Protecting our Future: Assessment & Management of Pediatric Concussion

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Disclosure Statement

Psychological Assessment Resources, Inc.

- Test Author (royalties)
  - Behavior Rating Inventory of Executive Function (BRIEF)
  - PostConcussion Executive Inventory (PCEI)
  - PostConcussion Symptom Inventory-2nd Ed (PCSI-2)

Many other tests & measures (no royalties)

Acute Concussion Evaluation (ACE) – office, ED
ACE Care Plan; Home/School Instructions
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:

1. Articulate unique foundational elements in concussion of the developing child
2. Describe (sub)types of clinical/ symptom presentations
3. Identify evidence-based tools for the assessment of concussion
4. Describe the active rehabilitation approach across the developmental age span, with a particular focus on school return and supports

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Concussion's Medical Neighborhood Connected Care

Point of Entry

Parents/Coaches/ Group Leaders/ Peers (R&R)

Injury

Emerg Dept
Urgent Care
Primary Care
Athletic Trainers

Continued Care "Typical"

Primary Care

Continued Care "Atypical"

Specialty Care
Incl. Rehabilitation Services

School Return
1. Safety
2. Managed, monitored, gradual return to academic, social, physical activity

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Evolution of Concussion Knowledge

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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,[5] 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-

Berlin 2016

Review

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

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keypoi

Duration/ Prognosis

What is already known?

- The
- children are different from adults.
- Children may take longer to recover from spo
- Retu
- of children following sport-related concussion.

Assessment Tools

Active Treatment

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.

Active School Management

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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 evidence-based clinical guidelines have been developed to date for diagnosing and managing

Editorial
Related article
Supplemental content

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

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Many Causes

Motor Vehicle Collisions

Falls

Struck By/ Against

Assaults

Sports & Recreations

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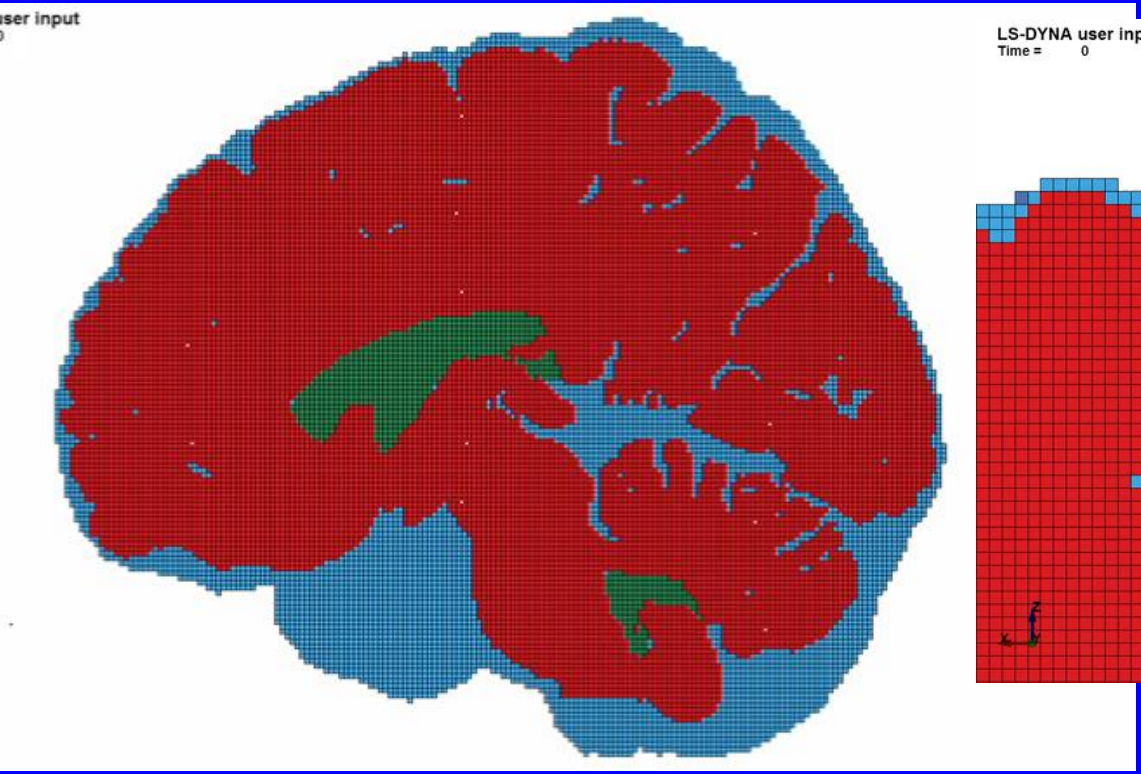
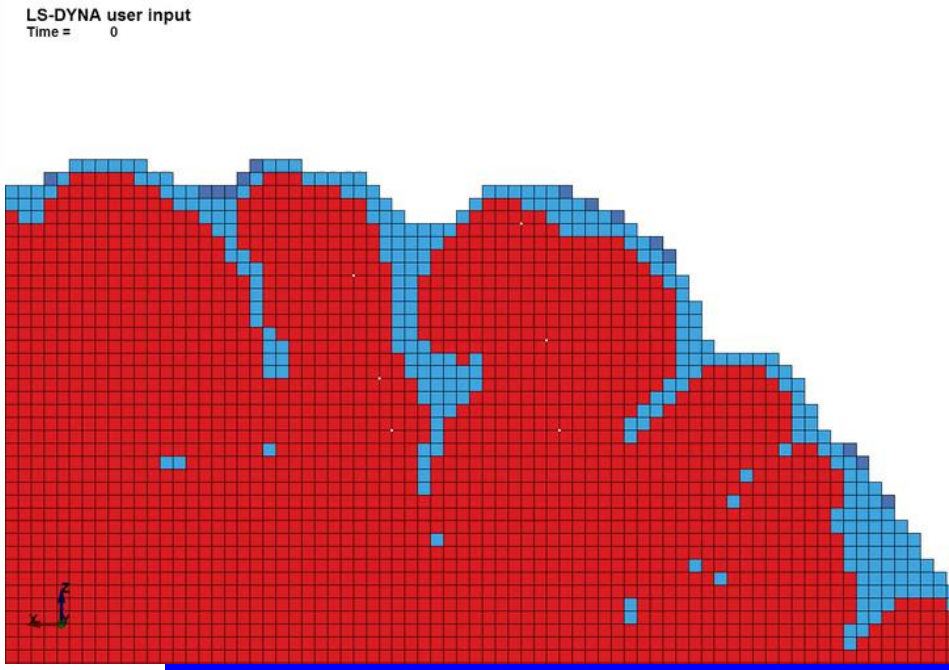
Brain Motion...





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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

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Giza & Hovda, 2001; 2014

Anatomical Timeline of a Concussion
Defining the Key Factors

C. Risk Factors

A. Injury Characteristics

B. Symptom Assessment

CONCUSSION

Pre-Injury Risks

Retro-grade Amnesia 20-35%

LOC <10%

Antero-grade Amnesia 25-40%

Neurocog dysfx & Post-Concuss Sx's

Sec-Hrs

Sec-Min

Sec-Hrs

Hours - Days - Weeks+

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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

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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

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Recovery of Child/ Adolescent: Our Best Guess

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

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Further Defining Concussion: Symptom Subtypes

- Headaches
- Vestibular
- Ocular-motor
- Cognitive
- Anxiety/ mood problems

- -

Associated conditions

- Sleep
- Cervical strain

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GUIDELINES

Concussion Guidelines Step 2: Evidence for Subtype Classification

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BACKGROUND: Concussion is a heterogeneous mild traumatic brain injury (mTBI) characterized by a variety of symptoms, clinical presentations, and recovery trajectories. By thematically classifying the most common concussive clinical presentations into concussion subtypes (cognitive, ocular-motor, headache/migraine, vestibular, and anxiety/mood) and associated conditions (cervical strain and sleep disturbance), we derive useful definitions amenable to future targeted treatments.

OBJECTIVE: To use evidence-based methodology to characterize the 5 concussion subtypes and 2 associated conditions and report their prevalence in acute concussion patients as compared to baseline or controls within 3 d of injury.

METHODS: A multidisciplinary expert workgroup was established to define the most common concussion subtypes and their associated conditions and select clinical questions related to prevalence and recovery. A literature search was conducted from January 1, 1990 to November 1, 2017. Two experts abstracted study characteristics and results independently for each article selected for inclusion. A third expert adjudicated disagreements. Separate meta-analyses were conducted to do the following: 1) examine the prevalence of each subtype/associated condition in concussion patients using a proportion,

Neurosurgery, 2019

TABLE 2. Concussion Symptom Scales, and Other Subjective and Objective Indicators Used for Meta-Analysis of Prevalence using Prevalence Ratio and Standardized Mean Difference (SMD)

Concussion subtype or associated condition	Classification	Measurements used for prevalence ration	Measurements used for SMD
Concussion subtype	Cognitive	Concentration, remembering, retrograde amnesia, anterograde amnesia, posttraumatic amnesia, cognitive problems, feeling slow	ImPACT - verbal memory, ImPACT—visual motor speed, ImPACT - reaction time, ImPACT—impulse control, verbal learning test—immediate memory, verbal learning test—delayed recall, verbal learning test—recognition, trail making test A, trail making test B, Stroop word, Stroop color, Stroop word-colors test, controlled oral word association test, symbol digit, symbol digit recall, digit symbol substitution test, learning trial, Wechsler digit span test forward, Wechsler digit span test backward, letter-number sequencing, total sentences, concentration, remembering, Sternberg task—percent accuracy, Sternberg task—reaction time (ms)
	Ocular-motor	Visual problems, blurred vision, visual changes, sensitivity to light, double vision	Antisaccade (errors), antisaccade (latency), remembered saccade (errors), remembered saccade (latency), visual problems, visual acuity, sensitivity to light, King-Devick (K-D) test
	Headache-migraine	Headache, sensitivity to light, sensitivity to light or sound, sensitivity to noise, neck pain, vomiting, nausea, nausea/vomiting, nausea, nausea/vomiting, abnormal coordination	Headache, sensitivity to light, sensitivity to noise, vomiting, nausea
	Vestibular	Dizziness, balance problem, tinnitus, fogginess, disequilibrium, confusion/disorientation, disorientation, vomiting, nausea, nausea/vomiting, abnormal coordination	BESS, mBESS, dizziness, balance problem, fogginess, vomiting, nausea
	Anxiety-mood	Depression, irritability, emotional problem, nervousness, confusion/disorientation, confusion, sadness, slow down, photophobia, personality changes, numbness, tingling, numbness/tingling	Anxiety, depression, irritability, emotional problem, nervousness, sadness, slow down, stress, numbness
Associated condition	Sleep disturbance	Drowsiness, sleeping more than usual, sleeping less than usual, trouble falling asleep, sleepiness	Drowsiness, sleep symptoms

TABLE 3. Prevalence of Concussion Subtypes and Sleep Disturbance in Concussion Patients

	Concussion subtype/ associated condition	Population	Study N (Sample N)	Proportion (95% CI)
3	Cognitive	Pediatric	10 (654)	0.32 (0.21, 0.43)[a]
		Adult	16 (1233)	0.40 (0.25, 0.55)
3	Ocular-motor	Pediatric	8 (600)	0.34 (0.27, 0.41)
		Adult	6 (438)	0.34 (0.18, 0.53)
1	Headache/migraine	Pediatric	15 (1320)	0.52 (0.37, 0.67)
		Adult	16 (1107)	0.38 (0.26, 0.52)
2	Vestibular	Pediatric	21 (1705)	0.50 (0.40, 0.60)[b]
		Adult	26 (1853)	0.25 (0.18, 0.33)[c]
3	Anxiety/mood	Pediatric	15 (989)	0.30 (0.21, 0.39)
		Adult	15 (975)	0.23 (0.15, 0.33)
3	Sleep disturbance	Pediatric	4 (156)	0.33 (0.19, 0.49)
		Adult	7 (600)	0.34 (0.18, 0.51)

CI — confidence interval

Evidence-Based Assessment

Evidence-based Assessment

- In essence, we want our clinical assessment tools/ data to help predict outcomes
  - Likelihood of diagnosis
  - Time to recovery
  - Likelihood of prolonged/ complicated recovery
  - Need for treatment
  - Return to school, necessary accommodations
  - Return to physical activity/ sports/ recreation
- Examine set of clinical factors that are predictive current status, or treatment needs

Evidence-based assessment:

- Refines the predictive capability of known risk factors, clinical measures, functional impairment to the likelihood of post-injury problems.
- Improves our understanding of probabilities for specific outcomes, allows better targeting of individualized treatments.
- Identifies when clinically important change has occurred beyond chance.

Clinical Questions

- Is this student's symptom pattern consistent with a likely concussion?
- Is the student at high risk for prolonged recovery?
- Is this student at high risk for problems with academics?
- Has the student made clinically significant change in their functioning?

Predicting & Preventing Persistent Post-Concussion Problems in Pediatrics (5P)

Original Investigation

Clinical Risk Score for Persistent Postconcussion Symptoms Among Children With Acute Concussion in the ED

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IMPORTANCE Approximately one-third of children experiencing acute concussion experience ongoing somatic, cognitive, and psychological or behavioral symptoms, referred to as persistent postconcussion symptoms (PPCS). However, validated and pragmatic tools enabling clinicians to identify patients at risk for PPCS do not exist.

OBJECTIVE To derive and validate a clinical risk score for PPCS among children presenting to the emergency department.

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CME Quiz at jamanetworkcme.com and CME Questions page 1050

Table 5. Selected Predictor Variables for Multivariable Model of Persistent Postconcussive Symptoms (PPCS) at 28 Days in the Derivation Cohort[a]

	No. of Risk Points for PPCS	Odds Ratio (95%CI)	*P* Value
Age group, y			
5-7	0	1 [Reference]	<.001
8-12	1	1.54 (1.09-2.19)	
13-<18	2	2.31 (1.62-3.32)	
Sex			
Male	0	1 [Reference]	<.001
Female	2	2.24 (1.78-2.82)	
Prior concussion and symptom duration			
No prior concussion; symptom duration <1 wk	0	1 [Reference]	.01
Prior concussion; symptom duration ≥1 wk	1	1.53 (1.10-2.13)	
Physician-diagnosed migraine history			
No	0	1 [Reference]	.001
Yes	1	1.73 (1.24-2.43)	
Answering questions slowly			
No	0	1 [Reference]	.008
Yes	1	1.37 (1.08-1.74)	
Balance Error Scoring System tandem stance No. of errors			
0-3	0	1 [Reference]	.02
≥4 or Physically unable to undergo testing	1	1.31 (1.04-1.66)	
Headache			
No	0	1 [Reference]	.01
Yes	1	1.66 (1.11-2.48)	
Sensitivity to noise			
No	0	1 [Reference]	.002
Yes	1	1.47 (1.15-1.87)	
Fatigue			
No	0	1 [Reference]	<.001
Yes	2	1.84 (1.37-2.46)	

5P Clinical Risk Score

12- point scale of predictors

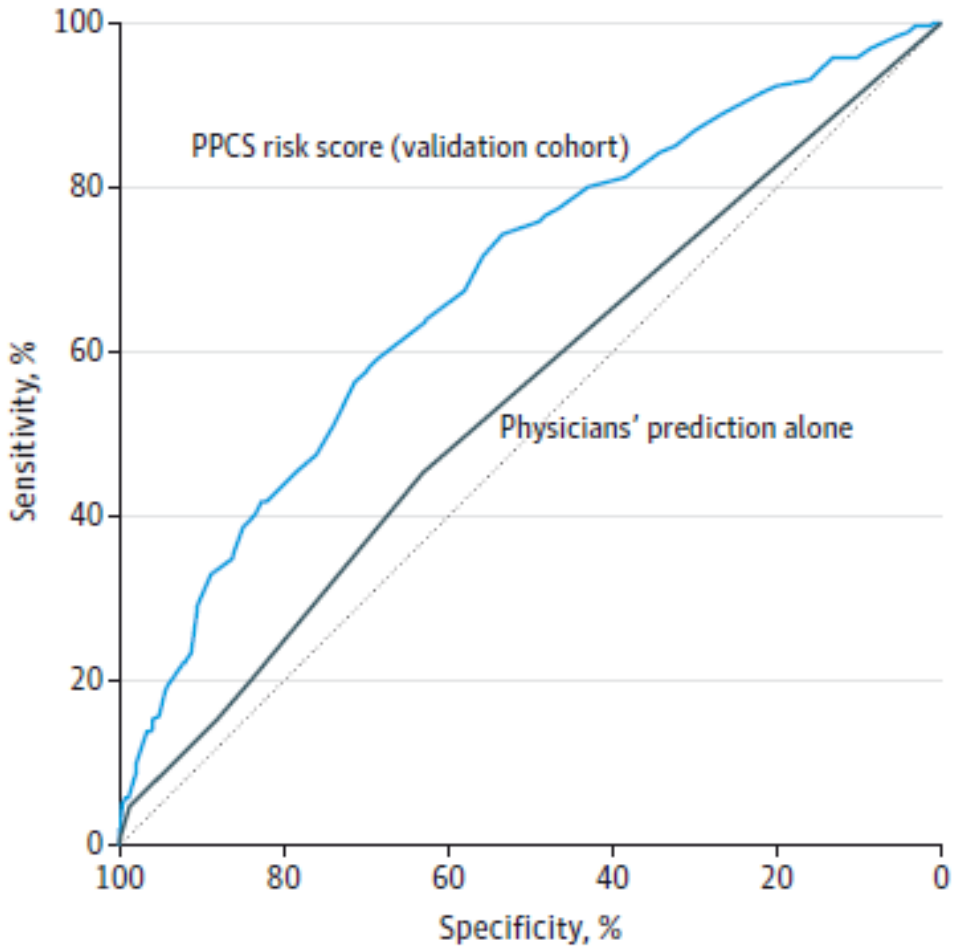
N=1701

- Demographic factors
- History
- Signs
- Clincal tests
- Symptoms

Table 6. Risk Categories for Persistent Postconcussive Symptoms (PPCS) in the Derivation Cohort[a]

PPCS Risk Category	Total No. of Risk Points	Estimated Risk of PPCS, % (95% CI)	No. With PPCS/ Total No. of Patients (%)
Low risk	0	4.1 (2.4-6.7)	0/6 (0)
	1	5.8 (3.9-9.5)	6/37 (16.2)
	2	8.3 (6.0-13.2)	11/98 (11.2)
	3	11.8 (8.5-17.8)	15/165 (9.1)
Medium risk	4	16.4 (11.9-22.4)	41/239 (17.2)
	5	22.3 (16.7-29.7)	71/289 (24.6)
	6	29.7 (22.7-37.9)	90/299 (30.1)
	7	38.2 (30.1-46.9)	96/243 (39.5)
	8	47.6 (38.9-57.1)	80/172 (46.5)
High risk	9	57.1 (48.2-65.6)	58/103 (56.3)
	10	66.1 (57.2-74.4)	30/43 (69.8)
	11	74.1 (65.8-81.5)	9/13 (69.2)
	12	80.8 (74.6-88.3)	3/3 (100)

Figure 2. Receiver Operating Characteristic Curves



PPCS indicates persistent postconcussive symptoms. The area under the curve was 0.71 (95% CI, 0.69-0.74) for the derivation cohort and 0.68 (95% CI, 0.65-0.72) for the validation cohort.

70% prediction accuracy vs. clinician prediction (55%)

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

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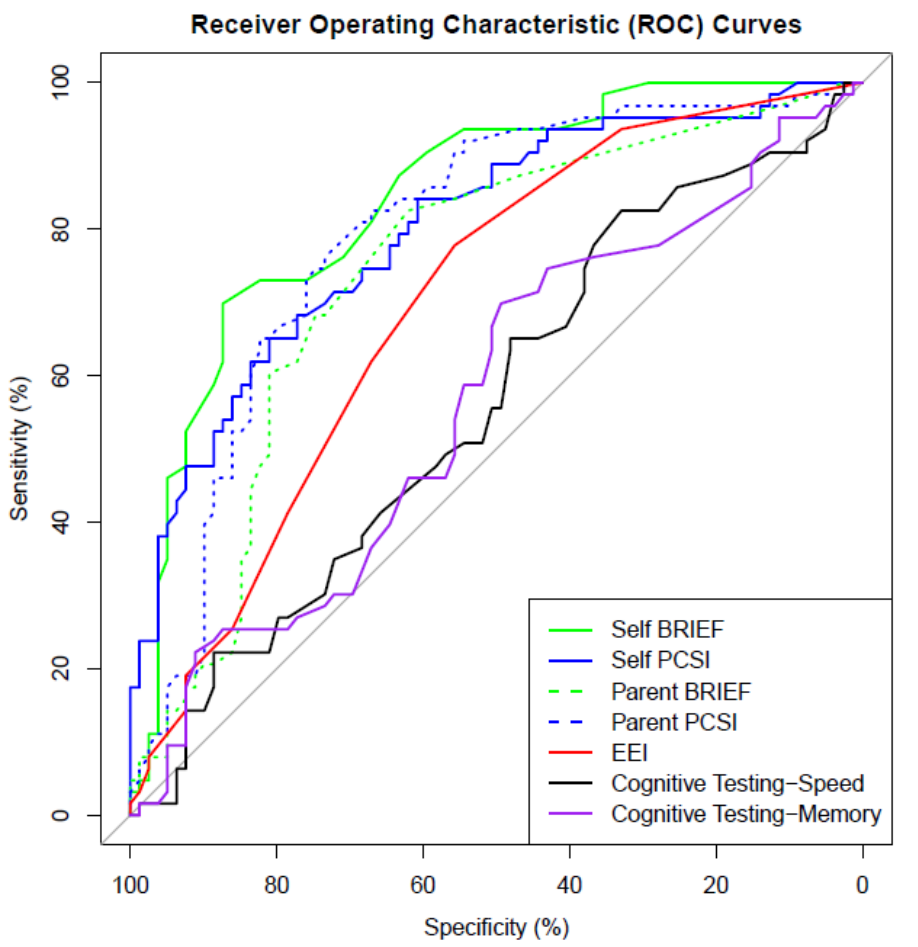
Predicting Academic Outcomes

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

- ROC modeling of academic outcome
- Predicting “good” vs “challenged” academic outcomes (CLASS)
- Predictors: Post-concussion sxs (PCSI), executive dysfunction (BRIEF), exertion (ChEERS)



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Predicting Academic Outcome
(and likely need for service)

Table 3. AUC from ROC analyses identifying students reporting school problems at visit 1 with index tests and moderators

Index test	Area under curve	Standard error	*p*-Value	95% Confidence interval Lower	95% Confidence interval Upper
Modified BRIEF Self-Report	.84	.03	<.001	.78	.91
PCSI Self-Report	.80	.04	<.001	.73	.87
PCSI Parent Report	.79	.04	<.001	.72	.87
Modified BRIEF Parent-Report	.74	.04	<.001	.66	.83
Exertional Effects Index	.70	.04	<.001	.61	.78
Cognitive performance:					
Processing Speed	.56	.05	.22	.47	.66
Memory	.57	.05	.17	.47	.66

Note. Benchmarks provided by Rice and Harris (2005) indicate that AUCs in the mid .50s are small and not clinically useful; AUCs in the mid .60s are medium in size and may provide some incremental clinical value, but are not sufficient in isolation; AUCs in the low to mid .70s reflect large, clinically informative values; AUCs in the low .80s are excellent; AUCs in the high .80s are exceptional under clinically rigorous designs and are often highly informative; while AUCs in the .90s are extraordinary.

PCSI Reliable Change metrics

Table 2. RCIs for PCSI Total Symptom Score

Measure	SD1	SD2	SEM1	SEM2	r	Sdiff	0.80 CI	0.90 CI
PCSI 5-7 (5 items)	1.9	2.0	1.4	1.5	0.5	2.0	2.6	3.3
PCSI 8-12 (17 items)	6.0	6.2	2.7	2.7	0.8	3.8	4.9	6.3
PCSI 13-18 (21 items)	7.6	7.9	4.5	4.7	0.6	6.5	8.3	10.7

Sdiff = SQRT [(SEM1*SEM1)+(SEM2*SEM2)]
SEM1 = SD1 [SQRT(1-r12)]
SEM2 = SD2 [SQRT(1-r12)]

80% confidence interval = Sdiff * 1.28
90% confidence interval = Sdiff * 1.645

RCI's for Symptom Subtypes

Table 3. RCIs for Postconcussion Symptom Inventory Age 13-18

Subtype	n	SD1	SD2	SEM1	SEM2	r	Sdiff	0.80 RCI	0.90 RCI
Migraine	102	1.7	1.8	1.4	1.4	0.4	2.0	2.5	3.3
Cognitive	102	3.0	3.3	1.8	2.0	0.6	2.7	3.5	4.5
Emotional	102	2.1	1.9	1.3	1.2	0.6	1.8	2.3	2.9
Vestibular	102	1.4	1.4	1.0	1.0	0.5	1.4	1.7	2.2
Ocular Motor	102	1.1	0.8	0.8	0.6	0.4	1.0	1.3	1.6
Sleep/Fatigue	102	2.9	2.5	1.7	1.5	0.6	2.3	2.9	3.7
Cervical	102	0.4	0.3	0.3	0.3	0.5	0.4	0.5	0.6

RCI's for Symptom Subtypes

Table 4. RCIs for Postconcussion Symptom Inventory Age 8-12

Subtype	n	SD1	SD2	SEM1	SEM2	r	Sdiff	0.80 RCI	0.90 RCI
Migraine	81	1.8	1.8	1.0	1.1	0.7	1.5	1.9	2.5
Cognitive	81	2.1	1.9	1.2	1.1	0.7	1.7	2.1	2.7
Emotional	81	1.9	1.8	1.0	1.0	0.7	1.4	1.8	2.3
Vestibular	81	1.1	1.0	0.7	0.6	0.6	0.9	1.2	1.5
Ocular Motor	81	0.7	0.7	0.4	0.4	0.7	0.5	0.7	0.8
Sleep/Fatig	81	1.6	1.8	0.9	1.0	0.7	1.4	1.8	2.3
Cervical	81	0.6	0.6	0.4	0.4	0.6	0.5	0.7	0.9

Critical Importance of History in Concussion Diagnosis & Mgt

- Concussion occurs within the context of the person's developmental, medical, social and emotional/psychiatric history.
- A number of concussion "symptoms" mimic pre-existing behaviors or "symptoms" and must be distinguished.
- This must occur at the time of establishing the diagnosis as well as at the time of recovery.

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Diagnostic Confidence

1. Was there a definite reported mechanism of injury?
   □ Yes (There was a discrete event with force to the head or rapid head movement without impact)
   □ No (There was no discrete event)

2. Was there an onset of typical symptoms within 24-48 hours of the injury event?
   □ Yes (Typical concussion symptoms AND onset < 24-48 hrs)
   □ No (Atypical concussion symptoms, delayed onset)

3. Has there been gradual recovery or stability of symptoms over the first week of the injury?
   □ Yes (There have been improving symptoms over the first week)
   □ Yes (There have been stable symptoms over the first week)
   □ No (There have been worsening symptoms over the first week)

4. Was there an alternative explanation for the symptoms?
   □ Yes (comorbid conditions: migraine, exacerbation of current concussion, anxiety, ADHD, etc)
   □ No (concussion is the only likely cause for the current symptoms)

Assessment & Management of Concussion

Processes, Pathways & Tools

Symptom Assessment

Acute Concussion Evaluation (ACE)

Post-Concussion Symptom Inventory (PCSI)

Post-Concussion Executive Inventory (PCEI)

ACUTE CONCUSSION EVALUATION (ACE)

Physician/Clinician Office Version

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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 __Lft Temporal __Rt Temporal __Lft 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 Durati
4. Amnesia After (Anterograde) Are there any events just AFTER the injury that you/ person has no memory of (even brief)? __Yes __No Durati
5. Loss of Consciousness: Did you/ person lose consciousness? __Yes __No Durati
6. EARLY SIGNS: __Appears dazed or stunned __Is confused about events __Answers questions slowly __Repeats Questions __Forgetful (re
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 J

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)			SLEEP Total (0-4)		
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)			EMOTIONAL Total (0-4)					
(Add Physical, Cognitive, Emotion, Sleep totals) Total Symptom Score (0-22)					____			

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

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

Concussion History? Y ___ N___	√	Headache History? Y ___ N___	√	Developmental History	√	Psychiatric
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
If multiple concussions, less force caused reinjury? Yes___ No___				Other developmental disorder_____		Sleep disord
						Other psychi

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

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

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

E. Diagnosis (ICD): __Concussion w/o LOC 850.0 __Concussion w/ LOC 850.1 __Concussion (Unspecified) 850.9 __Other (854)_____
__No diagnosis

F. Follow-Up Action Plan Complete *ACE Care Plan* and provide copy to patient/family.
___ No Follow-Up Needed
___ Physician/ Clinician Office Monitoring: Date of next follow-up _____
___ Referral:
___ Neuropsychological Testing
___ Physician: Neurosurgery___ Neurology___ Sports Medicine___ Physiatrist___ Psychiatrist___ Other_____
___ Emergency Department

ACE Completed by:_____ MD RN NP PhD ATC

Post-Concussion Symptom Inventory

Ages 13-18 (PCSI-SR13)

Pre/Post 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 the 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 symptom has been for you.

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

		Before the Injury/ Pre-Injury	Current Symptoms/ Yesterday and Today
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
	[Office Use Only] Physical	Total Pre=	Total Post=
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=
13	Feeling mentally "foggy"	0 1 2 3 4 5 6	0 1 2 3 4 5 6
14	Difficulty concentrating	0 1 2 3 4 5 6	0 1 2 3 4 5 6
15	Difficulty remembering	0 1 2 3 4 5 6	0 1 2 3 4 5 6
16	Get confused with directions or tasks	0 1 2 3 4 5 6	0 1 2 3 4 5 6
17	Answer questions more slowly than usual	0 1 2 3 4 5 6	0 1 2 3 4 5 6
18	Feeling slowed down	0 1 2 3 4 5 6	0 1 2 3 4 5 6
	[Office Use Only] Cognitive	Total Pre=	Total Post=
19	Fatigue	0 1 2 3 4 5 6	0 1 2 3 4 5 6
20	Drowsiness	0 1 2 3 4 5 6	0 1 2 3 4 5 6
21	Sleep more than usual	0 1 2 3 4 5 6	0 1 2 3 4 5 6
	[Office Use Only] Sleep/ Fatigue	Total Pre=	Total Post=
22	In general, to what degree do you feel "differently" than before the injury (not feeling like yourself)?	No Difference 0 1 2 3 4 Major Difference *Circle your rating with "0" indicating "Normal" (No Difference) and "4" indicating "Very Different" (Major Difference)*	

PCSI Total Symptom Score [Office Use Only]: Pre (sum 4 domains) = ____ Post (sum 4 domains) = ____
PCSI Total Adjusted Symptom Score (Post-Pre) = ____

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Authored / Developed by: Gioia, Janusz, Vaughan & Sady. 2011-2
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LOGO

SELF-REPORT Answer Sheet

Name _____ Gender _____ Age _____ Today's date _____
Post-Injury visit number _____ Grade in school _____ Date of birth _____

Please rate each problem at two points in time: ***the week before the injury*** and ***within the past week***. In Part 1 like to know if you had any problems with these behaviors the week ***before*** your injury. In Part 2, we would like to these problems changed ***after*** your injury by rating your behavior during the past week.

AN – Almost Never R – Rarely S – Sometimes O – Often AA – Almost always

	Part 2 Within the past week	Part 1 The week before the injury
1. When I am given three things to do, I remember only the first or last	AN R S O AA	AN R S O AA
2. I have trouble with jobs or tasks that have more than one step	AN R S O AA	AN R S O AA
3. I have trouble remembering things, even for a few minutes	AN R S O AA	AN R S O AA
4. I forget instructions easily	AN R S O AA	AN R S O AA
5. I am absentminded	AN R S O AA	AN R S O AA
6. I have a short attention span	AN R S O AA	AN R S O AA
7. I forget where my bedroom is located	AN R S O AA	AN R S O AA
	Within the past week	The week before the injury
8. I have angry outbursts	AN R S O AA	AN R S O AA
9. I overreact to small problems	AN R S O AA	AN R S O AA
10. My eyes fill with tears quickly over little things	AN R S O AA	AN R S O AA
11. I get upset over small events	AN R S O AA	AN R S O AA
12. I cannot remember the names of my friends	AN R S O AA	AN R S O AA
	Within the past week	The week before the injury
13. I have trouble concentrating on chores, schoolwork, etc.	AN R S O AA	AN R S O AA
14. I have problems completing my work	AN R S O AA	AN R S O AA
15. I have trouble finishing tasks	AN R S O AA	AN R S O AA
16. It takes me longer to complete my work	AN R S O AA	AN R S O AA
17. I am slower than others when completing my work	AN R S O AA	AN R S O AA
18. I have problems getting started on my own	AN R S O AA	AN R S O AA
19. I have difficulty chewing my food	AN R S O AA	AN R S O AA

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

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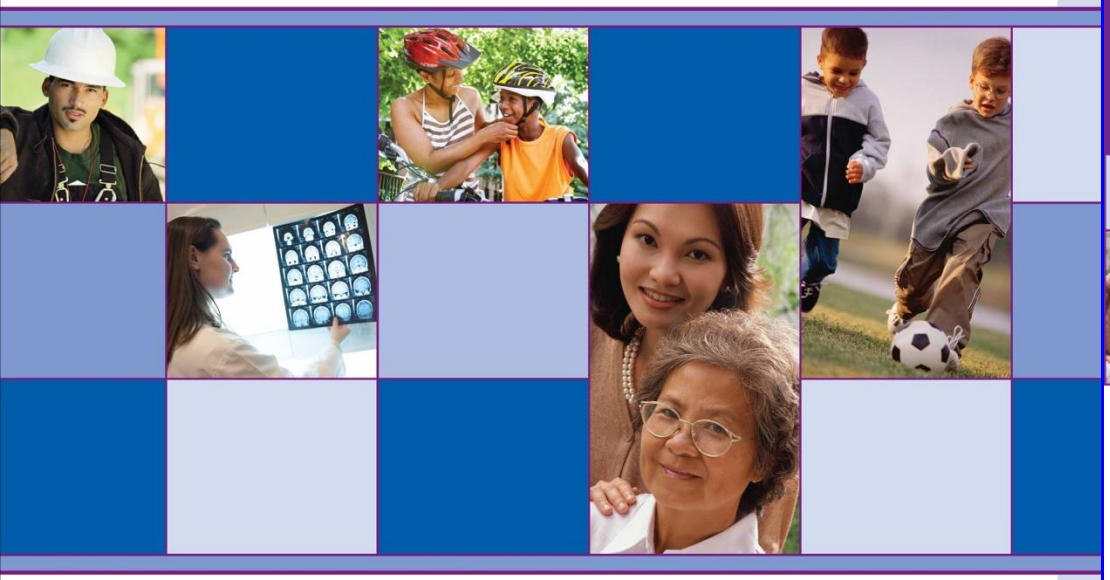
Since June 2007

Heads Up

Brain Injury in Your Practice



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

Facts for Physicians

Heads Up

Facts for Physicians About Mild Traumatic Brain Injury (MTBI)

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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

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Tracking Symptom Status/ Recovery

Post-Concussion Symptom Conceptualization

- "Static" symptom manifestation: symptoms that are present over period of time (days, weeks)
  - Assessed by traditional graded symptom scales
- "Dynamic" symptom manifestation: symptom presentation (and change) in response to stimulation/ activity → Exertional effects
  - Assessed by dynamic symptom scale (using ecological momentary assessment-EMA)

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

Concept of RAPID score

- Retrospective-Adjusted Post-Injury Difference (RAPID) score is central, unique feature
- Addresses two essential questions of whether:
  - there is change from pre to post injury functioning
  - if there has been change (recovery) over post-injury time
- Employ reliable change metrics to answer these questions

Interpreting Reliable Change
(Evidence-driven)

When interpreting change, ask two fundamental questions.

1. Are the postinjury 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

Interpreting Reliable Change
(Evidence-driven)

Two fundamental questions.

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

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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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 the 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, and across recovery.
- Guides intervention supports across recovery

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
- Validity
  - Construct
  - Relationship to other measures
  - Sensitivity to clinical condition

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+

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)

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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

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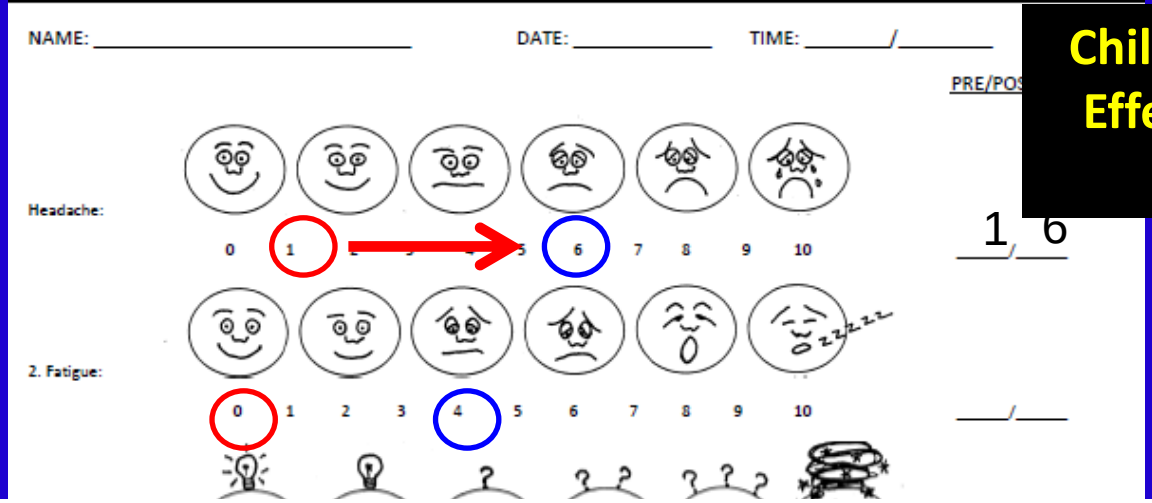
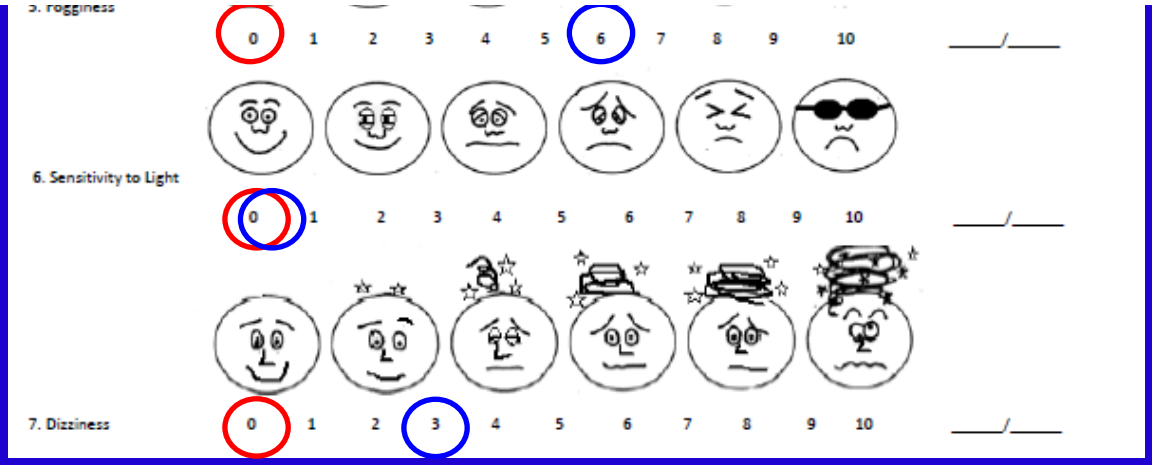
Children's Exertional Effects Rating Scale (ChEERS)



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

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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?

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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:							

TREATING CONCUSSION/ MILD TBI

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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.

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Historic Approach(es) to Concussion Treatment

- REST
- REST
- REST

TIME

(CISG, AAP, etc.)

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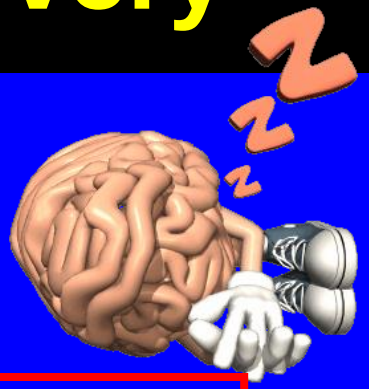
General Principles of Recovery



- 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.

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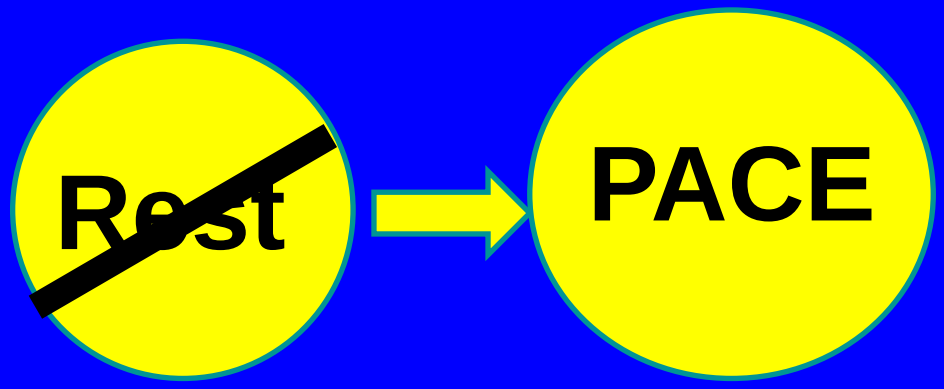
Progressive Activities of Controlled Exertion (PACE)

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



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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.

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Effect of Concussion on School Learning & Performance

Effect of School Learning & Performance on Concussion Recovery

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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

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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.

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Academic Effects of Concussion in Children and Adolescents

Danielle M. Ransom, PsyD[a,b], 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]

abstract

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)

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

Predicting Academic Outcomes

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

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

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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 Pathway
(suggested)

School is notified of injured student

Concussion Management Team

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)

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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	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

Acute Concussion Evaluation (ACE) Care Plan

Gerard Gioia, PhD[1] & Micky Collins, PhD[2]
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Children's National Medical Center

Changes You Can Make Based on Type of Concussion Symptoms

THINKING/REMEMBERING (such as having difficulty thinking clearly or concentrating, feeling slowed down)

- Reduce class assignments and homework to key tasks only and base grades on adjusted work.
- Provide extra time to work on class assignments.
- Provide written instructions and help for homework and classwork.
- Allow extra time to take tests, limit tests to one per day, and/or provide study guides.
- Allow your students to show they understand a concept orally instead of in writing.
- Provide class notes and/or allow students to use a computer or tape recorder to record classroom information.

FATIGUE/SLEEP AND PHYSICAL (such as feeling tired, having no energy, having headaches or dizziness)

- Allow time to visit the school nurse for treatment of headaches or other symptoms.
- Provide rest breaks.
- Give your students extra time to go from class to class, to avoid crowds.
- If bothered by light, allow your students to wear sunglasses or sit in a place that is less bright (e.g., draw blinds, sit away from window).
- If bothered by noise, provide a quiet place for your students to study, take a test, or spend lunch or recess.
- Do not substitute concentration activities for physical activity (e.g., do not assign reading instead of PE).

EMOTIONAL (such as feeling sad, irritable, anxious)

- Develop an emotional support plan for your students (e.g., identify an adult to whom they can talk if feeling overwhelmed).
- Locate a quiet place for your students to go to if they feel overwhelmed. And provide information on how they can safely get to this quiet location.
- Students may benefit from continued involvement in certain extracurricular activities during their recovery. Identify student and family preferences and consider these activities, approved by their health care provider, in relation to rest time and academic work.

CDC

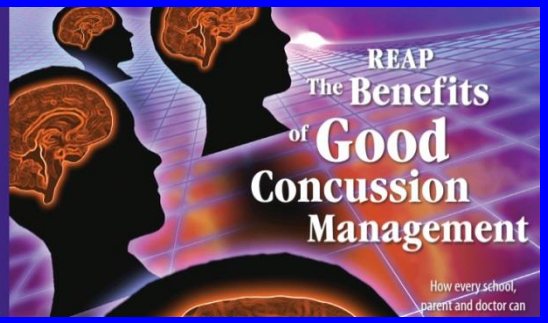
BRAIN 101 THE CONCUSSION PLAYBOOK

CONCUSSION MANAGEMENT POLICY AND RESOURCE HANDBOOK

BrainSTEPS
Strategies Teaching Educators, Parents, & Students
A BRAIN INJURY SCHOOL RE-ENTRY CONSULTING PROGRAM

The REAP Project
Reduce
Educate
Accommodate
Pace

A Partnership between:
Rocky Mountain Hospital For Children at Sky Ridge Medical Center
Swedish Medical Center
and
Cherry Creek Schools
Denver Public Schools
Aurora Public Schools
Littleton Public Schools



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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

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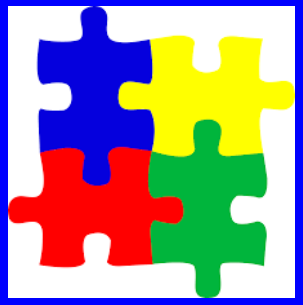
Summary



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

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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!

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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