



PEDIATRIC CONCUSSIONS

EDITED

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INSTITUT DE RECHERCHE



uOttawa

Disclosures

HOME CLINICAL GUIDELINE ▾ RESOURCES ▾ METHODS ▾ ABOUT ▾ WHAT'S NEW?    

LIVING GUIDELINE FOR DIAGNOSING AND MANAGING PEDIATRIC CONCUSSION

CLINICAL
RECOMMENDATIONS
FOR HEALTHCARE
PROFESSIONALS



SHARING AND USING
THE GUIDELINE



PARENT, TEACHER,
AND COACH
RESOURCES



DOWNLOAD
GUIDELINE (English)



<https://braininjuryguidelines.org/pediatricconcussion/>

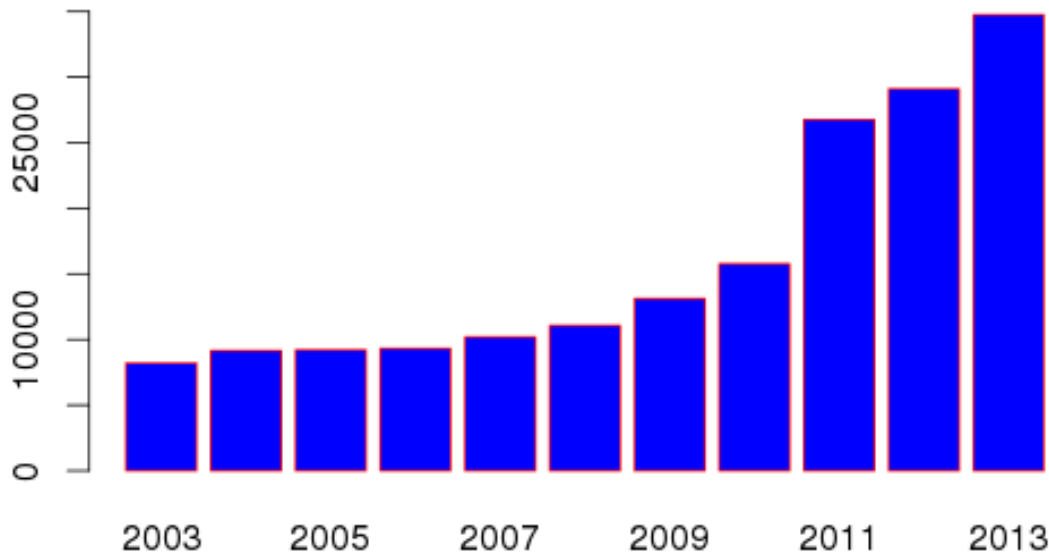
Learning Objectives

- Recognizing and understanding what is a concussion, persistent post-concussion symptoms and second impact syndrome
- When will my child be better? Exploring recovery trajectories and factors that may predict which children will have longer symptom duration
- When can my child return to play? Examining the association between early physical activity and prolonged recovery risk
- Guidelines and strategies on how to return to learn, play and LIFE

The Concussion Epidemic

CDC calls concussion a “Silent epidemic”

ED and office visits in Ontario 2003–13



Zemek et al., 2016 Journal of Pediatrics

6 things you should know about concussions

Concussion is a brain injury.

1

A child's brain is still developing and requires a unique approach to care.

2

You can have a concussion without losing consciousness.

3

4

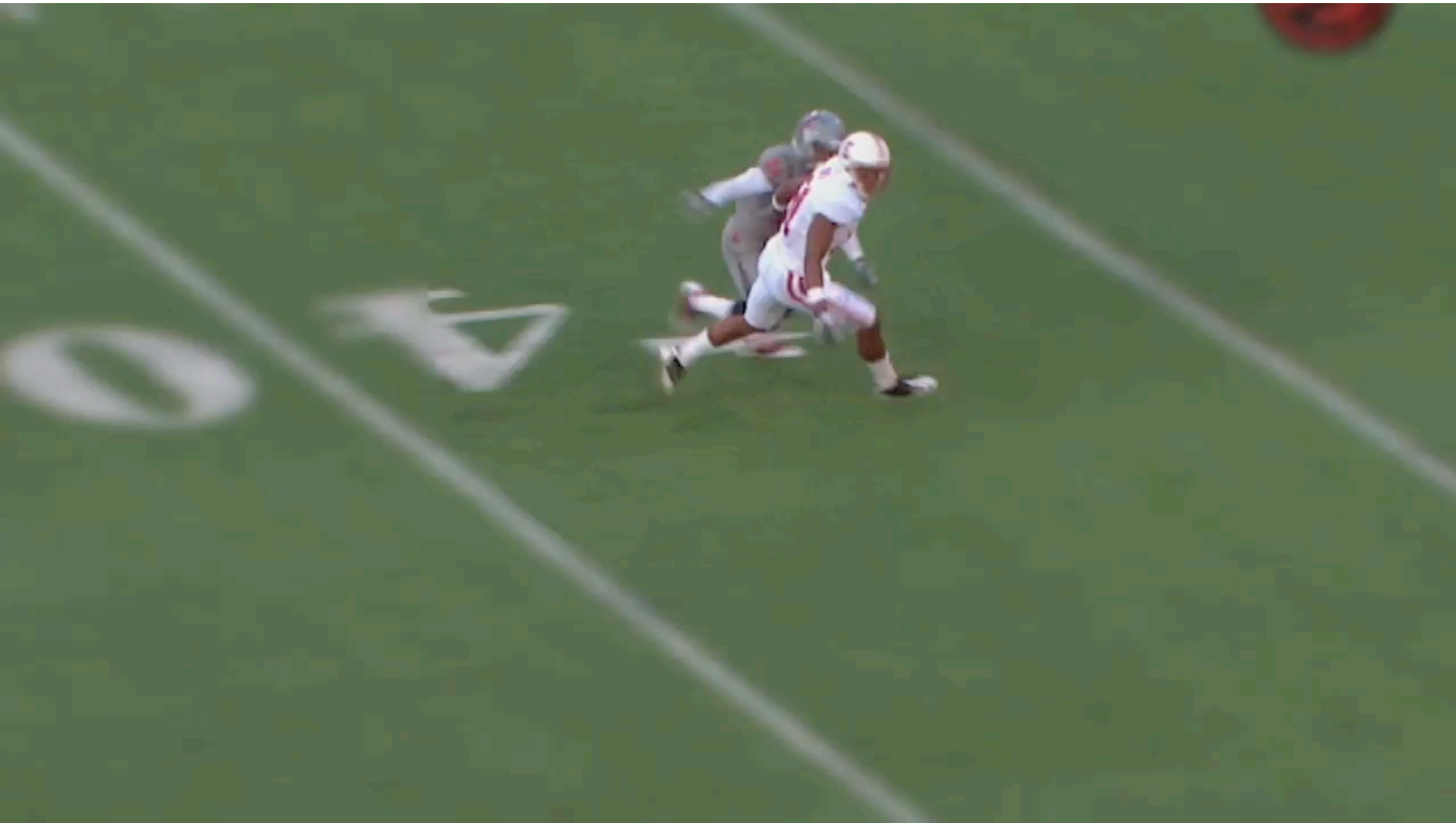
Concussion symptoms are more than just physical. They can be mental, emotional or behavioural.

5

Most concussions resolve quickly, however 30% of people have symptoms that last longer than 4 weeks.

6

It's essential for optimal recovery to rest your mind and body. (1-2 days)



https://int.nyt.com/data/videotape/finished/2017/01/1483807075/pre-comp-1_11-1280w.mp4

Summary of neurophysiological changes

- Injury to the brain tissues
- Biochemical and electrical changes in the brain and brain cell
- Changes in how the brain makes and uses energy
- Energy crisis
- Changes in blood flow and the transport of energy and oxygen
 - Difficulty to autoregulate blood supply
- Inflammation
- Injury to your neck, vestibular system or other nerves that can cause symptoms

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Recognizing a concussion

RED FLAGS

- Neck pain or tenderness
- Double vision
- Weakness or tingling/
burning in arms or legs
- Severe or increasing
headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious
state
- Vomiting
- Increasingly restless,
agitated or combative

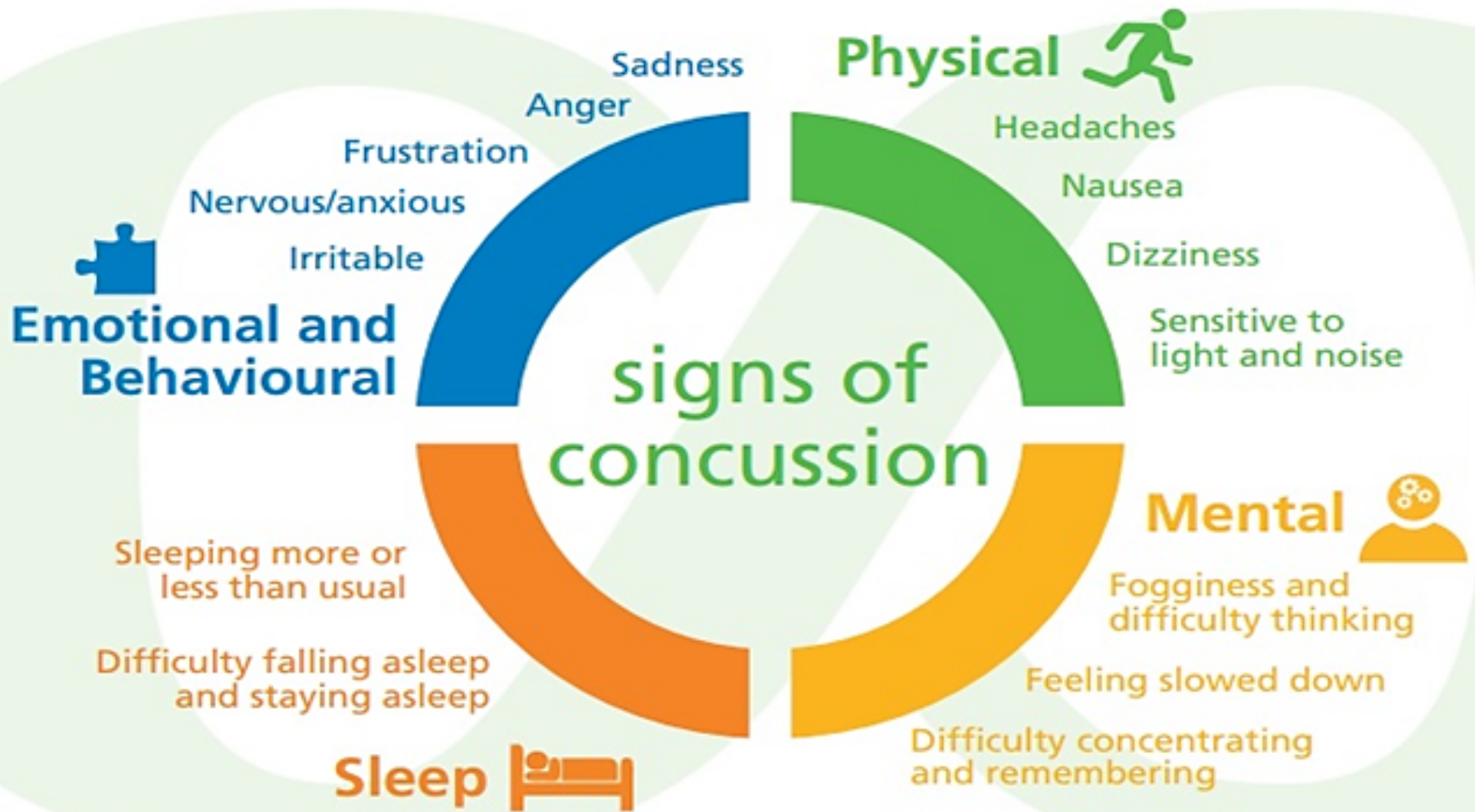
Observational Signs

- Lying motionless
- Slow down at getting up
- Disoriented or confusion, difficulty answering appropriately to questions
- Blank or vacant look
- Balance, motor incoordination, stumbles

If you're concussed

- Reaction time is increased
 - Processing time is increased
 - Memory impaired
 - More prone for mistakes
-
- You are at risk for another concussion....

Signs and Symptoms of Concussion



Impact to the head or
cause the brain to
slide the skull

STOP

**REMOVE FROM ACTIVITY IMMEDIATELY
AND ASSESS FOR RED FLAGS**

RED FLAGS

- ☒ Neck pain or tenderness
- ☒ Double vision
- ☒ Seizure or convulsion

- ☒ Weakness or tingling/burning
in arms or legs
- ☒ Severe or increasing headache
- ☒ Loss of consciousness

- ☒ Deteriorating conscious state
- ☒ Vomiting
- ☒ Increasingly restless, agitated,
or combative

IF YES TO ANY OF THE ABOVE:
Call an ambulance or seek
immediate medical care

IF NO TO ALL RED FLAGS:
Assess for signs and
symptoms of concussion

FOLLOW MEDICAL ADVICE, AND:

Follow initial recovery protocol of
physical and cognitive rest
(2 days max), including:

- ☐ Limited screen time
(computers, TV, smartphones)
- ☐ Limited cognitive activity
(reading, schoolwork)
- ☐ Limited physical activity

Note: Sleep is important! Do not wake
during the night if sleeping comfortably

CONCUSSION SIGNS AND SYMPTOMS

- | | |
|--------------------------------------------------|---------------------------------------------------|
| <input type="checkbox"/> Headache | <input type="checkbox"/> Irritability |
| <input type="checkbox"/> Dizziness | <input type="checkbox"/> Fogginess |
| <input type="checkbox"/> Nausea | <input type="checkbox"/> Fatigue |
| <input type="checkbox"/> Blurred vision | <input type="checkbox"/> Difficulty concentrating |
| <input type="checkbox"/> Light/Sound sensitivity | <input type="checkbox"/> Poor memory |
| <input type="checkbox"/> Imbalance | <input type="checkbox"/> Neck pain |
| <input type="checkbox"/> Ringing in the ears | <input type="checkbox"/> Sadness |
| <input type="checkbox"/> Seeing "stars" | <input type="checkbox"/> Confusion |

IF YES TO ANY OF THE ABOVE:
SEEK MEDICAL ATTENTION from a
licensed medical professional
(physician/nurse practitioner *)
*If applicable in your area

IF NO SYMPTOMS:
Limit physical activity and watch for
concussion signs and symptoms for
up to 48 hours

**IF SYMPTOMS
OBSERVED WITHIN
48 HOURS**

**IF NO SYMPTOMS
OBSERVED AFTER
48 HOURS**

AFTER 48 HOURS:

Follow Return to Activity protocol
Follow Return to School protocol
Follow Return to Sport protocol

MENTAL HEALTH

During the course of recovery from
a concussion, seek medical
attention for mental health
challenges as needed, such as:

- | | |
|-----------------------------------------|-------------------------------------------------|
| <input type="checkbox"/> More emotional | <input type="checkbox"/> Nervousness or anxiety |
| <input type="checkbox"/> Irritability | <input type="checkbox"/> Trouble falling asleep |
| <input type="checkbox"/> Sadness | <input type="checkbox"/> Depression |

**RESUME NORMAL
ACTIVITY**

CONCUSSION RECOGNITION TOOL 5 ©

To help identify concussion in children, adolescents and adults



FIFA®

Supported by



RECOGNISE & REMOVE

Head impacts can be associated with serious and potentially fatal brain injuries. The Concussion Recognition Tool 5 (CRT5) is to be used for the identification of suspected concussion. It is not designed to diagnose concussion.

STEP 1: RED FLAGS – CALL AN AMBULANCE

If there is concern after an injury including whether ANY of the following signs are observed or complaints are reported then the player should be safely and immediately removed from play/game/activity. If no licensed healthcare professional is available, call an ambulance for urgent medical assessment:

- Neck pain or tenderness
- Double vision
- Weakness or tingling/ burning in arms or legs
- Severe or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless, agitated or combative

Remember:

- In all cases, the basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Assessment for a spinal cord injury is critical.
- Do not attempt to move the player (other than required for airway support) unless trained to do so.
- Do not remove a helmet or any other equipment unless trained to do so safely.

If there are no Red Flags, identification of possible concussion should proceed to the following steps:

STEP 2: OBSERVABLE SIGNS

Visual clues that suggest possible concussion include:

- Lying motionless on the playing surface
- Slow to get up after a direct or indirect hit to the head
- Disorientation or confusion, or an inability to respond appropriately to questions
- Blank or vacant look
- Balance, gait difficulties, motor incoordination, stumbling, slow laboured movements
- Facial injury after head trauma

© Concussion in Sport Group 2017

STEP 3: SYMPTOMS

- Headache
- "Pressure in head"
- Balance problems
- Nausea or vomiting
- Drowsiness
- Dizziness
- Blurred vision
- Sensitivity to light
- Sensitivity to noise
- Fatigue or low energy
- "Don't feel right"
- More emotional
- More Irritable
- Sadness
- Nervous or anxious
- Neck Pain
- Difficulty concentrating
- Difficulty remembering
- Feeling slowed down
- Feeling like "in a fog"

STEP 4: MEMORY ASSESSMENT

(IN ATHLETES OLDER THAN 12 YEARS)

Failure to answer any of these questions (modified appropriately for each sport) correctly may suggest a concussion:

- "What venue are we at today?"
- "Which half is it now?"
- "Who scored last in this game?"
- "What team did you play last week/game?"
- "Did your team win the last game?"

Athletes with suspected concussion should:

- Not be left alone initially (at least for the first 1-2 hours).
- Not drink alcohol.
- Not use recreational/ prescription drugs.
- Not be sent home by themselves. They need to be with a responsible adult.
- Not drive a motor vehicle until cleared to do so by a healthcare professional.

The CRT5 may be freely copied in its current form for distribution to individuals, teams, groups and organisations. Any revision and any reproduction in a digital form requires approval by the Concussion in Sport Group. It should not be altered in any way, rebranded or sold for commercial gain.

ANY ATHLETE WITH A SUSPECTED CONCUSSION SHOULD BE IMMEDIATELY REMOVED FROM PRACTICE OR PLAY AND SHOULD NOT RETURN TO ACTIVITY UNTIL ASSESSED MEDICALLY, EVEN IF THE SYMPTOMS RESOLVE

© Concussion in Sport Group 2017

Advice #1: Coaches, Teachers, Parents, Youth

- If there is suspicion of a concussion **DO NOT** return to play!

‘If in doubt, sit them out.’



When will my child be better?

Goal: Investigate the Natural Recovery of Concussion

1 Stollery Children's Hospital
2 Alberta Children's Hospital



9 IWK Health Sciences Centre

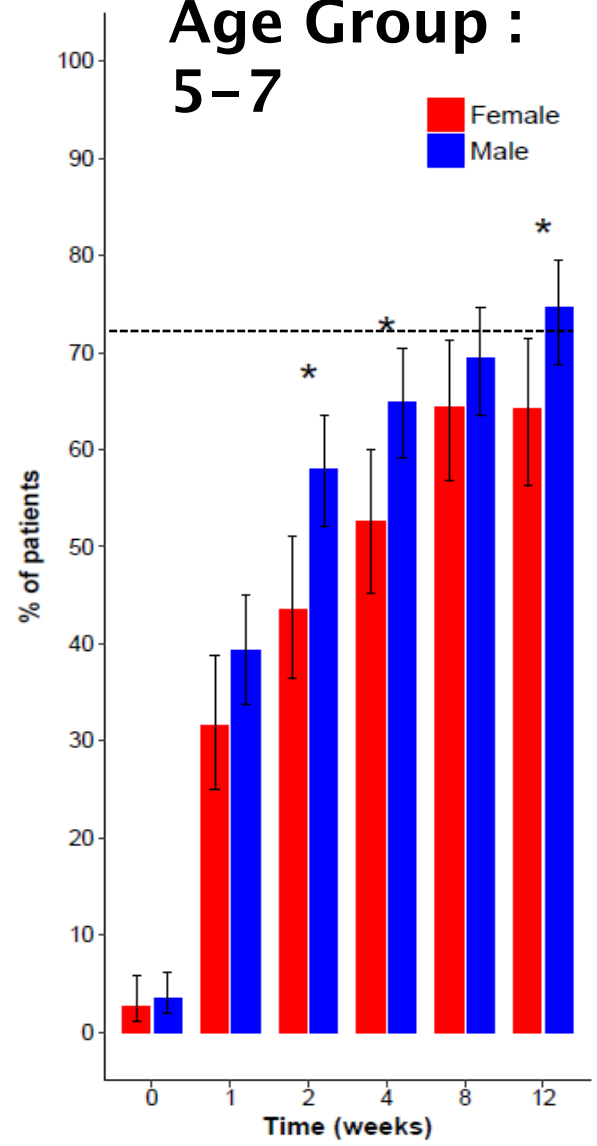
3 Children's Hospital of Winnipeg

4 Children's Hospital of Eastern Ontario
5 The Hospital for Sick Children
6 Children's Hospital of Western Ontario

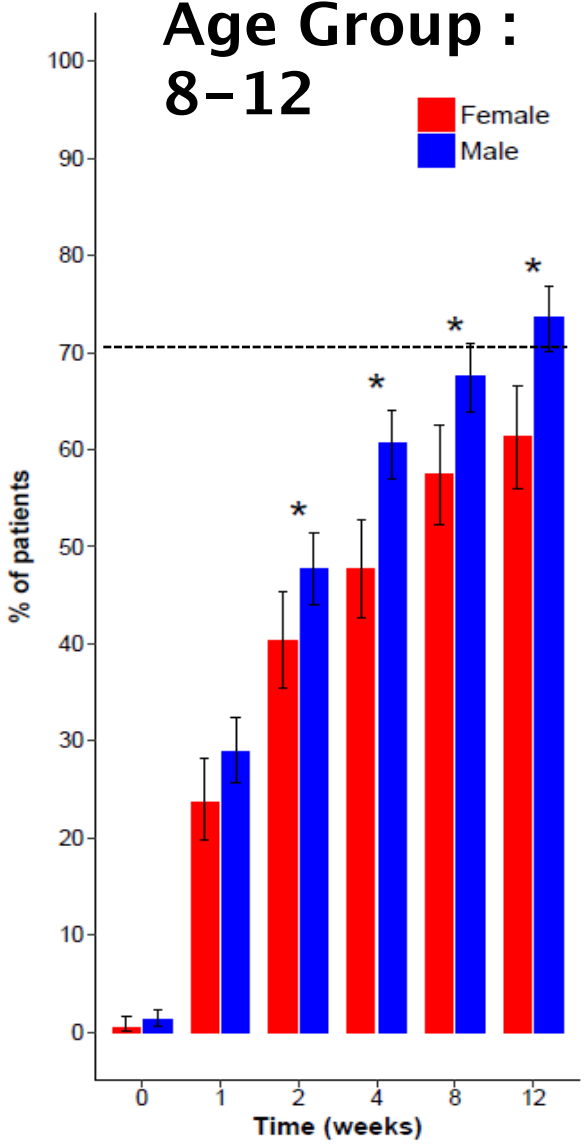
7 CHU Sainte-Justine
8 Montreal Children's Hospital

Proportion Recovered Participants

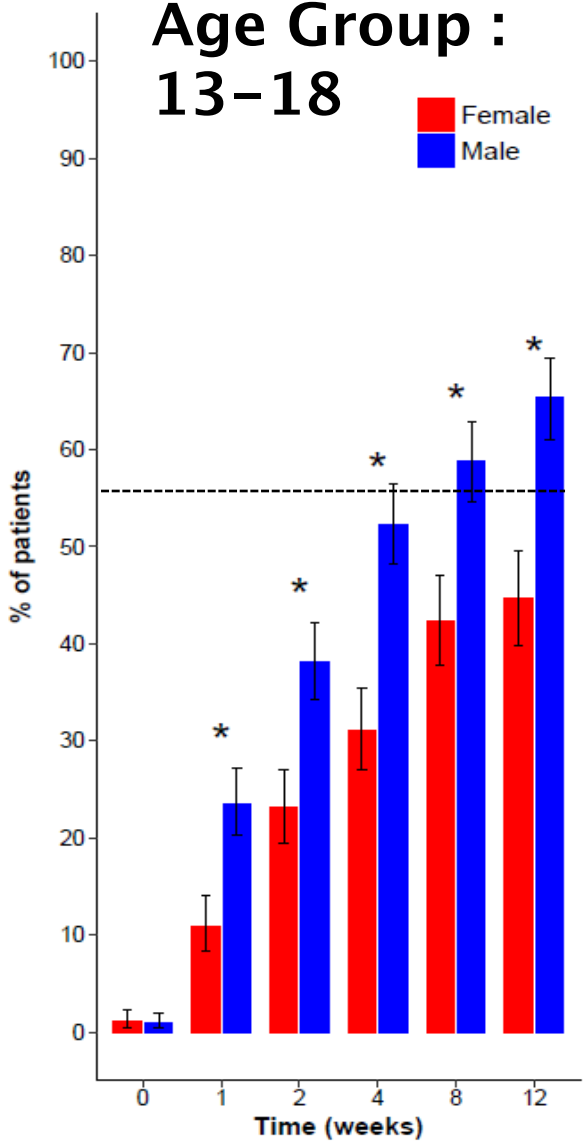
Age Group :
5-7



Age Group :
8-12

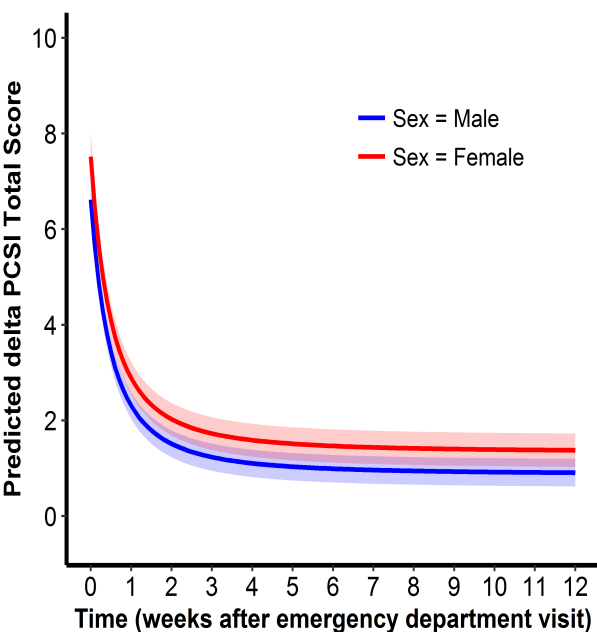


Age Group :
13-18

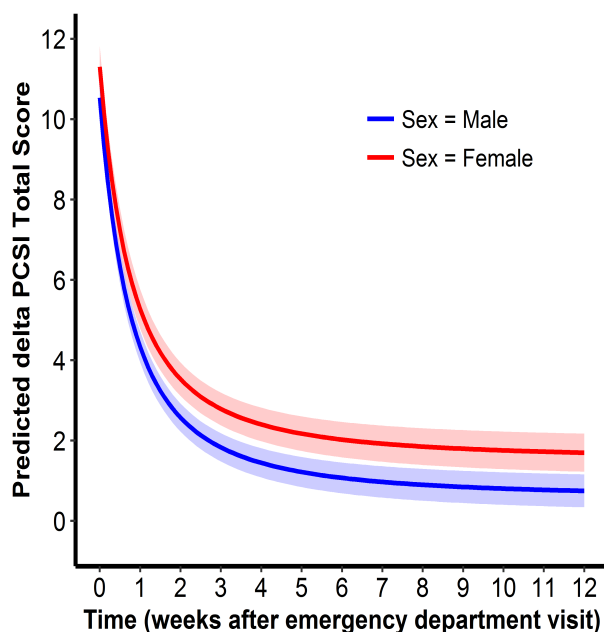


Recovery Trajectory

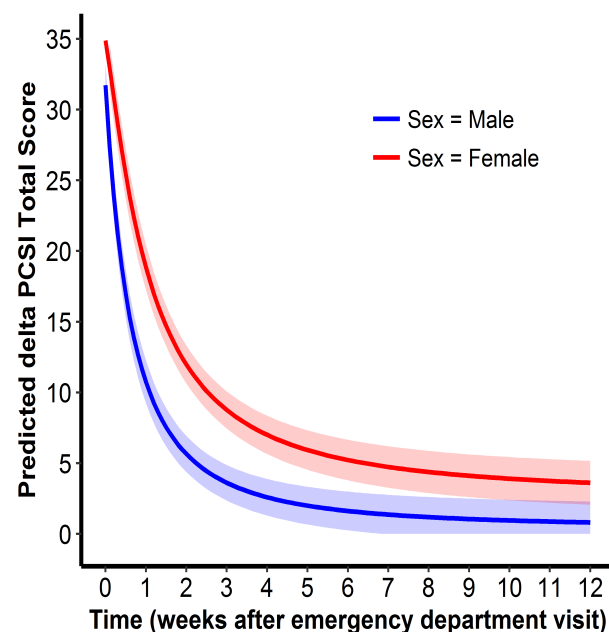
Age Group: 5–7



Age Group: 8–12



Age Group: 13–18



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When will my child be better?

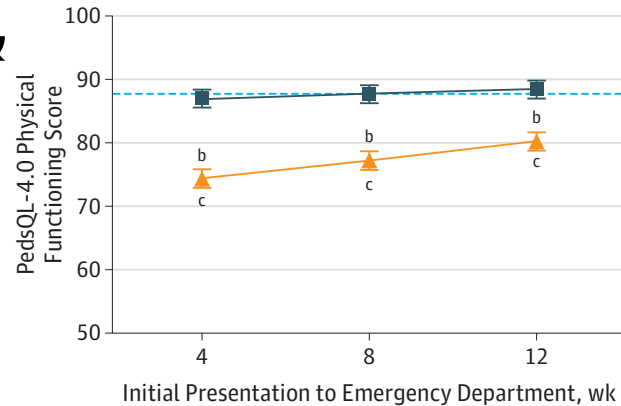
Persistent Post-Concussive Symptoms (PPCS)

Sun	Mon	Tue	Wed	Thu	Fri	Sat
 1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	1	2	3	4	5
PPCS						

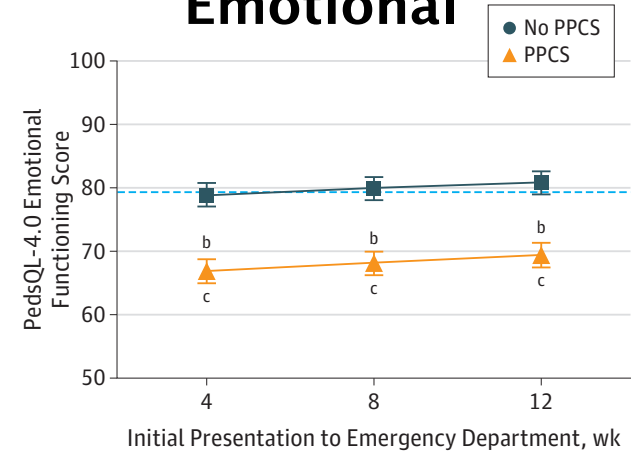
Impact of Persistent Symptoms

- Missed school & activities
- Impaired academic performance
- Depressed mood
- Lower quality of life

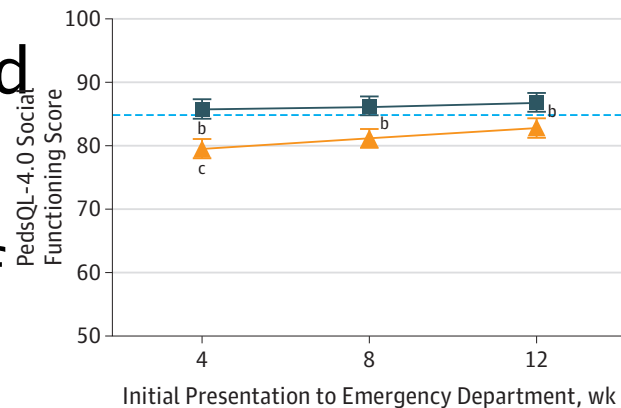
Physical



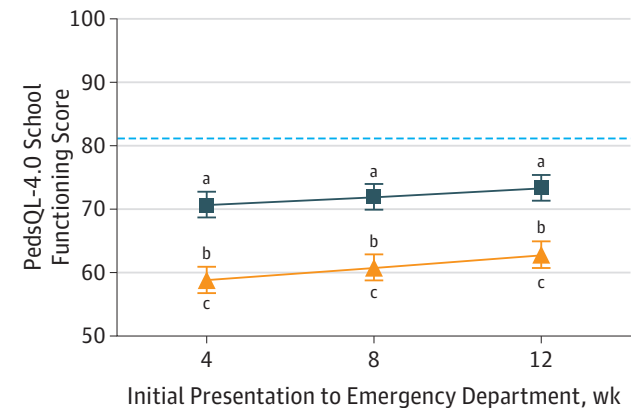
Emotional



Social



Academic



Advice #2 About Prolonged symptoms and management

Initial Assessment



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graph TD; A[Initial Assessment] --> B[1) 1-4 weeks following acute injury re-assessment<br/>2) Receive Post-injury education and guidance<br/>3) > 4 weeks still symptomatic the child need to get referred to a specialized therapy or interdisciplinary concussion team];
```

- 1) 1–4 weeks following acute injury re-assessment
- 2) Receive Post-injury education and guidance
- 3) > 4 weeks still symptomatic the child need to get referred to a specialized therapy or interdisciplinary concussion team

<https://braininjuryguidelines.org/pediatricconcussion/>

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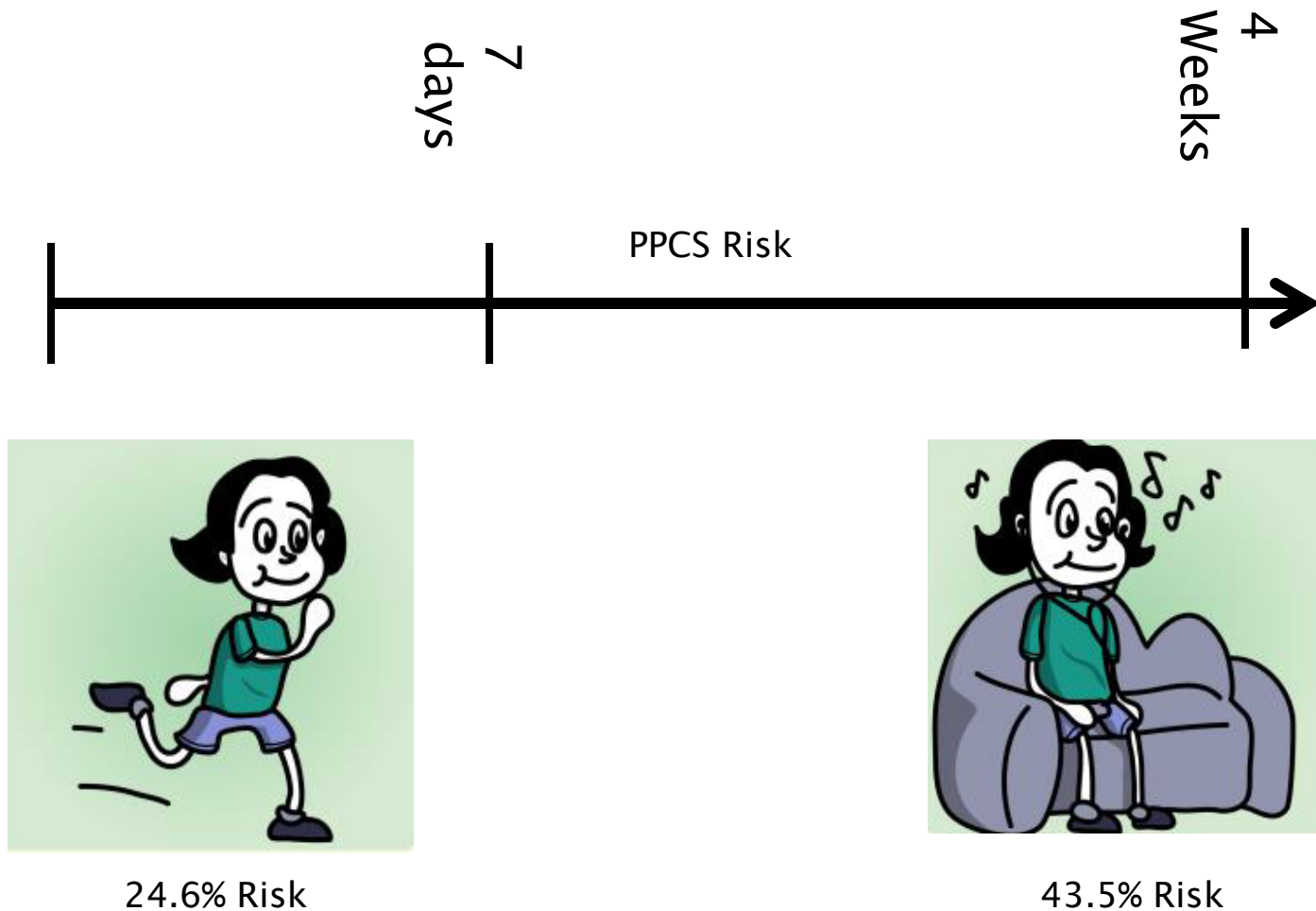


When will my child be able to return to sport?

Goal: Investigate the association between participation in physical activity and PPCS

Grool et al., 2016, JAMA

Early Physical Activity



Physical activity and your brain

- Improves mood
- Improves sleep
- Improves cognition (thinking)
- Improves academic performance
- Increases cerebral blood flow
- Increase neurotrophic factors
 - Neuroplasticity
 - Neurogenesis
 - Angiogenesis
- Reduces inflammation

Return to Learn and Play Guidelines (ONF)

- Rest for the first 1–2 days after a concussion
- Afterwards child/adolescent can start physical and thinking activities (at the same time) as long as they **do not**:
 - Make symptom worse
 - Bring on new symptoms
 - Increase the risk of a fall or hit to the head or body that could cause another concussion
 - Increase the risk for another concussion
- Child/Adolescent must return to school full-time before completely returning to full-contact sport, high-risk activities or work.

ONF Guideline Return to Learn

Steps	Activity	Example
1	Activities at home that do not make the child/adolescent feel worse	Reading, texting, screen time and other activities that do not make symptoms worse Start at 5–15 minutes at a time
2	School activities	Homework, reading or other activities outside of the classroom
3	Return-to-school part-time	Getting back to school for a few hours or half days
4	Return-to-school full-time	Gradual return to full days at school

<https://braininjuryguidelines.org/pediatricconcussion/wp-content/uploads/2019/08/Living-Guideline-Resource-Parent-09.2019.pdf>

<https://braininjuryguidelines.org/pediatricconcussion/wp-content/uploads/2019/07/Tool-12.1-Concussion-Implications-and-Interventions-for-the-Classroom.pdf>

Cattonline: Guideline Return to Learn

AT HOME			AT SCHOOL			
STAGE 1:	STAGE 2:		STAGE 3:	STAGE 4:	STAGE 5:	STAGE 6:
Physical & cognitive rest <ul style="list-style-type: none"> Basic board games, crafts, talk on phone Activities that do not increase heart rate or break a sweat Limit/Avoid: <ul style="list-style-type: none"> Computer, TV, texting, video games, reading No: <ul style="list-style-type: none"> School work Sports Work Driving until cleared by a health care professional 	Start with light cognitive activity: Gradually increase cognitive activity up to 30 min. Take frequent breaks. Prior activities plus: <ul style="list-style-type: none"> Reading, TV, drawing Limited peer contact and social networking Contact school to create <i>Return to School</i> plan.	When light cognitive activity is tolerated: Introduce school work. Prior activities plus: <ul style="list-style-type: none"> School work as per <i>Return to School</i> plan Communicate with school on student's progression.	Back to school part-time Part-time school with maximum accommodations. Prior activities plus: <ul style="list-style-type: none"> School work at school as per <i>Return to School</i> plan No: <ul style="list-style-type: none"> P.E., physical activity at lunch/recess, homework, testing, sports, assemblies, field trips Communicate with school on student's progression.	Part-time school Increase school time with moderate accommodations. Prior activities plus: <ul style="list-style-type: none"> Increase time at school Decrease accommodations Homework – up to 30 min./day Classroom testing with adaptations No: <ul style="list-style-type: none"> P.E., physical activity at lunch/recess, sports, standardized testing Communicate with school on student's progression.	Full-time school Full days at school, minimal accommodations. Prior activities plus: <ul style="list-style-type: none"> Start to eliminate accommodations Increase homework to 60 min./day Limit routine testing to one test per day with adaptations No: <ul style="list-style-type: none"> P.E., physical activity at lunch/recess, sports, standardized testing 	Full-time school Full days at school, no learning accommodations. <ul style="list-style-type: none"> Attend all classes All homework Full extracurricular involvement All testing No: <ul style="list-style-type: none"> full participation in P.E. or sports until <i>Return to Sport</i> protocol completed and written medical clearance provided
	No: <ul style="list-style-type: none"> School attendance Sports Work 					
	Gradually add cognitive activity including school work at home		School work only at school	Increase school work, introduce homework, decrease learning accommodations	Work up to full days at school, minimal learning accommodations	Full academic load
Rest						
When symptoms start to improve OR after resting for 2 days max, BEGIN STAGE 2	Tolerates 30 min. of cognitive activity, introduce school work at home	Tolerates 60 min. of school work in two 30 min. intervals, BEGIN STAGE 3	Tolerates 120 min. of cognitive activity in 30–45 min. intervals, BEGIN STAGE 4	Tolerates 240 min. of cognitive activity in 45–60 min. intervals, BEGIN STAGE 5	Tolerates school full-time with no learning accommodations BEGIN STAGE 6	<i>Return to School</i> protocol completed; focus on RETURN TO SPORT

ONF Guideline Return to Play

Steps	Activity	Example
1	Physical and cognitive activities that do not make the child/adolescent feel worse	Walking at home or in school
2	Light physical activity	Jogging or stationary cycling at slow to medium speed. No weight training.
3	Sport-specific exercise	Running or skating drills. No drills with risk of head injury.
4	Non-contact activities	Practice without body contact. Gym class activities without risk of head injury.
5	Full-contact activities	Full activities/sports practices after doing full-time school and getting a medical doctor's note that states the child/adolescent is cleared to return to full-contact sport or high-risk activity.
6	Return to all activities and sports	Normal full-contact game play.

Cattonline: Guideline Return to Play

STAGE 1:	STAGE 2:	STAGE 3:	STAGE 4:	STAGE 5:	STAGE 6:
No sporting activity Physical and cognitive rest until symptoms start to improve OR after resting for 2 days max.	Light aerobic exercise Walking, swimming, stationary cycling. No resistance training. The pace of these activities should be at the point where you are still able to have a conversation.	Sport-specific exercise Skating drills (ice hockey), running drills (soccer). No head-impact activities.	Non-contact drills Progress to complex training drills (e.g. passing drills). May start resistance training.	Full-contact practice Following medical clearance participate in normal training activities.	Back in the game Normal game play
Recovery	Increase heart rate	Add movement	Exercise, coordination, cognitive load	Restore confidence; assess functional skills	
Symptoms improve or 2 days rest max? Yes: Move to stage 2 No: Continue resting Time & Date completed:	No new or worsening symptoms for 24 hours? Yes: Move to stage 3 No: Return to stage 1 Time & Date completed:	No new or worsening symptoms for 24 hours? Yes: Move to stage 4 No: Return to stage 2 Time & Date completed:	Symptom-free for 24 hours? Yes: Move to stage 5 No: Return to stage 3 Time & Date completed:	Symptom-free for 24 hours? Yes: Move to stage 6 No: Return to stage 4 Time & Date completed:	Note: Premature return to contact sports (full practice and game play) may cause a significant setback in recovery.

If new or worsening symptoms are experienced at any stage, go back to the previous stage for at least 24 hours. You may need to move back a stage more than once during the recovery process.

Medical clearance required before moving to stage 5

Medical clearance to return to full-contact activities and sport/game play

- Returned to all school activities including writing exams without any accommodation related to concussion or post-concussion symptom.
- Normal neurological and cervical spine examination
- Asymptomatic at rest
- Tolerates physical activities and non-contact activities without any symptoms
- No longer taking any prescribed drugs for managing concussion symptoms

Strategies to help with recovery

- Energy conservation
- Sleep
- Nutrition
- Relaxation

1 **PRIORITIZE**

What is important?

Decide: What is important? What are you able to do based on how you currently feel?

Break daily activities into:

- Urgent: must be done today.
- Important: must be done in next few days.
- For later: must be done this week or month.
- Don't need to/can't do: can it wait until you are feeling better?
- Help needed: can someone do it for you?

2 **PLAN**

What are you going to do?

- Organize what you need to do.
- Do tasks that use more energy at times in the day when you feel best.
- Make rest breaks part of your routine.
- Planning saves mental energy and helps you avoid trying to remember what to do and when to do it during the day.

3 **PACE**

How are you going to do it?

- Take breaks if you don't feel well.
- After a concussion, your brain is less able to do tasks that were once automatic (e.g. tasks you have a lot of practice doing). It may take more time to complete tasks as you recover.
- Complete the task over stages (you may not be able to finish everything all at once).
- Plan tasks throughout the day so you aren't doing too much at one time.

4 **POSITION**

Where are you going to do it?

- Noisy, busy and distracting environments make it hard to concentrate and will use up more energy.
- Think about your environment and how you stand/sit in it.
- Your environment can make a difference in how you feel.

Sleep tips to recover from concussion



© 2015 Holland Bloorview Kids Rehabilitation Hospital

Nutrition

- Eat a balanced diet
- Have regular meals and snacks
- Include healthy carbohydrates in diet
- Drink water regularly



Relaxation

- Find relaxation that work for you
 - Deep breathing
 - Visualization
 - Meditation
- Practice relaxing everyday
- Learn the stressors that make you feel worse

Reminder about a concussion

- Return to physical activity \neq full return to sports
- What to do in case of **development of new concussion-like** symptoms or sustains a new concussion
- **Communication**/conversation with your child
- **Maintain HEALTHY HABITS**
- **Time and Patience**

Conclusion Remarks

A concussions is a brain injury.

Parents, coaches, teachers, and peers:

- Recognize the signs (peers tell an adult)
- Remove from play (if playing a sport)
- Refer to medical providers
- Return safely to school and sports

Be attentive and patient with the child



Ontario Neurotrauma Foundation
Fondation ontarienne de neurotraumatologie



Tools

Guidelines :

<https://braininjuryguidelines.org/pediatricconcussion/>

Parachute concussion App:

<http://www.parachutecanada.org/injury-topics/item/2587>

Concussion recognition tool 5:

<https://braininjuryguidelines.org/pediatricconcussion/wp-content/uploads/2019/08/Tool-1.2-Concussion-Recognition-Tool-5.pdf>

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