussion.

What are the new findings?

- Children and adolescents are expected to take up to 4 weeks to recover following sport-related concussion.
- The widespread routine use of baseline computerised neuropsychological testing is not recommended in children and adolescents.
- A brief period of cognitive and physical rest following sport-related concussion in children and adolescents should be followed with gradual symptom-limited physical and cognitive activity.
- All schools be encouraged to have a concussion prevention and management policy and should offer appropriate academic accommodations and support to students recovering from sport-related concussion.

Clinical Review & Education

JAMA Pediatrics | Special Communication

Centers for Disease Control and Prevention Guideline on the Diagnosis and Management of Mild Traumatic Brain Injury Among Children

Angela Lumba-Brown, MD; Keith Owen Yeates, PhD; Kelly Sarmiento, MPH; Matthew J. Breiding, PhD; Tamara M. Haegerich, PhD; Gerard A. Gioia, PhD; Michael Turner, MD; Edward C. Benzel, MD; Stacy J. Suskauer, MD; Christopher C. Giza, MD; Madeline Joseph, MD; Catherine Broomand, PhD; Barbara Weissman, MD; Wayne Gordon, PhD; David W. Wright, MD; Rosemarie Scolaro Moser, PhD; Karen McAvoy, PhD; Linda Ewing-Cobbs, PhD; Ann-Christine Duhaime, MD; Margot Putukian, MD; Barbara Holshouser, PhD; David Paulk, EdD; Shari L. Wade, PhD; Stanley A. Herring, MD; Mark Halstead, MD; Heather T. Keenan, MD, PhD; Meeryo Choe, MD; Cindy W. Christian, MD; Kevin Guskiewicz, PhD, ATC; P. B. Raksin, MD; Andrew Gregory, MD; Anne Mucha, PT, DPT; H. Gerry Taylor, PhD; James M. Callahan, MD; John DeWitt, PT, DPT, ATC; Michael W. Collins, PhD; Michael W. Kirkwood, PhD; John Ragheb, MD; Richard G. Ellenbogen, MD; Theodore J. Spinks, MD; Theodore G. Ganiats, MD; Linda J. Sabelhaus, MLS; Katrina Altenhofen, MPH; Rosanne Hoffman, MPH; Tom Getchius, BA; Gary Gronseth, MD; Zoe Donnell, MA; Robert E. O'Connor, MD, MPH; Shelly D. Timmons, MD, PhD

IMPORTANCE Mild traumatic brain injury (mTBI), or concussion, in children is a rapidly growing public health concern because epidemiologic data indicate a marked increase in the number of emergency department visits for mTBI over the past decade. However, no

Editorial
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Supplemental content

JAMA Pediatrics 2018

CONCUSSION 101: THE FOUNDATIONS

Concussion = Traumatic Brain Injury

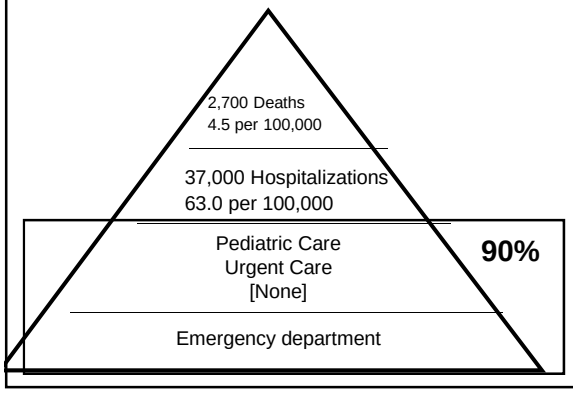
Concussion, or mild TBI, is:

- A TBI induced by traumatic biomechanical forces secondary to direct or indirect forces to the head.
- Produces disturbance of brain function secondary to disruption of neurometabolism with normal structural neuroimaging
- Typically results in symptoms in physical, cognitive, emotional and sleep domains that may last minutes to weeks or, or sometimes longer

What is a concussion?

- A bump, blow or jolt to the head or body that causes the brain to move rapidly back & forth
- Causes stretching of brain, causing chemical changes, and cell damage
- Causes change in how brain works (signs & symptoms)
- Once these changes occur, brain is more vulnerable to further injury and sensitive to increased stress

TBI in US Children



Many Causes

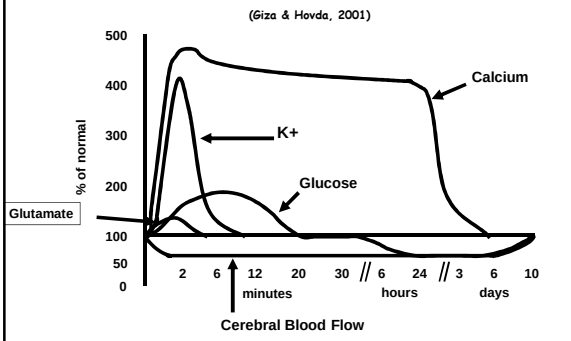
Motor Vehicle Collisions
Falls
Struck By/ Against
Assaults
Sports & Recreations

Pathophysiological Basis

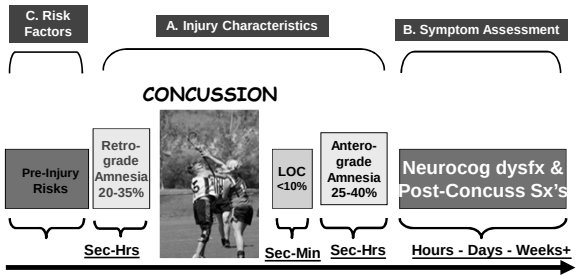
- Stress and strain of force:
  - cell wall
  - diffuse axonal injury
- Massive ionic flux of potassium and calcium.
- Metabolic demands on cells exposed to ionic flux results in injury-induced diaschisis
  - loss of coupling between neuronal activation and cerebral blood flow,
  - Produces energy crisis
  - Mitochondrial dysfunction

Giza & Hovda, 2001; Hovda, in press

Neurometabolic Cascade Following Traumatic Brain Injury



Anatomical Timeline of a Concussion Defining the Key Factors



Signs of a Concussion
(what you observe)

Cognitive
- Appears dazed/stunned
- Confused about events (assignment or position)
- Answers questions more slowly
- Repeats questions/ forgets instruction or play
- Can't recall events prior to or after the hit/fall

Physical
- Vomiting
- Loses consciousness
- Balance problems
- Moves clumsily
- Drowsy

Behavior/Emotion
- Behavior or personality changes

Symptoms of a Concussion
(what they feel and report)

Physical
- Headache
- Fatigue
- Visual problems (blurry/"double")
- Nausea/vomiting
- Balance problems/ dizziness
- Sensitivity to light/noise
- Numbness/tingling

Sleep
- Sleeping more/less
- Trouble falling asleep
- Drowsiness

Cognitive
- Mental fogginess
- Difficulty concentrating
- Difficulty remembering
- Feeling slowed down

Emotional
- More emotional
- Irritable
- Sad
- Nervous

Recovery of Child/ Adolescent: Our Best Guess

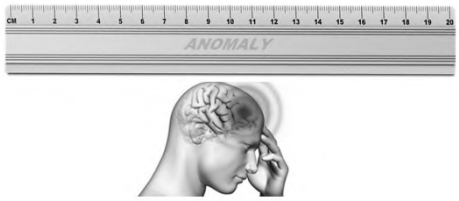
- Research literature still limited understanding of concussion recovery outcomes across full age range, and for boys and girls (IOM, 2013; CDC 2016; Berlin, 2016; NIH, 2016).
- Largest pediatric-adolescent study (Zemek et al., 2016; n>3,000; age 5-18) indicates **70 +/-% symptom recovery within 4 weeks**
- And – Age, sex, injury type/severity matter!
- Don't expect "7-10 days" for recovery!

Persisting Symptom Culprits

- Headaches
- Fatigue
- Vestibular (dizziness, balance)
- Cognitive problems (attention, memory, executive function, speed)
- Anxiety/ mood problems

Assessment & Management of Concussion

Processes, Pathways & Tools



Concussion Assessment, Monitoring and Management Toolbox

Concussion Recognition & Response (CRR)

Acute Concussion Evaluation (ACE) | Post-Concussion Symptom Inventory (PCSI) | Post-Concussion Executive Inventory (PCEI)

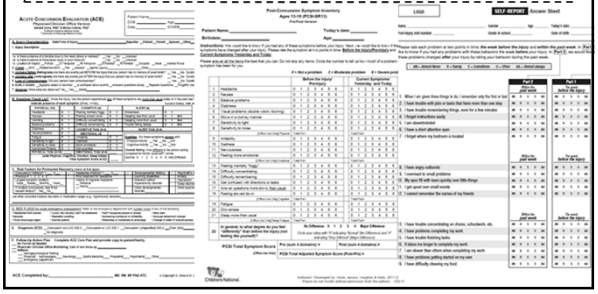
Multimodal Assessment of Cognition & Symptoms (MACS) | Children's Exertional Effects Rating Scale (ChEERS)

Concussion Learning Assessment & School Survey (3rd) CLASS-3 | Symptom Targeted Academic Management Plan (STAMP)

Online Treatment Recovery Assistance for Concussion in Kids (OnTRACK)

Symptom Assessment

Acute Concussion Evaluation (ACE) | Post-Concussion Symptom Inventory (PCSI) | Post-Concussion Executive Inventory (PCEI)



Acute Concussion Evaluation (ACE)

- ACE is a clinical protocol to assist diagnosis of mTBI/ concussion in medical/school settings
- Ages 4-adult
- Elements of clinical assessment protocol are evidence-based
- Link to follow-up care via ACE Care Plan

CDC

Facts for Physicians

Since June 2007

Heads Up
Brain Injury in Your Practice

Heads Up
Facts for Physicians About Mild Traumatic Brain Injury (MTBI)

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Pediatric Assessment and Management of Concussions

Gerard A. Gioia, PhD

Concussions and mild traumatic brain injuries have become more widely recognized and understood during the past 5 to 10 years. Earlier and more active evaluation and management of this brain injury is necessary to reduce risk to the developing child and adolescent. Pediatricians play a central role in the evaluation and management of concussions and should develop a working understanding of the injury and its clinical manifestations.

An individualized approach to evaluation and management by the pediatrician requires the development of a skillset to define the characteristics of the injury, conduct a full assessment of post-concussion symptoms, and define any risk history that may modify recovery.

This evaluation forms the basis of concussion treatment, which involves the active management of the child's and performance, and sports/recreational activities. The Acute Concussion Evaluation (ACE) and ACE Care Plan, published in the CDC's "Heads Up: Concussknowledge of the patient's post-injury status. Without the pediatrician's active and informed involvement, service coordination is not likely to be as effective, result-

Gioia, GA (2012) Pediatric Assessment and Management of Concussions. Pediatric Annuals, 41(5), 198-203.

Acute Concussion Evaluation (ACE) Key Elements

A. Define Injury Characteristics
B. Assess for Symptoms (22) (Lovell & Collins, 1998)
C. Identify Risk Factors for Prolonged Recovery
D. Red Flags for Neurological Deterioration
E. Establish the Diagnosis
F. Plan Follow-Up Action / Referral

Acute Concussion Evaluation (ACE)

A. Injury Characteristics

Injury Description

Cause

Amnesias (retrograde, anterograde)

Loss of Consciousness (LOC), Seizures

Early Signs

A. Injury Characteristics Date/Time of Injury Sept. 7, 2008 Reporter: Patient ✓arent Spouse Other

1. Injury Description **Fell to ground, hit head on ground, kneed in right temporal region; dazed initially but continued to play with bad headache. Felt sluggish and confused.**

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 Lft Temporal ✓Rt Temporal Lft Parietal Rt Parietal ✓Occipital Neck Indirect Force
2. Cause: MVC Pedestrian-MVC Fall Assault ✓Sports (specify) **basketball** 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

Acute Concussion Evaluation (ACE)

B. Symptom Checklist

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)	
Headache	0 (1)	Feeling mentally foggy	0 (1)	Drowsiness	0 (1)
Nausea	0 (1)	Feeling slowed down	0 (1)	Sleeping less than usual	0 1 N/A
Vomiting	0 1	Difficulty concentrating	0 (1)	Sleeping more than usual	0 (1) N/A
Balance problems	0 (1)	Difficulty remembering	0 (1)	Trouble falling asleep	0 1 N/A
Dizziness	0 1	COGNITIVE Total (0-4)	4	SLEEP Total (0-4)	2
Visual problems	0 1	EMOTIONAL (4)			
Fatigue	0 (1)	Irritability	0 (1)		
Sensitivity to light	0 (1)	Sadness	0 1		
Sensitivity to noise	0 1	More emotional	0 1		
Numbness/Tingling	0 1	Nervousness	0 1		
PHYSICAL Total (0-10)	5	EMOTIONAL Total (0-4)	1		
(Add Physical, Cognitive, Emotion, Sleep totals) Total Symptom Score (0-22)			12		

Exertion: Do these symptoms worsen with:
Physical Activity Yes No ✓N/A
Cognitive Activity ✓Yes No N/A

Overall Rating: How different is the person acting compared to his/her usual self? (circle)
Normal 0 1 2 (3) 4 5 6 Very Different

Acute Concussion Evaluation (ACE)

C. Risk Factors for Protracted Recovery

C. Risk Factors for Protracted Recovery *(check all that apply)*

Concussion History? Y ___ N___	√	Headache History? Y ___ N___	√	Developmental History	√	Psychiatric History
Previous # 1 2 3 4 5		Prior treatment for headache		Learning disabilities		Anxiety
Longest symptom duration Days__ Weeks__ Months__ Years__		History of migraine headache __ Personal __ Family_____		Attention-Deficit/ Hyperactivity Disorder		Depression
						Sleep disorder
If multiple concussions, less force caused reinjury? Yes__ No__				Other developmental disorder_____		Other psychiatric disorder _____

List other comorbid medical disorders or medication usage (e.g., hypothyroid, seizures)

Research findings have linked these risk factors to longer periods of recovery

Acute Concussion Evaluation (ACE)

D. Red Flags for Neurological Deterioration

D. RED FLAGS for acute emergency management: Refer to the emergency department with sudden onset of any of the following:

* Headaches that worsen	* Looks very drowsy/ can't be awakened	* Can't recognize people or places	* Neck pain
* Seizures	* Repeated vomiting	* Increasing confusion or irritability	* Unusual behavioral change
* Focal neurologic signs	* Slurred speech	* Weakness or numbness in arms/legs	* Change in state of consciousness

Physicians and parents/ patients need to be aware of signs that signal the need for emergency care.

Tracking Symptom Status/ Recovery

Post-Concussion Symptom Inventory

Post-Concussion Executive Inventory

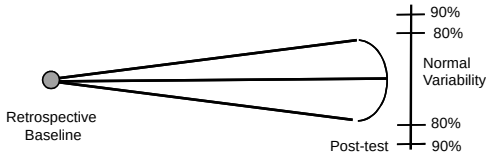
Use RAPID scores

- Retrospective-Adjusted Post-Injury Difference (RAPID) score is central, unique feature
- Use Reliable Change metrics to answer questions:
  - Is there is a change from pre- to post-injury?
  - Is there change (recovery) over time?

Reliable Change Index (RCI)

- Is change in score beyond what expected given variability in the instrument and effects of repeated ratings?
- RCI metrics incorporate measure's normal variability (SD) with stability (reliability), producing SEM and Se_{diff} and establishing confidence intervals
- RCI provides helpful guideline for determining when changes from two scores are beyond expectation based on measure's stability and expected change for two ratings
- RCIs of RAPID score indicate clinically meaningful difference beyond 80% or 90% CI range.

RAPID Score = Post-test - Baseline



Interpreting Reliable Change
(Evidence-driven)

When interpreting change, ask two fundamental questions.

1. Are post-injury symptom ratings clinically different from the RBL (retrospective baseline) ratings?
   - RAPID score indicates change from preinjury to post-injury status, reveals clinically significant problems relative to the preinjury state
   - Answer directs intervention strategies for clinically significant problem
2. Is there a significant change in symptom ratings relative to previous assessment?
   - Compare RAPID scores between the two visits to reveal recovery gains over time
   - Answer indicates recovery progress, whether interventions require adjustment

Concussion Symptom Assessment Toolkit

- Post-Concussion Symptom Inventory (PCSI)
  - Physical
  - Sleep/Fatigue
  - Cognitive
  - Emotional
- Post-Concussion Executive Inventory
  - Working Memory
  - Task Initiation/Completion
  - Emotional Control

Post-Concussion Symptom Inventory (PCSI)

Child Report
- Age 5-7 – 5 items
- Age 8-12 – 17 items
- Age 13-18 – 21 items

Parent Report
- Age 5-18 – 20 items

Assesses:
- 4 symptom categories
- Pre- and Post-Injury ratings to identify injury-specific effects

Developmentally sensitive

Psychometric support

Included in the NIH CDE toolkit

Used worldwide

Psychometric Characteristics of the Postconcussion Symptom Inventory in Children and Adolescents

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Accepted 11 March 2014

Post-Concussion Symptom Inventory
Ages 13-18 (PCSI-SR13)
RAPID Version

Patient Name:_____ Today's date:_____
Birthdate:_____ Age:_____

Instructions: We would like to know if you had any of these symptoms before your injury. Next, we would like to know if these symptoms have changed after your injury. Please rate the symptom at two points in time- **Before the Injury/Pre-Injury** and **Current Symptoms/ Yesterday and Today**.

Please answer all the items the best that you can. Do not skip any items. Circle the number to tell us how much of a problem this symptom has been for you.

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

		Before the Injury/ Pre-Injury	Current Symptoms/ Yesterday and Today	RAPID
1	Headache	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
2	Nausea	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
3	Balance problems	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
4	Dizziness	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
5	Visual problems (double vision, blurring)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
6	Move in a clumsy manner	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
7	Sensitivity to light	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
8	Sensitivity to noise	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
9	Irritability	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
10	Sadness	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
11	Nervousness	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
12	Feeling more emotional	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
	[Office Use Only] Emotional	Total Pre=	Total Post=	

Retrospective Adjusted Post-Injury Difference (RAPID) Score
Post – Pre-Injury

PSCI Discriminates between injured and non-injured children

Table 9. Classification statistics from discriminant function analysis

	Ages 13–18			Ages 8–12		
	Self	Parent	Both	Self	Parent	Both
Sensitivity	0.51	0.60	0.61	0.56	0.63	0.62
Specificity	0.89	0.89	0.89	0.79	0.97	0.97
PPV	0.82	0.97	0.98	0.73	0.96	0.96
NPV	0.64	0.71	0.72	0.64	0.72	0.72
+ Likelihood	4.63	35.00	53.00	2.66	24.60	24.40
− Likelihood	0.55	0.40	0.40	0.56	0.38	0.39
Odds ratio	8.35	86.74	134.06	4.74	64.36	62.98
Classification accuracy	70%	79%	80%	67%	80%	80%
Area under the curve	0.71	0.88	0.85	0.71	0.91	0.89

Assessing & Monitoring Key Executive Functions

- Problems with executive functions are common following brain injuries (Chapman et al., 2010; Isquith, Roth, & Gioia, 2013)
- Routinely assessed in an ecologically valid manner (Gioia, Kenworthy, & Isquith, 2010).
- The BRIEF is most widely used measure of executive functions following brain injury in children/ adolescents

Assessing & Monitoring Key Executive Functions

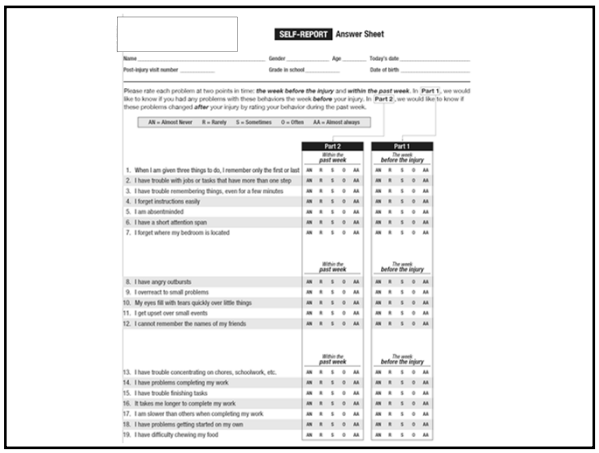
- BRIEF has demonstrated sensitivity to executive function deficits associated with TBI of all severity levels
- We modified the BRIEF to include scales sensitive to concussion
  - Working Memory
  - Emotional Control
  - Task Initiation/Completion

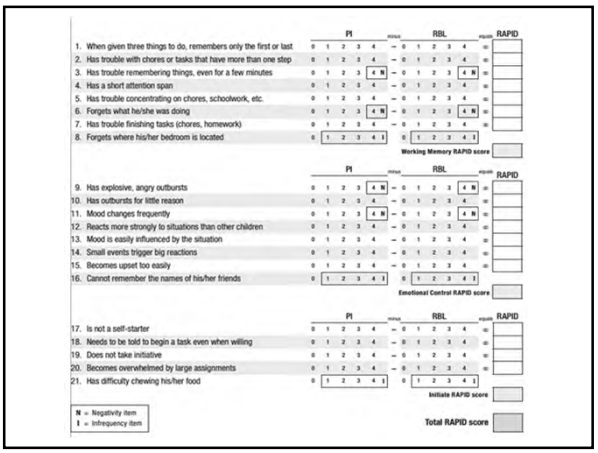
Post-Concussion Executive Inventory (PCEI) Description

- Originally, component in 2003 CDC mTBI outcomes grant
- Two forms: Parent (18 items), Self (16 items)
- Focused domains: Working Memory, Task Initiation/ Completion, Emotional Control
- Ratings of pre-injury status (Retrospective Baseline (RBL), post-injury status

Post-Concussion Executive Inventory (PCEI) Description

- Central score is the Retrospective Adjusted Post-Injury Difference (RAPID) score (Post-Pre)
- Detect change in executive function domains & items from pre- to post-injury
- Measure progress across recovery
- Guide intervention supports across recovery





RCIs applied to the Post-Concussion Executive Inventory

Score Summary Table

Visit 1				
Scale	RAPID score	*ns*	80%	90%
Working Memory	**8**	0-2	3	(4+)
Emotional Control	**1**	0	(1)	2+
Task Completion	**4**	0-3	(4)	5+
Total	**13**	0-6	7-8	(9+)

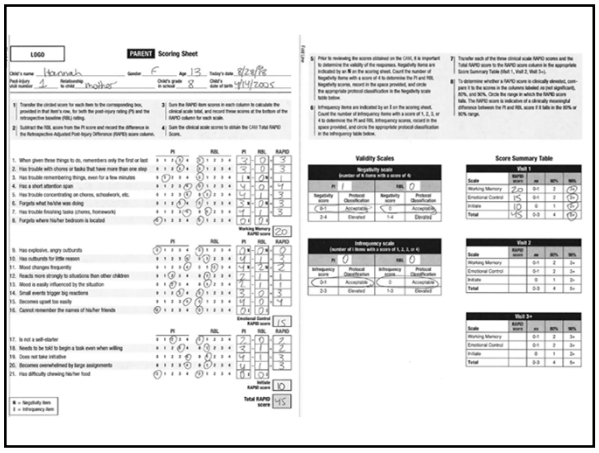
Change over Time

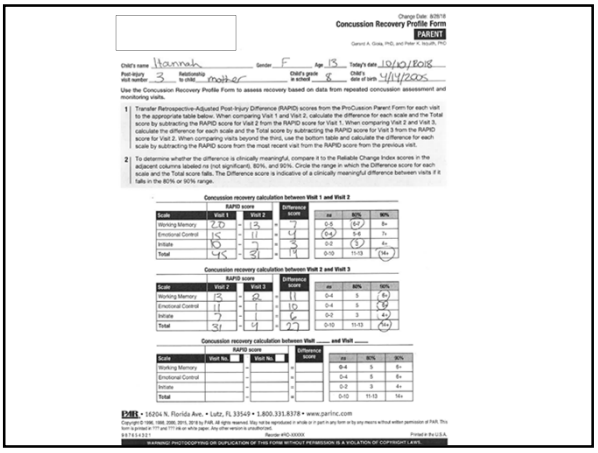
Concussion recovery calculation between Visit 1 and Visit 2

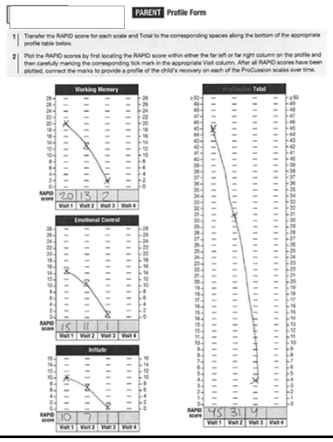
Scale	RAPID score Visit 1		RAPID score Visit 2		Difference score	*ns*	80%	90%
Working Memory		–		=		0-4	5-6	7+
Emotional Control		–		=		0-2	3	4+
Task Completion		–		=		0-5	6-7	8+
Total		–		=		0-11	12-14	15+

Concussion recovery calculation between Visit 2 and Visit 3

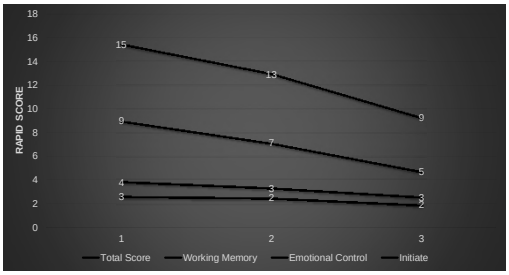
Scale	RAPID score Visit 2		RAPID score Visit 3		Difference score	*ns*	80%	90%
Working Memory		–		=		0-4	5-6	7+
Emotional Control		–		=		0-1	2	3+
Task Completion		–		=		0-5	6-7	8+
Total		–		=		0-10	11-14	15+





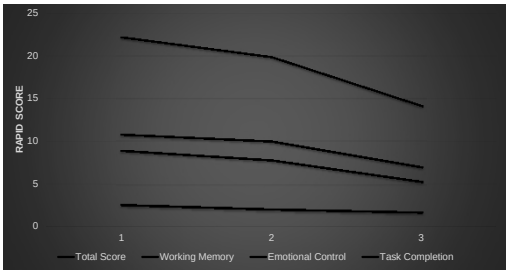


Parent ratings on PCEI over 3 Post-Injury Visits



N = 99

Self-Report PCEI over 3 Visits



N = 84

Post-Concussion Executive Inventory (PCEI) Psychometrics

- Samples: Asymptomatic, symptomatic mTBI; ages 5-18
  - Completed RBL, Post-Injury ratings
  - Across 3 assessment time points
- Reliability
  - Internal consistency of scales
  - Stability over time
- Validity
  - Construct
  - Relationship to other measures
  - Sensitivity to clinical condition

Dynamic Symptom Assessment & Tracking

Exertional Effects Response As Target of Interest/ Intervention

- Exertional Effects = symptom exacerbation following physical, cognitive, emotional activity
- Possible signal that brain's neurometabolism pushed beyond tolerable limits
- Child's sensitivity to symptom exacerbation / exertional effects hypothesized as indicator of injury status.
- Possible treatment/ management implications (i.e., Controlled Exertion)

Cognitive & Physical Intolerance
(% Reporting Exertional Effects)

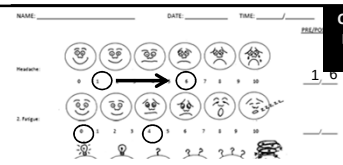
	Elementary (n=88)	Middle (n=138)	High School (n=206)
Demand	*Yes*	*Yes*	*Yes*
Cognitive	47.7	52.5	62.5
Physical	12.5	20.3	16.5

Degree of intolerance/ exertional effects indicates need to manage activity demands at school

Gioia, 2010

Children's National

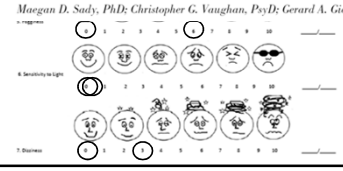
Children's Exertional Effects Rating Scale (ChEERS)



1_6

Measuring Dynamic Symptom Response in Concussion: Children's Exertional Effects Rating Scale

Maegan D. Sady, PhD; Christopher G. Vaughan, PsyD; Gerard A. Gioia, PhD



Psychosocial Impact

- Invisible injury
  - TBI not appreciated
  - Look "normal"
- Cut off from social group (team)
- Loss of identity
- Pressures to be "normal", return & contribute
- Pressure of schoolwork

Assessing Academic Effects

- How does concussion affect school learning and performance?
- What kinds of problems?
  - Symptom-specific
  - General
- What kinds of stresses is the student feeling?
- What subjects are affected?
- What supports are needed? Are they getting?

Concussion Learning Assessment & School Survey (CLASS) Self-report – Initial Appointment

Your Name: _____ DOB: _____ Age: _____ Today's Date: _____

General (pre-injury) school performance (Circle ALL grades that apply): A's B's C's D's E's/ F's

1. ***Since your concussion***, how concerned have you been about this injury affecting your school learning and performance?
CHECK ONE: □ Not Concerned □ Mildly □ Moderately □ Very Concerned

2. Think about the past few days and tell us whether the following school problems are worse **because of your concussion**.

		Not Worse/ Not a problem	A little Worse	Somewhat Worse	A lot Worse
a	Difficulty taking notes	□	□	□	□
b	Difficulty understanding new material	□	□	□	□
c	In class, work taking longer	□	□	□	□
d	Homework taking longer	□	□	□	□
e	Difficulty studying for tests or quizzes	□	□	□	□
f	Trouble remembering what was studied	□	□	□	□
g	Trouble reading	□	□	□	□
h	Easily distracted during classwork	□	□	□	□
i	Easily distracted during homework	□	□	□	□
j	Headaches interfering with classwork	□	□	□	□
k	Headaches interfering with homework	□	□	□	□
l	Tiring easily during the school day	□	□	□	□
m	Tiring easily during homework	□	□	□	□
n	Easily bothered by lights/ screens or noise	□	□	□	□

3. What is ***currently*** stressful or overwhelming for you ***because of your concussion***? Indicate your level of stress.

		Not Stressful	A Little Stressful	Moderately Stressful	Very Stressful
a	Missing time with friends and/ or social activities	□	□	□	□
b	Not being allowed to play sports/ recreation	□	□	□	□
c	Not having enough support from teachers	□	□	□	□
d	Not having enough support at home from parents/ siblings	□	□	□	□
e	More stressed out/ overwhelmed with the schoolwork piling up	□	□	□	□

5. Please check one column for each of the following supports to indicate which supports you need and/ or are receiving ***because of your concussion***.

Support	Do you need it?			Do you have it?			
	No	Yes	I Don't Know	No	Yes, but not enough	Yes	I Don't Know
Shortened day							
Shorter classes							
Rest breaks							
Extra time to complete work							
No tests							
Modified tests (shorter length, more time, no screens, etc.)							
Current work reduced or waived							
Makeup work reduced or waived							
Coordinated plan for makeup work							
Other:							

Test-Based Assessment

- Concussion can produce impairment of neuropsychological function in children and adults
  - Attention, memory, speed, executive function
- Strengths: Assessment of neuropsychological function provides measurable outcome of injury
- Limitations: Other factors can influence performance and reporting; findings do not stand alone
- Test findings are best understood as one tool within a multidimensional, multidisciplinary model
- Training in the proper administration is critical to obtain valid results (Vaughan et al., 2014; Moser et al., 2011)
- Interpretation of findings requires higher level of training/expertise

MANAGING CONCUSSION

Treatment (Zurich)

Concussion management

The cornerstone of concussion management is physical and cognitive rest until the acute symptoms resolve and then a graded programme of exertion prior to medical clearance and RTP. The current published evidence evaluating the effect of rest following a sports-related concussion is sparse. An initial period of rest in the acute symptomatic period following injury (24–48 h) may be of benefit. Further research to evaluate the long-term outcome of rest, and the optimal amount and type of rest, is needed. In the absence of evidence-based recommendations, a sensible approach involves the gradual return to school and social activities (prior to contact sports) in a manner that does not result in a significant exacerbation of symptoms.

Historic Approach(es) to Concussion Treatment

- REST
- REST
- REST

TIME

(CISG, AAP, etc.)

PEDIATRICS

Benefits of Strict Rest After Acute Concussion: A Randomized Controlled Trial

Danny George Thomas, MD, MPH[a], Jennifer N. Apps, PhD[a], Raymond G. Hoffmann, PhD[a], Michael McCrea, PhD[b], Thomas Hammeke, PhD[a]

were recruited. Participants underwent neurocognitive, balance, and symptom assessment in the ED and were randomized to strict rest for 5 days versus usual care (1–2 days rest, followed by stepwise return to activity). Patients completed a diary used to record physical and mental

There was no clinically significant difference in neurocognitive or balance outcomes. However, the intervention group reported more daily postconcussive symptoms (total symptom score over 10 days, 187.9 vs 131.9, $P < .03$) and slower symptom resolution.

CONCLUSIONS: Recommending strict rest for adolescents immediately after concussion offered no added benefit over the usual care. Adolescents' symptom reporting was influenced by recommending strict rest.

Thomas et al. (2015) *Pediatrics*

General Principles of Recovery

- No additional forces to head/ brain
- Get good sleep
- Managing Activity – Exertion Relationship
  - Not over-exerting body or brain
  - Not under-exerting body or brain
  - Avoid activities that produce symptoms

Ways to over-exert

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

Managed Activity

Concussion in Sports: Postconcussive Activity Levels, Symptoms, and Neurocognitive Performance

Cynthia W. Majerske, MD, MS*; Jason P. Mihalik, MS, CAT(C), ATC†; Dianxu Ren, PhD*; Michael W. Collins, PhD*; Cara Camiolo Reddy, MD*; Mark R. Lovell, PhD*; Amy K. Wagner, MD*

Objective: To examine the role postinjury activity level plays

Not too Little, Not Too Much

Setting: University-based sports concussion clinic.

Patients or Other Participants: Ninety-five student-athletes (80 males, 15 females: age = 15.88 ± 1.35 years) were retrospectively assigned to 1 of 5 groups based on a postinjury activity intensity scale.

Results: Level of exertion was significantly related to all outcome variables ($P < .02$ for all comparisons). With multivariate analysis, activity intensity remained significant with respect to visual memory ($P = .003$) and reaction time ($P < .001$).

Conclusions: Activity level after concussion affected symptoms and neurocognitive recovery. Athletes engaging in high levels of activity after concussion demonstrated worse neurocognitive performance. For these tasks, those engaging in moderate levels of activity demonstrated the best performance.

Progressive Activities of Controlled Exertion (PACE)

1. Set the Positive Foundation for Recovery
2. Define the Parameters of the Activity-Exertion Schedule
3. Skill Teaching: Activity-Exertion Monitoring/ Management
4. Reinforcing the Progressive Path to Recovery

~~Rest~~ → PACE

Active Recovery Management (ARM) Key Messages

You will get better.
You will improve and recover.
You have control of your activity.
Your efforts to control your activity and time will pay off.
Find your "sweet spot" of activity.

Effect of Concussion on School Learning & Performance

Effect of School Learning & Performance on Concussion Recovery

Return to ~~Learn~~ Life in School

School:
- Kid's Major "Job" is new learning/ acquiring knowledge
- Practicing incompletely learned knowledge (HW)
- Mental and physical exertion is essential to new learning/ practice

ALSO:
- Social with peers
- Interacting with teachers
- Managing the environment
- Academic pressure

Epidemiology of Recovery Our Best Guess

- Research literature is still limited with respect to understanding concussion recovery outcomes across full age range, and for boys and girls (IOM, 2013).
- Perhaps 70 +/-% recovery within 4 weeks (Zemek et al, 2016).

Recovery Supports must plan for a window from several days to several months (school, physical, social).

Academic Effects of Concussion in Children and Adolescents

Danielle M. Ransom, PsyD[a], Christopher G. Vaughan, PsyD[a,b], Lincoln Pratson, ATC[c], Maegan D. Sady, PhD[a,b], Catherine A. McGill, PsyD[a,b], Gerard A. Gioia, PhD[a,b]

OBJECTIVE: The aim of this work is to study the nature and extent of the adverse academic effects faced by students recovering from concussion.

METHOD: A sample of 349 students ages 5 to 18 who sustained a concussion and their parents reported academic concerns and problems (eg, symptoms interfering, diminished academic skills) on a structured school questionnaire within 4 weeks of injury. Postconcussion symptoms were measured as a marker of injury severity. Results were examined based on recovery status (recovered or actively symptomatic) and level of schooling (elementary, middle, and high school).

RESULTS: Actively symptomatic students and their parents reported higher levels of concern for the impact of concussion on school performance ($P < .05$) and more school-related problems ($P < .001$) than recovered peers and their parents. High school students who had not yet recovered reported significantly more adverse academic effects than their younger counterparts ($P < .05$). Greater severity of postconcussion symptoms was associated with more school-related problems and worse academic effects, regardless of time since injury ($P < .001$).

CONCLUSIONS: This study provides initial evidence for a concussion's impact on academic learning and performance, with more adverse effects reported by students who had not yet recovered from the injury. School-based management with targeted recommendations informed by postinjury symptoms may mitigate adverse academic effects, reduce parent and student concerns for the impact of the injury on learning and scholastic performance, and lower the risk of prolonged recovery for students with active postconcussion symptoms.

What kinds of school problems are you having SINCE YOUR INJURY?

Ransom et al. (2015)

Type of Problem	Elementary (n=42)	Middle (n=78)	High School (n=120)
Headaches interfering	53%	73%	71%
Can't pay attention	47%	58%	66%
Feeling too tired	53%	61%	52%
Homework taking much longer	35%	48%	63%*
Difficulty understanding material	29%	46%	54%
Difficulty studying for tests	18%	36%	53%*
Difficulty taking Notes	18%	17%	35%*
Average # reported **Mn (SD)**	2.53 (2.1)	3.37 (1.7)	3.92 (2.1)

* Significant (p<.05) difference across grade level

Which classes/ subjects are you having trouble with SINCE YOUR INJURY?

Type of Problem	Elementary (n=27/ 82)	Middle (n=92/ 122)	High School (n=147/ 186)
	Student	**Student**	**Student**
Reading	**33.3**	**37.0**	**46.3**
Math	**29.6**	**54.3**	**59.2**
Science	**14.8**	**29.7**	**46.3**
Social Studies	**14.8**	**23.1**	**36.1**
Foreign Language	**7.4**	**33.7**	**32.0**
Art	**0.0**	**5.5**	**3.4**
None	**14.8**	**16.3**	**12.9**

Predicting Academic Outcomes

Journal of the International Neuropsychological Society (2016), **22**, 1038–1049.

doi:10.1017/S1355617716000916

Applying an Evidence-Based Assessment Model to Identify Students at Risk for Perceived Academic Problems following Concussion

Danielle M. Ransom,[1] Alison R. Burns,[2,3] Eric A. Youngstrom,[4] Christopher G. Vaughan,[2,3] Maegan D. Sady,[2,3] AND Gerard A. Gioia[2,3]

[1]University of Miami Miller School of Medicine, Miami, Florida
[2]Children's National Health System, Washington, DC
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[4]University of North Carolina, Chapel Hill, North Carolina

(Received March 14, 2016; Final Revision October 10, 2016; Accepted October 10, 2016)

Childrens National

Cognitive & Physical Demands & Symptoms (% Reporting Exertional Effects)

	Elementary (n=88)	Middle (n=138)	High School (n=206)
Demand	*Yes*	*Yes*	*Yes*
Cognitive	47.7	52.5	62.5
Physical	12.5	20.3	16.5

Degree of exertional effects indicates Need to Manage Activity Demands during School Day (w/ accommodations)

Gioia, 2010

And don't forget the Psychosocial Issues!

- Invisible injury
  - TBI not appreciated
  - Look "normal"
- Cut off from social group (team)
- Loss of identity
- Pressures to be "normal", return & contribute
- Pressure of schoolwork

Symptoms of a Concussion
(what they feel and report)

Physical
- Headache
- Fatigue
- Visual problems (blurry/"double")
- Nausea/vomiting
- Ba
- Se
- Nu ss/tingling

Cognitive
- Mental fogginess
- Difficulty concent g

Sleep
- Sleeping more/less
- Trouble falling asleep
- Drowsiness

Emotional
- More emotional
- Irritable
- Sad
- Nervous

Targets for Supports

(Today) A Student is Identified with a Mild TBI/ Concussion

What Do You Do (Tomorrow)?

School and the Concussed Youth: Recommendations for Concussion Education and Management

Maegan D. Sady, PhD[a,*], Christopher G. Vaughan, PsyD[a,b,c], Gerard A. Gioia, PhD[a,b,c]

Building Statewide Infrastructure for the Academic Support of Students With Mild Traumatic Brain Injury

Gerard A. Gioia, PhD, Ann E. Glang, PhD, Stephen R. Hooper, PhD, Brenda Eagan Brown, MEd, CBIS

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

Original Article

Medical-School Partnership in Guiding Return to School Following Mild Traumatic Brain Injury in Youth

Gerard A. Gioia, PhD[1]

What factors must be considered in 'return to school' following concussion and what strategies or accommodations should be followed?
A systematic review

Laura K Purcell,[1] Gavin A Davis,[2] Gerard A Gioia[3]

Conclusions Schools should have a concussion policy and offer individualised academic accommodations to students recovering from SRC on RTS; a medical letter should be provided to facilitate provision/receipt of academic accommodations; students should have early, regular medical follow-up following SRC to help with RTS and monitor recovery; students may require temporary absence from school after SRC; clinicians should assess risk factors/modifiers that may prolong recovery and require more intensive academic accommodations.

What Berlin has to say about School Return **(Purcell et al, 2018)**

Five factors influence return to school post-concussion:

1. Age: Adolescents tend to take longer to recover and return to school; adolescents more concerned about the negative academic effects of concussion than younger children.
2. Symptom load/severity: Students with greater number/ severity of symptoms tend to take longer to return to school, require more academic accommodations, longer to recover
3. Course load: Certain subjects pose greater problems for students returning to school: math (#1) reading/language arts (#2), then science, social studies.

Berlin & School (cont.)

4. Medical follow-up: Students who receive RTS letter in ED, medical follow-up after ED more likely to receive academic accommodations
5. School resources: Schools with concussion policies that include student/ parent concussion education tend to…
   - practice best-practice guidelines for concussion mgt.
   - provide more accommodations and greater variety of accommodations to students
   - be more likely to form concussion management teams at school to facilitate return to school
   - have students and parents who are more knowledgeable about concussion (Glang et al. 2014)

CDC Recommendations Related to Management/Treatment
Return to School (Rec. 15)

15A. To assist children returning to school following mTBI, medical and school-based teams should counsel the student and family regarding the process of gradually increasing the duration and intensity of academic activities as tolerated, with the goal of increasing participation without significantly exacerbating symptoms. (Level B)

15B. Return to school protocols should be customized based on the severity of postconcussion symptoms in children with mTBI as determined jointly by medical and school-based teams. (Level B)

15C. For any student with prolonged symptoms that interfere with academic performance, **school-based teams** should assess the educational needs of that student and determine the student's need for additional educational supports, including those described under pertinent federal statutes (eg, Section 504, IDEA). (Level B) ***[see 15F]***

CDC Recommendations Related to Management/Treatment
Return to School (Rec. 15)

15D. Postconcussion symptoms and academic progress in school should be monitored collaboratively by the student, family, healthcare provider, and school teams, who jointly determine what modifications or accommodations are needed to maintain an academic workload without significantly exacerbating symptoms. (high; Level B)

15E. The provision of educational supports should be monitored and adjusted on an ongoing basis by the school-based team until the student's academic performance has returned to preinjury levels. (moderate; Level B)

15F. For students who demonstrate prolonged symptoms and academic difficulties despite an active treatment approach, **healthcare providers** should refer the child for a formal evaluation by a specialist in pediatric mTBI. (moderate; Level B) ***[see 15C]***

Connecting Medical & Schools

Original Article

Medical-School Partnership in Guiding Return to School Following Mild Traumatic Brain Injury in Youth

Journal of Child Neurology
2016, Vol. 31(1) 93-108

DOI: 10.1177/0883073814555604
jcn.sagepub.com
SAGE

Gerard A. Gioia, PhD[1]

Expertise within the Team

- **Healthcare Provider**: knowledge of injury, symptom manifestations, recovery path, comorbid health/developmental factors
  * TASK: DIAGNOSE, DEFINE, REDEFINE NEEDS
- **School**: Teaching/learning, school environment
  * TASK: TRANSLATE INJURY INFO INTO SUPPORTS TO OPTIMIZE LEARNING, ADJUST SUPPORTS

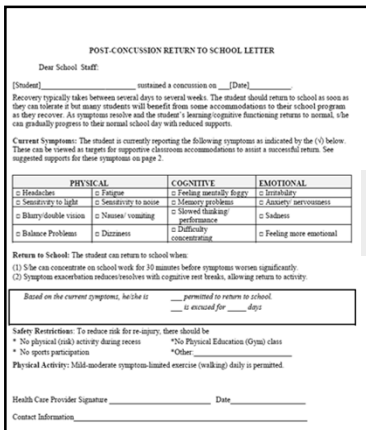
Expertise within the Team

Healthcare Provider

- - knowledge of injury
- - symptom manifestations
- - recovery path
- - comorbid health/developmental factors
  * TASK: DIAGNOSE, DEFINE, REDEFINE NEEDS

Medical System Role in Setting Up School Return
CDC "Discharge" Education
Key Components

1. Educate about concussions (definition, risks)
2. Reasons to go/return to Emerg. Dept. (red flags)
3. Safety restrictions: sports, other risk activities
4. Activity restriction & management
5. School/ work return guidance → **Return to School Letter**
6. Medical follow up



POST-CONCUSSION RETURN TO SCHOOL LETTER

Dear School Staff:

[Student]_____ sustained a concussion on ___[Date]_____.

Recovery typically takes between several days to several weeks. The student should return to school as soon as they can tolerate it but many students will benefit from some accommodations to their school program as they recover. As symptoms resolve and the student's learning/cognitive functioning returns to normal, s/he can gradually progress to their normal school day with reduced supports.

Current Symptoms: The student is currently reporting the following symptoms as indicated by the (√) below. These can be viewed as targets for supportive classroom accommodations to assist a successful return. See suggested supports for these symptoms on page 2.

PHYSICAL		COGNITIVE	EMOTIONAL
□ Headaches	□ Fatigue	□ Feeling mentally foggy	□ Irritability
□ Sensitivity to light	□ Sensitivity to noise	□ Memory problems	□ Anxiety/ nervousness
□ Blurry/double vision	□ Nausea/ vomiting	□ Slowed thinking/ performance	□ Sadness
□ Balance Problems	□ Dizziness	□ Difficulty concentrating	□ Feeling more emotional

Return to School: The student can return to school when:

(1) S/he can concentrate on school work for 30 minutes before symptoms worsen significantly.
(2) Symptom exacerbation reduces/resolves with cognitive rest breaks, allowing return to activity.

Based on the current symptoms, he/she is ___ *permitted to return to school.*
___ *is excused for* ____ *days*

Safety Restrictions: To reduce risk for re-injury, there should be
* No physical (risk) activity during recess *No Physical Education (Gym) class
* No sports participation *Other: _____

Physical Activity: Mild-moderate symptom-limited exercise (walking) daily is permitted.

Health Care Provider Signature _____ Date_____

Contact Information_____

Healthcare Provider Input
- **Diagnose**
- **(Re)Define**
- **Recommend/Suggest**

Who is on the School Team?

Concussion Management Team
- – Medical Monitor
- – Academic Monitor

School nurse, psychologist, athletic trainer
Guidance counselor
Administrator
Teacher(s)
Healthcare Provider(s)
Family

School-based Concussion Management Team

Roles

– Medical monitor:
- monitors the symptom status of the student, using standardized symptom scale
- Liaisons with community medical provider
- Reports status to academic monitor

– Academic monitor:
- oversees & guides academic support process - Day 1 to recovery
- Links student symptom status with accommodations
- Liaisons with, student, teachers and medical monitor

How long do students need support?

- Perhaps 70 +/-% with symptom recovery within 4 weeks (Zemek et al, 2016)
- Therefore, 30% beyond 4 weeks.

Recovery Supports must plan for a window from several days to several months (school, physical, social).

School Psychologist Pathway (suggested)

School is notified of injured student ⇨

School Psychologist Role?
- Early Team Assessment & Planning
- Later Referral
- Not At All

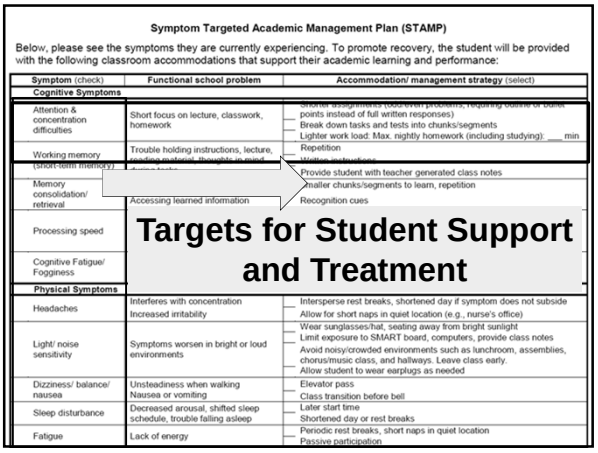
Student Evaluation
- Symptoms, Exertion
- Academic Effects
- Psychological Effects

Assessment Tools

Broad-based symptoms	- ACE, PCSI
Specific Sx (cog/emot)	- PCEI
Exertional effects	- ChEERS
Academic effects	- CLASS

Academic Planning
- Symptom Targets & Supports
- Academic Management
- Activity Management

Social-Emotional Support
- Irritability/ Emotional Control
- Anxiety/ Stress
- Mood
- Self-Efficacy (Recovery Control)



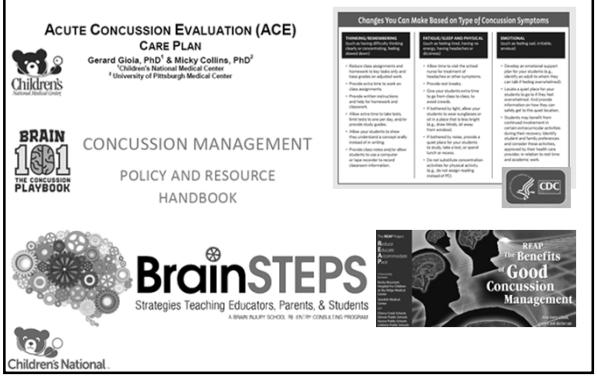
Symptom Targeted Academic Management Plan (STAMP)

Below, please see the symptoms they are currently experiencing. To promote recovery, the student will be provided with the following classroom accommodations that support their academic learning and performance:

Symptom (check)	Functional school problem	Accommodation/ management strategy (select)
Cognitive Symptoms		
Attention & concentration difficulties	Short focus on lecture, classwork, homework	Shorter assignments (odd/even problems, highlight outline of bullet points instead of full written responses) Break down tasks and tests into chunks/segments Lighter work load: Max. nightly homework (including studying): ___ min.
Working memory (short-term memory)	Trouble holding instructions, lecture, reading material, thoughts in mind during tasks	Repetition Written instructions Provide student with teacher generated class notes
Memory consolidation/ retrieval	Accessing learned information	Smaller chunks/segments to learn, repetition Recognition cues
Processing speed		
Cognitive Fatigue/ Fogginess		
Physical Symptoms		
Headaches	Interferes with concentration Increased irritability	Intersperse rest breaks, shortened day if symptom does not subside Allow for short naps in quiet location (e.g., nurse's office)
Light/ noise sensitivity	Symptoms worsen in bright or loud environments	Wear sunglasses/hat, seating away from bright sunlight Limit exposure to SMART board, computers, provide class notes Avoid noisy/crowded environments such as lunchroom, assemblies, chorus/music class, and hallways. Leave class early. Allow student to wear earplugs as needed
Dizziness/ balance/ nausea	Unsteadiness when walking Nausea or vomiting	Elevator pass Class transition before bell
Sleep disturbance	Decreased arousal, shifted sleep schedule, trouble falling asleep	Later start time Shortened day or rest breaks
Fatigue	Lack of energy	Periodic rest breaks, short naps in quiet location Passive participation

Targets for Student Support and Treatment

Tools for School Management



JT - Care Pathway

- JT - 14 year old 9th grade male; plays soccer, basketball, lacrosse; no hx of LD, ADHD, emotional dx. One previous concussion (age 8, riding bike).
- Injured yesterday (10/18) skateboarding, fell and struck the back of his head; no LOC but does not recall the fall or 5-10 minutes prior; 10 minutes of PTA; confusion.
- Pediatrician evaluation: ACE identifies physical, cognitive, emotional and sleep symptoms; concussion diagnosed
- Recommends 2 days off school; Return To School letter provided

POST-CONCUSSION RETURN TO SCHOOL LETTER

Dear School Staff:

[Student] JT sustained a concussion on 5/30/2018

Recovery typically takes between several days to several weeks. The student should return to school as soon as they can tolerate it but many students will benefit from some accommodations to their school programme as they recover. As symptoms resolve and the student's learning/cognitive functioning returns to normal, s/he can gradually progress to their normal school day with reduced supports.

Current Symptoms: The student is currently reporting the following symptoms as indicated by the (√) below. These can be viewed as targets for supportive classroom accommodations to assist a successful return. See suggested supports for these symptoms on page 2.

PHYSICAL		COGNITIVE	EMOTIONAL
X Headaches	X Fatigue	X Feeling mentally foggy	X Irritability
X Sensitivity to light	□ Sensitivity to noise	X Memory problems	□ Anxiety/ nervousness
X Blurry/double vision	X Nausea/ vomiting	X Slowed thinking/ performance	□ Sadness
X Balance Problems	X Dizziness	X Difficulty concentrating	□ Feeling more emotional

Return to School: The student can return to school when:

(1) S/he can concentrate on school work for 30 minutes before symptoms worsen significantly.
(2) Symptom exacerbation reduces/resolves with cognitive rest breaks, allowing return to activity.

Based on the current symptoms, he/she is ✓ *permitted to return to school.* / *is excused for* 2 *days*

Safety Restrictions: To reduce risk for re-injury, there should be

JT – School Evaluation & Support Plan

- Presents to school Day 3 post-injury; RTS letter provided
- Symptom & Academic Effects evaluation
  - Acute Concussion Evaluation (ACE)
  - Post-Concussion Symptom Inventory (PCSI)
  - Post-Concussion Executive Inventory (PCEI)
  - Academic Effects (CLASS)
  - Exertion ratings

- PCSI:
  - Physical: Headaches, dizziness, balance problems, sensitivity to light, blurry vision
  - Cognitive: fogginess, problems concentrating, slowed thinking
  - Emotional: irritability
  - Sleep/fatigue: fatigue, drowsiness, sleeping more than usual

Acute Concussion Evaluation (ACE)

B. Symptom Checklist

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)	
Headache	0 (1)	Feeling mentally foggy	0 (1)	Drowsiness	0 (1)
Nausea	0 (1)	Feeling slowed down	0 (1)	Sleeping less than usual	0 1 N/A
Vomiting	0 1	Difficulty concentrating	0 (1)	Sleeping more than usual	0 (1) N/A
Balance problems	0 (1)	Difficulty remembering	0 (1)	Trouble falling asleep	0 1 N/A
Dizziness	0 1	COGNITIVE Total (0-4)	4	SLEEP Total (0-4)	2
Visual problems	0 1	EMOTIONAL (4)			
Fatigue	0 (1)	Irritability	0 (1)		
Sensitivity to light	0 (1)	Sadness	0 1		
Sensitivity to noise	0 1	More emotional	0 1		
Numbness/Tingling	0 1	Nervousness	0 1		
PHYSICAL Total (0-10)	5	EMOTIONAL Total (0-4)	1		
(Add Physical, Cognitive, Emotion, Sleep totals) Total Symptom Score (0-22)			12		

Exertion: Do these symptoms worsen with:
Physical Activity __Yes __No ✓N/A
Cognitive Activity ✓Yes __No __N/A

Overall Rating: How different is the person acting compared to his/her usual self? (circle)
Normal 0 1 2 (3) 4 5 6 Very Different

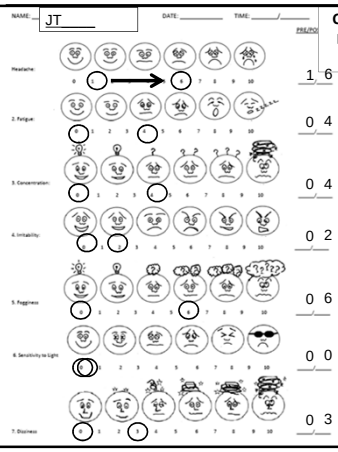
JT (cont)

- PostConcussion Executive Inventory:
  - Difficulties with working memory, task completion; mild emotional (dys)control
- Physical & cognitive activity worsens symptoms
- CLASS: Moderately concerned
  - Academic problems
  - Stress
  - Classes affected

Score Summary Table

Visit 1				
Scale	RAPID score	*ns*	80%	90%
Working Memory	**12**	0-2	3	4+
Emotional Control		0	1	2+
Task Completion		0-3	4	5+
Total		0-6	7-8	9+

Children's Exertional Effects Rating Scale (ChEERS)



Exertional Effects Index (EEI) = 24

Gradual Return to School
Six Stages w Recommended Activity Level

Stage	Description	Activity Level
0	No return, at home	Day 1 - Maintain low level cognitive and physical activity. No prolonged concentration. Cognitive Readiness Challenge: As symptoms improve, try reading or math challenge task for 10-30 minutes; assess for symptom increase.
1	Return to School, Partial Day (1-3 hours)	Attend 1-3 classes, intersperse rest breaks. No tests or homework. Minimal expectations for productivity.
2	Full Day, Maximal Supports (required throughout day)	Attend most classes, with 2-3 rest breaks (20-30'), no tests. Minimal HW (≤ 60'). Minimal-moderate expectations for productivity.
3	Return to Full Day, Moderate Supports (provided in response to symptoms during day)	Attend all classes with 1-2 rest breaks (20-30'); begin quizzes. Moderate HW (60-90') Moderate expectations for productivity. Design schedule for make-up work.
4	Return to Full Day, Minimal Supports (Monitor final recovery)	Attend all classes with 0-1 rest breaks (20-30'); begin modified tests (breaks, extra time). HW (90+') Moderate- maximum expectations for productivity.
5	Full Return, No Supports Needed	Full class schedule, no rest breaks. Max. expectations for productivity. Begin to address make-up work.

Symptom Targeted Academic Management Plan (STAMP)

Below, please see the symptoms they are currently experiencing. To promote recovery, the student will be provided with the following classroom accommodations that support their academic learning and performance:

Symptom (check)	Functional school problem	Accommodation/ management strategy (select)
Cognitive Symptoms		
Attention & concentration difficulties	Short focus on lecture, classwork, homework	Shorter assignments (odd/even problems, requiring outline or bullet points instead of full written responses) Break down tasks and tests into chunks/segments Lighter work load. Max. nightly homework (including studying): ___ min
Working memory (short-term memory)	Trouble holding instructions, lecture, reading material, thoughts in mind during tasks	Repetition Written instructions Provide student with teacher generated class notes
Memory consolidation/ retrieval	Retaining new information	Smaller chunks/segments to learn; repetition [illegible]tion cues
Processing speed	Unable to keep pace with work load Slower reading/writing/calculation Difficulty processing verbal information effectively	Allowances for extended time to complete coursework, assignments, tests Reduce/slowdown verbal information and check for comprehension
Cognitive Fatigue/ Fogginess	Decreased arousal, mental energy; trouble thinking clearly, formulating thoughts	Rest breaks during classes Homework, and examinations in quiet location
Physical Symptoms		
Headaches	Interferes with concentration	Intersperse rest breaks, shortened day if symptom does not subside
Light/ noise sensitivity		
Dizziness/ balance/ nausea		
Sleep disturbance	Decreased arousal, shifted sleep schedule, trouble falling asleep	Later start time Shortened day or rest breaks
Fatigue	Lack of energy	Periodic rest breaks, short naps in quiet location Passive participation

Targets for Student Support and Treatment

Summary

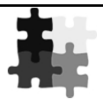
- Most children & adolescents recover from concussion within 1-4 weeks
- Concussions can have a significant effect on the injured student's school learning

NEW TREATMENT APPROACH:

- Day 1-3 (5-7*): Initial restriction of activity with good nighttime sleep
- Day 4+ (8+*): Individualized progressive cognitive and physical activity with monitored symptom management
- Return to School requires medical-school teamwork
- Schools need Concussion Management Teams to provide systematic, coordinated support services

*More significant symptom load

Summary



- Concussion care is a team sport. Communication, collaboration, coordination!
- Implement the Berlin/CDC rec's for Return to School!
- Medical & school expertise must be coordinated
- Systematic Return to School pathway is critical!
- Understanding student's unique symptom profile is critical to delivering effective support (STAMP).
- Regular monitoring of student's symptoms, adjusting types & intensity of supports is critically important.

Summary

- School psychologists can play an important role in supporting the student with concussion.
- Apply your assessment expertise to define symptom targets to support
- Use your skills with interventions to understand, accommodate, monitor & readjust supports based on student's symptoms
- Get in the Game!

Rewards of Working with Concussion

What to Do?

- Join the Concussion Mgt Team
- Help develop a Concussion Mgt Team
- Use the Pathway(s)
- Apply your good skills in evidence-based assessment, consultation & intervention

Concussion/ mTBI CDC Educational Materials

www.cdc.gov/headsup

Heads Up: Concussion in High School Sports

Heads Up: Concussion in Youth Sports

Heads Up: Concussion in Your Practice

Heads Up to Schools: Know Your Concussion ABCs

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