Concussion Management Skill Development for School-based Professionals
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Objectives
This session will help participants:
1. Understand the underlying dysfunction of concussion or mild traumatic brain injury, including pathophysiology, signs and symptoms, recovery trajectories, and manifestations in school.
2. Perform competent symptom-based assessments.
3. Contribute to school-based management interventions to facilitate recovery.

Concussion/ mTBI 10-15 Years Ago
- Little understanding of mTBI
- Few treating healthcare providers
- Few medical tests or tools
- Minimal research/ funding
- Little public awareness of risks
- No rules to protect kids

Where Are We Today?
- Increased public awareness
- Significant increase in recognition of sport-related mTBI/ concussion
- Expanding our research knowledge
- Improving our understanding of the injury
- Training more healthcare providers, clinics
- Developing more clinical tests and tools
- Implementing rules to protect kids

Concussion as ADHD in 1980
ADHD
- 1980: Most kids were evaluated and treated by specialists – or not at all
- 2013: Most kids are evaluated/ treated by pediatricians and within schools
  + Refer Complex Cases

Concentration
- 2013: Most kids are evaluated and treated by specialists – or not at all
- 2017: Most kids are evaluated and treated by pediatricians and within schools
  + Refer Complex Cases

Concussion as ADHD

Typical ADHD
- Inattention/ Impulsivity/ Overactivity
- “Typical” ADHD
- “Atypical” Recovery (>4 wks)

Primary Care *
- School as a “primary care” setting

Specialty Care **
- School psychologist as a “specialist”
Rewards of Working with Concussion

Typically,
- Not a long-term issue
- Not a lot of testing, functional assessment
- 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

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

“Mild” TBI: Facts & Figures

- Annually, more than one (3-5?) million children sustain a TBI; 80-90% “mild”
- ED: Ages 0-14 - 435,000 average annual visits
  Ages 0-19 - 564,000 (Langlois et al., 2004)

TBI in US Children

Results - Ages 0-14

- 2,700 Deaths
  4.5 per 100,000
- 37,000 Hospitalizations
  63.0 per 100,000

Pediatric Office: est. 125,000 visits

Emergency department: 435,000 visits
731.2 per 100,000

Causes

Motor Vehicle Collisions
- Falls
- Struck By/Against
- Assaults
- Sports & Recreations
Concussion = Traumatic Brain Injury

Brain Motion...

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

Neurometabolic Cascade Following Traumatic Brain Injury

Anatomical Timeline of a Concussion
Defining the Key Factors

C. Risk Factors
A. Injury Characteristics
B. Symptom Assessment

UCLA Brain Injury Research Center

Giza & Hovda, 2001; Hovda, in press
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

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

**Emotional**
- More emotional
- Irritable
- Sad
- Nervous

Assessing Concussion

**Triggers to Concussion Evaluation**

1. Blow/ Force to Head/ Body
   - Blunt force or deceleration/acceleration event
2. Change in Function/ Behavior/ Performance
   - Alteration of consciousness or mental status

Assessing Concussion
What's My Protocol?

Acute Concussion Evaluation (ACE)
Sport Concussion Assessment Tool, 3rd Ed. (SCAT-3)
Acute Concussion Evaluation (ACE)

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

Acute Concussion Evaluation (ACE)

A. Define Injury Characteristics
Cause
Amnesias (retrograde, anterograde)
Loss of Consciousness (LOC), Seizures
Early Signs

Acute Concussion Evaluation (ACE) B. Symptom Checklist

B. Symptoms Checklist: Since the injury, has the person experienced any of these symptoms or signs other than usual today in the past day?

1. Headache
2. Nausea
3. Fatigue
4. Sensitivity to light
5. Sensitivity to sound
6. Balance problems
7. Concentration problems
8. Visual problems
9. Difficulty remembering
10. Difficulty concentrating

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)

C. Risk Factors for Protracted Recovery

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

Acute Concussion Evaluation (ACE)

D. Red Flags for Neurological Deterioration

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

Test-Based Assessment

- Concussion produces 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

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)

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

Acute Concussion Evaluation (ACE)

Red Flags for acute emergency management: Refer to the emergency department if any of the following:
- Insults or taunts someone
- Memory problems
- Seizures or loss of consciousness
- Change in level of consciousness
- Inability to follow instructions
- Change in sleep patterns
- New headache pattern
- Nausea or vomiting
- Change in behavior or personality
- Change in balance or coordination
- One or more of the above

Acute Concussion Evaluation (ACE)
Psychometric Characteristics of the Postconcussion Symptom Inventory in Children and Adolescents

Maggie D. Sady, Christopher G. Vaugn, Gerald A. Giesa

Results

Item Analysis: examined frequency distributions of endorsements between uninjured and mTBI
Factor Analysis: examined factor loadings, residual variances, and Mplus modification indices

Participants
Children/adolescents with concussion (n=663) and without (n=1,375), age 5–18
Most participants (71% of injured and 80% of uninjured) comprised parent–child pairs.

Method
• Rate degree of symptom expression/experience over time-frame "yesterday or today"
• Readability of the scales: 4th grade level; instructions and items can be read aloud to any individual who cannot read.

Initial scales:
- Parent (26 items)
- Adolescent SR13 (26) – 7 point dimensional scale
- Older Child 8–12 SR8 (25)
- Younger Child 5–7 SR5 (13) – 3 point dimensional scale

Results

Item Analysis: examined frequency distributions of endorsements between uninjured and mTBI
Factor Analysis: examined factor loadings, residual variances, and Mplus modification indices

Parent scale: 26→20 items, 4 factors
SR5: 13→5 items, 1 factor

SR13: 26→21 items; 4 factors
SR8: 25→17 items; 4 factors
SR5: 13→5 items; 1 factor

Adjusted Sx Score = Post – Pre-Injury

Monitoring the Executive Functions

- Working Memory
- Emotional Control
- Initiation
- Task Completion
- Plan & Organize
“Dynamic” symptom manifestation reflects symptoms in response to stimulating/ exertional activities.

Ecological Momentary Assessment (EMA) model - involves repeated sampling of subjects’ current behaviors and experiences in real time, in subjects’ natural environments. EMA aims to minimize recall bias, maximize ecological validity, and allow study of microprocesses that influence behavior in real-world contexts.

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)

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
- Role of pre-existing anxiety or mood problems (Yeates et al.)
- Family understanding, coping, and capacity for support (Yeates et al.)
- School understanding, capacity for support
- Medical system understanding, capacity for support

SETTING UP THE TREATMENT PROCESS
Recovery From Concussion: How Long Does it Take?

Persisting Symptom Culprits

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

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 (CISG, AAP, etc.)

Is Rest After Concussion “The Best Medicine?”

- “Practice guidelines recommend an initial period of rest for concussion/mild traumatic brain injury (MTBI)…"
- BUT, compelling evidence that other health conditions can be worsened by inactivity, improved by early mobilization/ exercise…
- Best available evidence suggests that rest exceeding three days is probably more harmful than helpful…
- Gradual resumption of pre-injury activities should begin as soon as tolerated…
- Supervised exercise may benefit patients who are slow to recover…"

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

Silverberg & Iverson (JHTR, 2013)

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

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

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.

Building Self-Confidence (Efficacy) in Recovery

- Child Self-Efficacy significantly correlated with concern for academic learning & performance ($r= -.41; p=.006; n=54$)
- Child Self-Efficacy significantly correlated with overall symptom burden ($r= -.88; p=.001; n=13$)
- Overall sx burden associated with length of recovery (5P) & level of academic problems (Ransom et al.)
- Overall Self-Efficacy improves between Session 1 and Session 2 ($F=9.6; p=.008; n=16$)
Applying Traditional Treatment Modalities

- **Headache**: behavioral medicine, lifestyle education, medication
- **Cognitive problems**: strategy use, environmental accommodations, medication
- **Anxiety/ Mood**: psychotherapy, medication
- **Fatigue/ Sleep issues**: behavioral sleep treatment, (medication)
- **Vestibular dysfunction**: vestibular therapy

Managed Activity
Balancing Activity-Rest
Managing Exertional Effects

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)

What are exertional effects?
When symptoms increase with (or shortly after) significant physical or mental (cognitive, emotional) activity.

Cognitive Intolerance: exertional effects as applied to cognitive activity, relevant to school learning & performance

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

<table>
<thead>
<tr>
<th></th>
<th>Elementary (n=88)</th>
<th>Middle (n=138)</th>
<th>High School (n=206)</th>
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<tr>
<td>Demand</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Cognitive</td>
<td>47.7</td>
<td>52.5</td>
<td>62.5</td>
</tr>
<tr>
<td>Physical</td>
<td>12.5</td>
<td>20.3</td>
<td>16.5</td>
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Gioia, 2010
Assessing Exertional Effects
Children’s Exertional Effects Rating Scale (ChEERS)

Exertion Effects Index
Difference Score = 17 - 5 = 12

ChEERS Validation

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<thead>
<tr>
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<th>Uninjured</th>
<th>Recovered mTBI</th>
<th>Not-Recovered mTBI</th>
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<tr>
<td>Pre-test ChEERS</td>
<td>4.12 (3.78)</td>
<td>2.97 (3.5)</td>
<td>11.08 (7.37)</td>
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<tr>
<td>Post-test ChEERS</td>
<td>4.71 (4.33)</td>
<td>3.16 (3.97)</td>
<td>13.43 (8.69)</td>
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<tr>
<td>EEI</td>
<td>0.59 (2.59)</td>
<td>0.19 (2.15)</td>
<td>2.35 (4.01)*</td>
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Sady et al. (in prep)

Cohen's d = 0.68/0.93

Cognitive Exertion Recovery

<table>
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<th>Mean</th>
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<tr>
<td>Active Aerobic</td>
<td>3.05</td>
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<tr>
<td>Rehabilitation</td>
<td>1.76</td>
</tr>
<tr>
<td>Total Change</td>
<td>1.36</td>
</tr>
</tbody>
</table>

“Active” Aerobic Rehabilitation

- Aerobic Activation (Gagnon et al., 2009; Leddy et al., 2010)
- Structured and monitored subsymptom threshold exercise to facilitate healing.
- Progressive “controlled” exercise below level that produces symptom occurrence or worsening

Benefits of Aerobic Activity

1. Aerobic Activity
   - Increase brain-derived neurotrophic factor (BDNF)
   - Synaptogenesis
   - Increased cardiovascular activity
   - Altered cerebral vascular function and brain perfusion
   - Increased endorphin release
   - Improved brain autoregulation
   - Improve overall fitness level
   - Reduce fatigue/improve energy levels
   - Reduce stress, worry and anxiety
   - Improve mood
   - Improve cognition
   - Improve self-efficacy and performance

Gagnon et al. (2010)
(Today) A Student is Identified with a Mild TBI/Concussion

What Do You Do (Tomorrow)?

Goals of Proper School Return

- **Prepared Systems**: trained medical & school providers
- **Initial medical evaluation** of student & communication of symptom profile to school
- **School Concussion Management Team (CMT) translates** symptom profile into necessary academic adjustments & accommodations
- **Regular monitoring** of symptom and academic progress in school, home
- **CMT (Re)Adjust accommodations** with progress/recovery
- **Coordination / communication between Student / Family, Medical Provider, School, Athletics**

Who is on the Team?

**Concussion Management Team**
- Medical Monitor
- Academic Monitor

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

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).

Symptoms of a Concussion
(what they feel and report)
Physical
• Headache
• Fatigue
• Visual problems (blurry/"double")
• Nausea/vomiting
• Body
• Speech
• 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
Sleep
• Sleeping more/less
• Trouble falling asleep
• Drowsiness

Returning to School

A Student is Identified with a Mild TBI/ Concussion
What Do You Do?
Return to Learn

Life in School

School:
- Kid’s Major “Job” is new learning/ acquring 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

Five key components to building a statewide infrastructure

1. Definition and training of the interdisciplinary school team
2. Professional development of the school and medical communities
3. Identification, assessment, and progress monitoring protocols
4. A flexible set of intervention strategies to accommodate students’ recovery needs
5. Systematized protocols for active communication among medical, school, and family team members

Who are the players?

What do they need to know?

What tools to identify can they use?

What tools to intervene can they use?

What pathways should be followed to communicate, collaborate, and coordinate?
Concussion Management System Planning

Building a Structure of Support in Your School

What Berlin has to say about School Return

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.

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...
   - 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)

Berlin Recommendations

1. All schools encouraged to have concussion policy that includes education on concussion prevention and management for teachers, staff, students, parents; should offer appropriate academic accommodations and support to students

2. Upon diagnosis of concussion, students should be provided with medical RTS letter to facilitate provision/receipt of necessary academic accommodations

3. Students should have early/ongoing medical follow-up to identify symptom targets, monitor recovery and help with return to school.

4. Students may require temporary absence from school after injury

5. Clinicians should assess risk factors/modifiers that may prolong recovery and require more/prolonged/formal academic accommodations. Adolescents may require more academic support during recovery

6. Further research is required to determine the appropriate return to school accommodations for children and adolescents with prolonged symptoms.

What the CDC Has to Say about Return to School

30. 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)

31. 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)

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 INTO SUPPORTS TO OPTIMIZE LEARNING, ADJUST SUPPORTS
Concussion Management Team

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

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

School Care Pathway

<table>
<thead>
<tr>
<th>Event</th>
<th>Action</th>
<th>Tools</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. School notified of concussion</td>
<td>Concussion Mgt Team (CMT) notified</td>
<td>email to school staff</td>
<td>Internal</td>
</tr>
<tr>
<td>2. Concussion Mgt Team Notified</td>
<td>Medical Symptom Monitor (MSM): Obtains healthcare provider's (HCP) evaluation w/ symptom report (revised school based), expects date of return</td>
<td>Review Return to School Letter</td>
<td>Speaks with family regarding student status, daily monitor plan, upcoming communication w/ HCP &amp; family</td>
</tr>
<tr>
<td></td>
<td>Academic Monitor (AM): contacts w/ MSM to create daily plan of action for student/parents</td>
<td>Concussion School Support Plan (SSP) (short specific)</td>
<td>Parent reviewed w/ teaching team, family, student, including progress in recovery</td>
</tr>
<tr>
<td>3. Day of Student Return</td>
<td>Student checks in w/ AM &amp; MSM to assess, make any final plan adjustments</td>
<td>Concussion Symptom Monitoring Log (CML)</td>
<td>Update teaching team if needed, schedule ongoing assessment &amp; feedback</td>
</tr>
<tr>
<td></td>
<td>MSM obtains healthcare provider (HCP) evaluation w/ symptom report (medical-school handoff), expected date of return</td>
<td>Concussion School Support Plan (SSP)</td>
<td>All may ask student, plan discussed</td>
</tr>
<tr>
<td>4. Periodic Monitoring</td>
<td>High symptom: Regular reassessment of symptom and medical progress</td>
<td>Concussion Symptom Monitoring Log (CML)</td>
<td>Medical in return weekly assessment(s)</td>
</tr>
<tr>
<td></td>
<td>Moderate symptom: Academic progress</td>
<td>Concussion School Support Plan (SSP)</td>
<td>Teacher reports weekly</td>
</tr>
<tr>
<td></td>
<td>Low Symptom: Academic &amp; Symptom Monitoring Tool (teacher reports weekly)</td>
<td>Concussion School Support Plan (SSP)</td>
<td>(Student &amp; Monitor adjusts weekly)</td>
</tr>
</tbody>
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Healthcare Provider Input

- Diagnose
- (Re)Define
- Recommend/Suggest

Effect of Concussion on School Learning & Performance

Effect of School Learning & Performance on Concussion Recovery
Defining Academic Outcomes

• Ransom et al. (2015) Pediatrics - Define types of academic challenges in concussed students 5-18 years

• Results: Non-recovered (RC-) group reported higher levels of concern, more school-related problems than RC+ group.
• High school students report higher levels of problems.
• Higher symptom burden associated with greater reported academic problems.
• Significantly greater impairment on cognitive testing in RC- group.
• Summary: empirical evidence of concussion’s impact on learning/ performance reported by students. Identifies academic effects to target interventions

What kinds of school problems are you having SINCE YOUR INJURY?
Ransom et al. (2015)

<table>
<thead>
<tr>
<th>Type of Problem</th>
<th>Elementary (n=42)</th>
<th>Middle (n=72)</th>
<th>High School (n=120)</th>
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<tbody>
<tr>
<td>Headaches interfering</td>
<td>53%</td>
<td>73%</td>
<td>71%</td>
</tr>
<tr>
<td>Can’t pay attention</td>
<td>47%</td>
<td>58%</td>
<td>66%</td>
</tr>
<tr>
<td>Feeling too tired</td>
<td>53%</td>
<td>61%</td>
<td>52%</td>
</tr>
<tr>
<td>Homework taking much longer</td>
<td>35%</td>
<td>48%</td>
<td>63%*</td>
</tr>
<tr>
<td>Difficulty understanding material</td>
<td>29%</td>
<td>46%</td>
<td>54%</td>
</tr>
<tr>
<td>Difficulty studying for tests</td>
<td>18%</td>
<td>36%</td>
<td>53%*</td>
</tr>
<tr>
<td>Difficulty taking Notes</td>
<td>18%</td>
<td>17%</td>
<td>35%*</td>
</tr>
<tr>
<td>Average # reported M± (SD)</td>
<td>2.53 (2.1)</td>
<td>3.37 (1.7)</td>
<td>3.92 (2.1)</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Type of Problem</th>
<th>Elementary (n=88)</th>
<th>Middle (n=138)</th>
<th>High School (n=206)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cognitive</td>
<td>47.7</td>
<td>52.5</td>
<td>62.5</td>
</tr>
<tr>
<td>Physical</td>
<td>12.5</td>
<td>20.3</td>
<td>16.5</td>
</tr>
</tbody>
</table>

Degrees of exertional effects indicate need to manage activity demands during school day (w/ accommodations)

Predicting Academic Outcomes

• ROC modeling of academic outcome
• Predicting “good” vs “challenged” academic outcomes
• Post-concussion symptoms, executive dysfunction

Symptoms (post-concussion, executive functions) should be (re)assessed in planning supports

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
Gradual Return to School  
Six Stages

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
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<tr>
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<tr>
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<td>Return to School, Partial Day (1-3 hours)</td>
</tr>
<tr>
<td>2</td>
<td>Full Day, Maximal Supports (required throughout day)</td>
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<tr>
<td>3</td>
<td>Return to Full Day, Moderate Supports (provided in response to symptoms during day)</td>
</tr>
<tr>
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Gradual Return to School  
Six Stages w Recommended Activity Level

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Gradual Return to School  
Six Stages w Recommended Activity Level & Criteria for Movement

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Symptom Targeted Academic Management Plan (STAMP)

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

Target for Student Support and Treatment

Tools for School Management

Summary

- Concussion care is a team sport. Communication, collaboration, coordination!
- Implement the Berlin/CDC recommendations for Return to School!
- Medical and school expertise must be coordinated and collaborative!
- Return to School policy and pathway is critical!
- Understanding student’s unique symptom profile is critical to support (STAMP).
- Active, ongoing communication between medical, school team, & family is essential for support!
- Regular monitoring of student’s symptoms, adjusting types & intensity of supports is critically important!
**RETURN TO SCHOOL**

**RTS Component**  
Y  N

- **School Policy**  
  √

- **CMT-Personnel & Roles Defined**  
  √

- **Education & Training - School Personnel**  
  √

- **Communication Pathway**  
  Healthcare<-->School<-->Family  
  √

- **Tools & Time**  
  √

- **Monitor & Adjust across Recovery**  
  √

---

**Summary**

- Most children & adolescents recover from concussion within 1-4 weeks
- **NEW TREATMENT APPROACH:**
  - Initial restriction of activity with good nighttime sleep
  - 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

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**Concussion/ mTBI**  
CDC Educational Materials

- **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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**Rewards of Working with Concussion**

Typically,
- Not a long-term issue
- Not a lot of testing, functional assessment
- 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

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**References**


ggiola@childrensnational.org