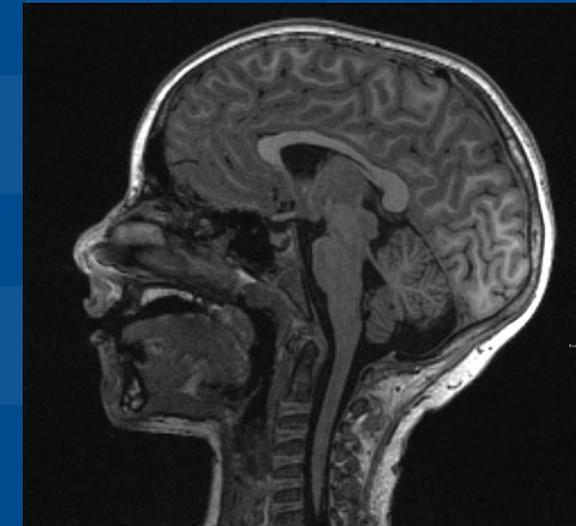


Concussion Update 2020

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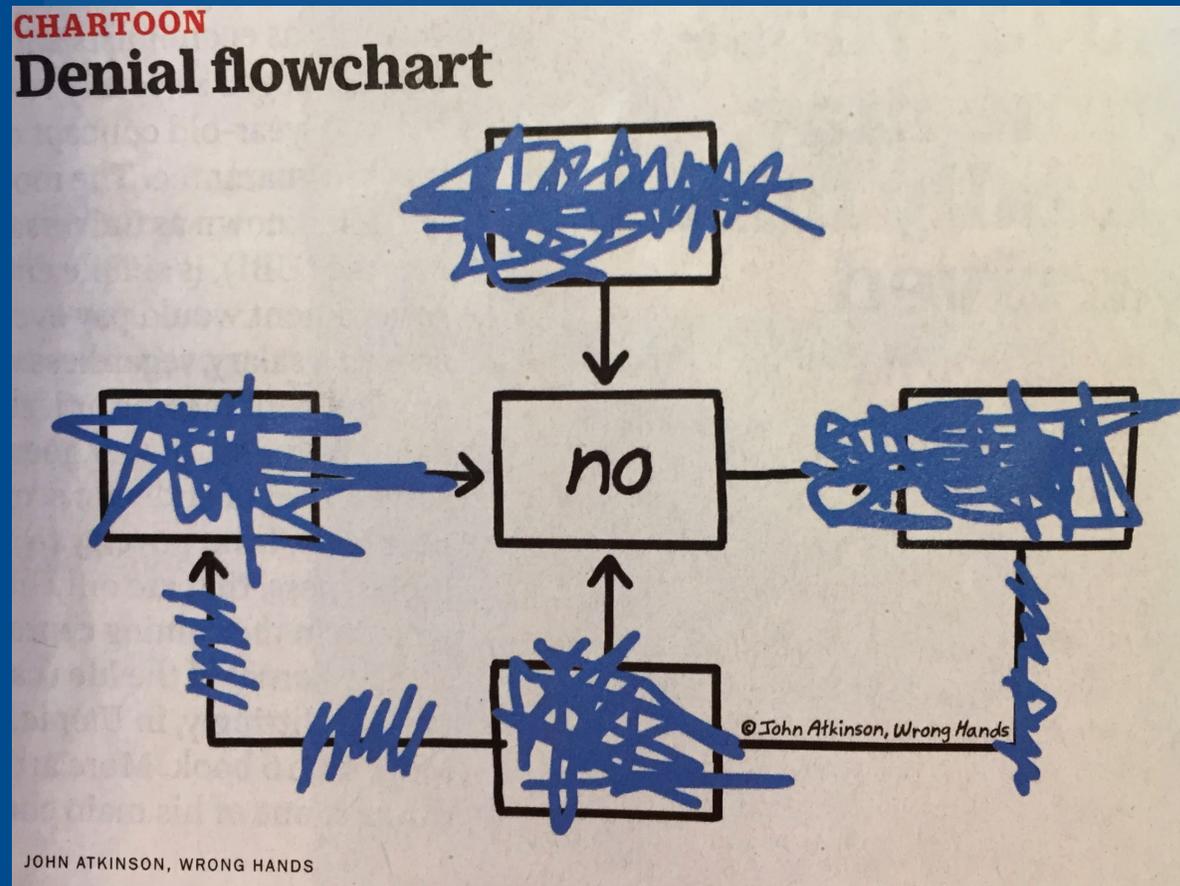
The University of Idaho, WWAMI Medical Education Program is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

The University of Idaho, WWAMI Medical Education Program designates this live activity for a maximum of 1.0 AMA PRA Category 1 Credit(s)[™]. Physicians should claim only the credit commensurate with the extent of their participation in the activity.



Disclosures

- I have no disclosures or conflicts or interest to report.



Objectives

- **After participation in this educational activity, attendees will be able to**
 - **-discuss concussion identification and assessment**
 - **-describe best practices in returning to learn and play after concussion**
 - **-identify treatments and therapies utilized in concussion management and supported by medical research**



Resources

American Medical Society for Sports Medicine position statement on concussion in sport

Kimberly G Harmon,¹ James R Clugston,² Katherine Dec,³ Brian Hainline,⁴
Stanley Herring,⁵ Shawn F Kane,⁶ Anthony P Kontos,⁷ John J Leddy,⁸ Michael McCrea,⁹
Sourav K Poddar,¹⁰ Margot Putukian,^{11,12} Julie C Wilson,¹³ William O Roberts¹⁴

Harmon KG, Clugston JR, Dec K, et al. American Medical Society for Sports Medicine position statement on concussion in sport. *Br J Sports Med.* 2019;53(4):213-225.

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 Duhalme, 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

Lumba-Brown A, Yeates KO, Sarmiento K, et al. Centers for Disease Control and Prevention Guideline on the Diagnosis and Management of Mild Traumatic Brain Injury Among Children. *JAMA Pediatr.* 2018;172(11):e182853

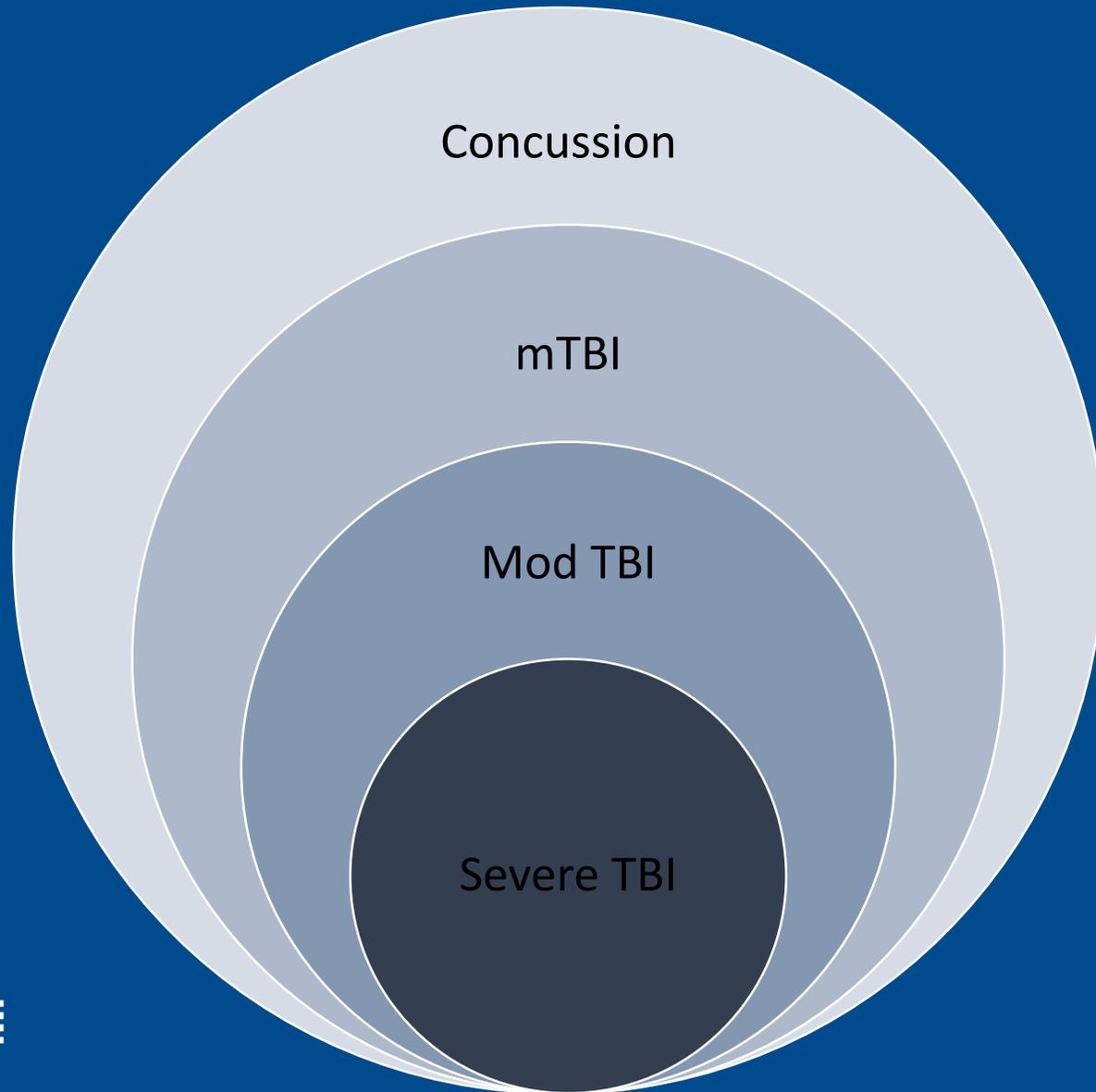


Concussion Definition

- Complex pathophysiological process affecting the brain caused by direct or indirect biomechanical forces
- Typically results in the rapid onset of short-lived neurological impairment that **resolves spontaneously**
- May or may not involve LOC
- The acute clinical symptoms largely reflect a functional disturbance rather than a structural injury
- Grossly normal neuroimaging studies



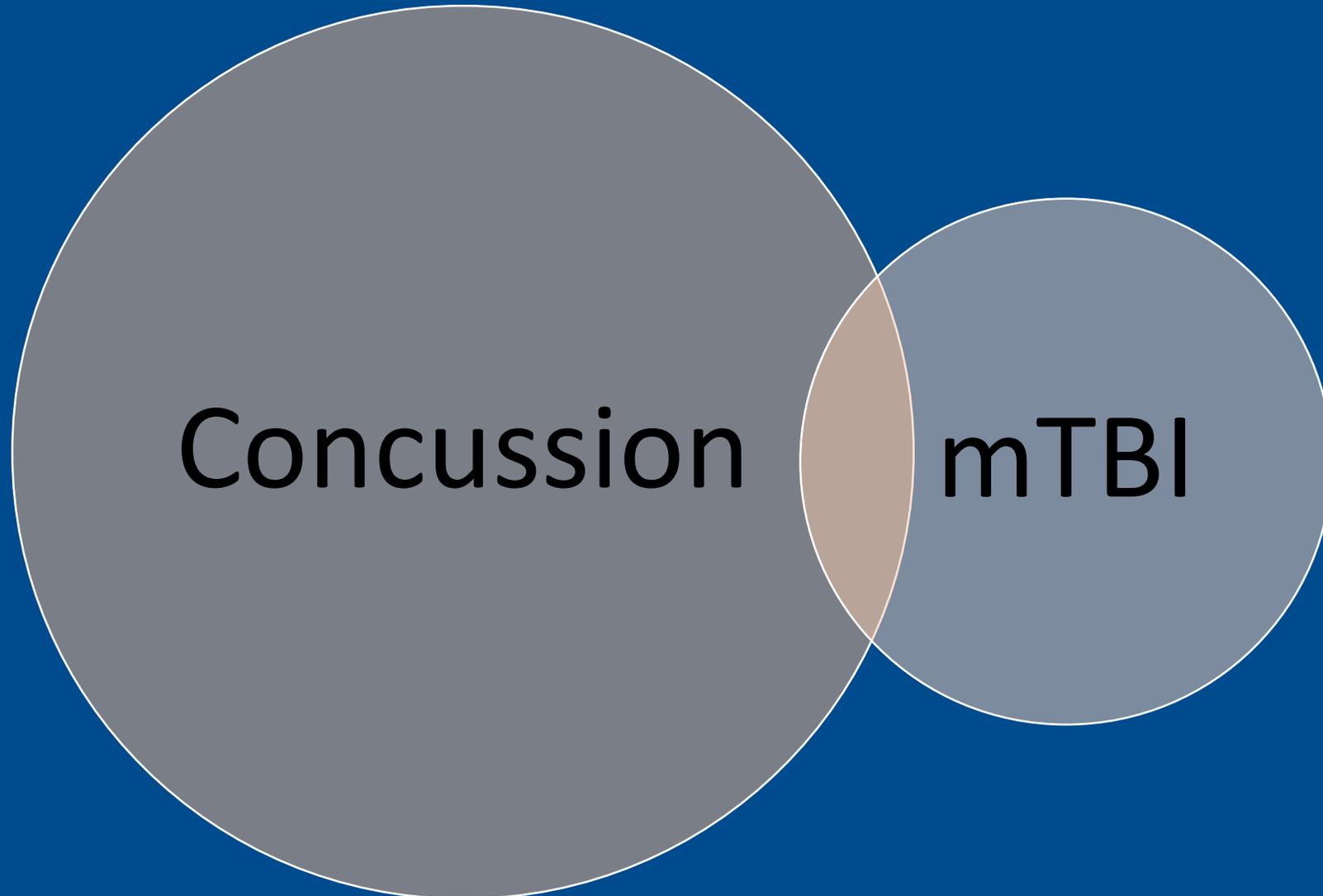
TBI – Traumatic Brain Injury



- **Globally, 10 million hospitalizations/deaths annually** (Langlois, J Head Trauma Rehab, 2006)
- **Majority of TBI's – probably 75% - are mild, which encompasses concussion** (<http://www.cdc.gov/traumaticbraininjury/data/rates.html>)
- **20% of Canadian and American 7-12th graders have had TBI** (Ilie et al, JAMA, 2013; Veliz et al, JAMA, 2017)



Why do we worry?



Why do we worry?

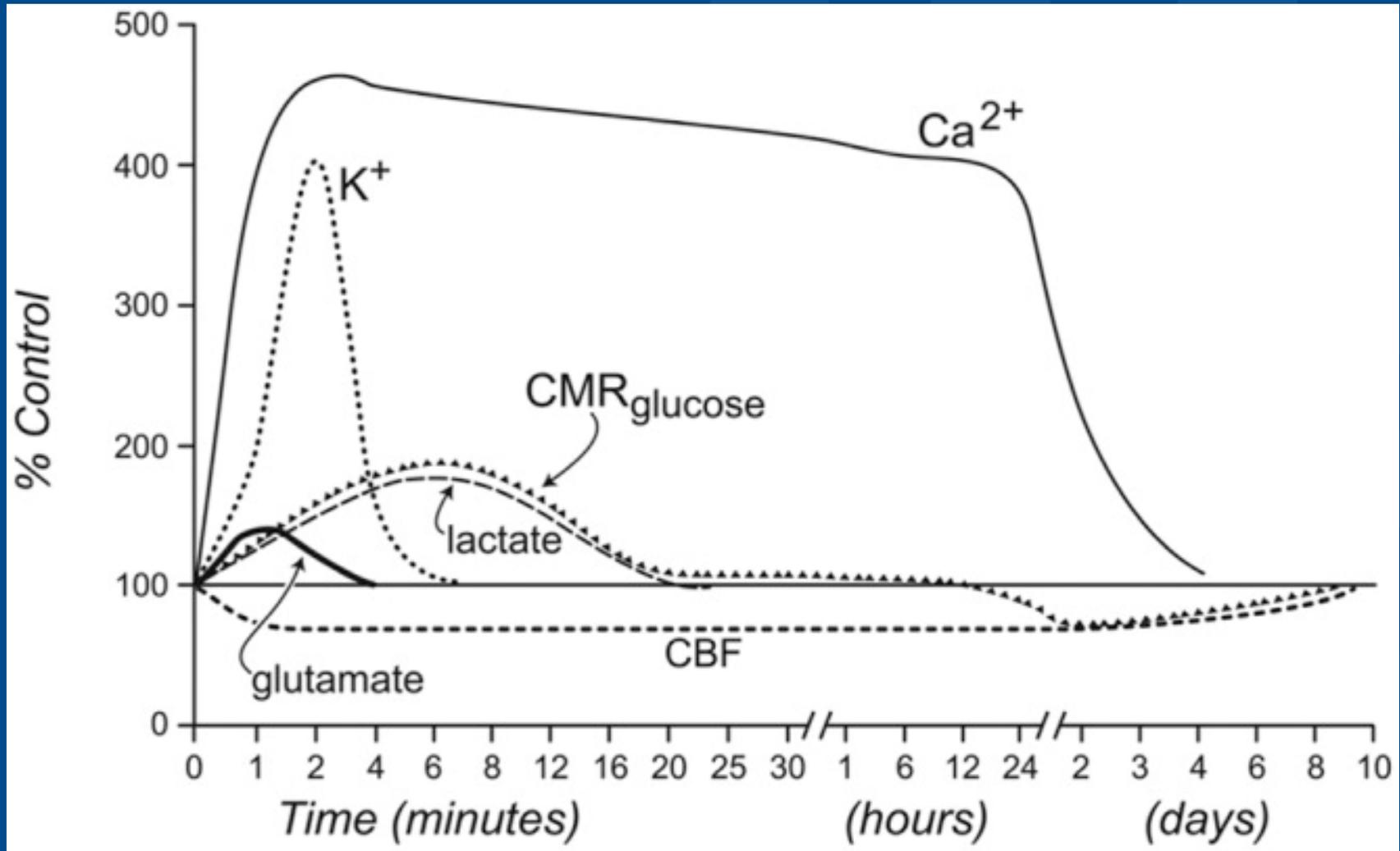
- **3.4x increased risk of lower extremity injury in NCAA D1 athletes in season after concussion (Herman, Sports Med, 2016)**
- **“... a cumulative effect of concussions across the lifetime may contribute to worsening dual-task dynamic motor function after concussion.” (Howell, J Neurotrauma, 2016)**



Why do we worry?

- **“The results of this study indicate that recovery from mTBI is a nonlinear process and the time course to full recovery for some may be protracted. This supports the possibility that, in a subpopulation of patients, full recovery may not ever be achieved.” (McMahon, J Neurotrauma, 2014)**





(Giza, Hovda, et al, UCLA Brain Injury Research Center)

Why do we worry?

- **“...the basic science finding of neurometabolic dysfunction underlying a period of vulnerability to repeated concussion has been linked to clinical vulnerability in multiple studies” (Giza, et al, Neuron, 2017)**



Concussion Lawsuits

- \$7.1 million settlement from Grossmont Union High School District - H.S. football injury- Coaches didn't recognize or respond to symptoms, did not complete concussion training
- \$7.5 million from La Salle University- Player wrongly cleared to return to play
- Sandpoint Idaho- Bonner County School District- Concussion suspected but did not remove from play
- Pop Warner Football Lawsuit- Failed to monitor games, practices, rules, and medical care. Did not have a protocol or an ability to recognize and diagnose brain injuries
- Parkrose School District, Portland, OR – Coaches failed to remove symptomatic player who was cleared by medical personnel.



Diagnosis

- **Clinical diagnosis – there is no single diagnostic test that is completely accurate.**
 - **Appropriate mechanism**
 - **Rapid onset of symptoms in any of 4 domains:**
 - **Somatic (headache, nausea, etc.)**
 - **Cognitive (impaired short term memory, perseveration, “fogginess”.)**
 - **Emotional (irritability, depression, etc.)**
 - **Sleep (increase need, decreased restorative sleep, etc.)**
- Symptoms are not explained by another diagnosis**



Diagnostic (Un)certainty

Table 1: Concussion diagnosis by degree of certainty

Classification	Definition	Management
Possible	Concussion is not the most likely cause of the clinical presentation. Other possible explanations are identified, such as migraine headache, dehydration, or viral illness. The presumed traumatic insult was not witnessed or difficult to describe.	situational
Probable	Concussion is the most likely cause of the clinical presentation. While other possible explanations exist, they are deemed less likely. The traumatic insult was clearly defined by witnesses or identifiable on video.	as concussed
Definite	Concussion is the ONLY explanation for the clinical presentation.	as concussed



Diagnosis - sideline

- Memory Test
- Glasgow Coma Scale
- Cervical Spine Assessment
- Background
- Symptom Evaluation
- Cognitive Screening
- Neuro Screen (includes balance)
- Delayed Recall

SCAT5® **SPORT CONCUSSION ASSESSMENT TOOL – 5TH EDITION**
DEVELOPED BY THE CONCUSSION IN SPORT GROUP
FOR USE BY MEDICAL PROFESSIONALS ONLY

supported by

Patient details

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date of Injury: _____ Time: _____

WHAT IS THE SCAT5?

The SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals¹. The SCAT5 cannot be performed correctly in less than 10 minutes.

Key points

- Any athlete with suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration. No athlete diagnosed with concussion should be returned to play on the day of injury.
- If an athlete is suspected of having a concussion and



Diagnosis - office

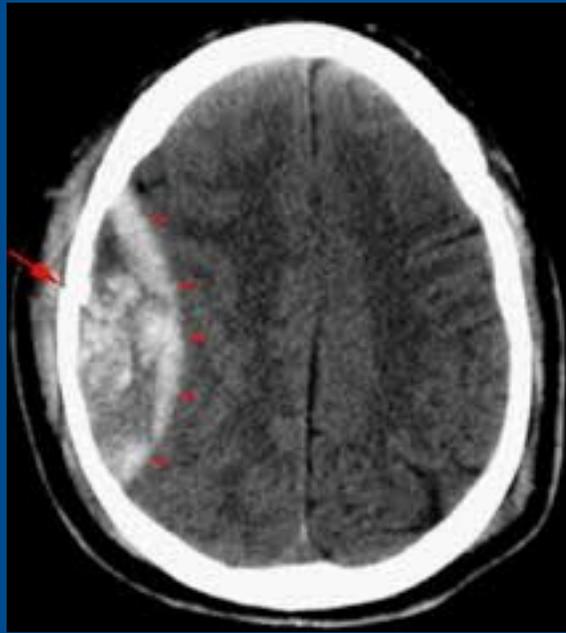
- **Symptom scale**
- **Sleep-wake cycle**
- **Cervical spine**
- **Detailed neurologic exam**
 - **Cranial nerves, motor function, DTRs**
 - **Balance**
 - **Vestibular-ocular**
 - **Cognitive**
 - **Coordination**

(Matuszek, Sports Health, 2016; McCrory, BJSM, 2017)



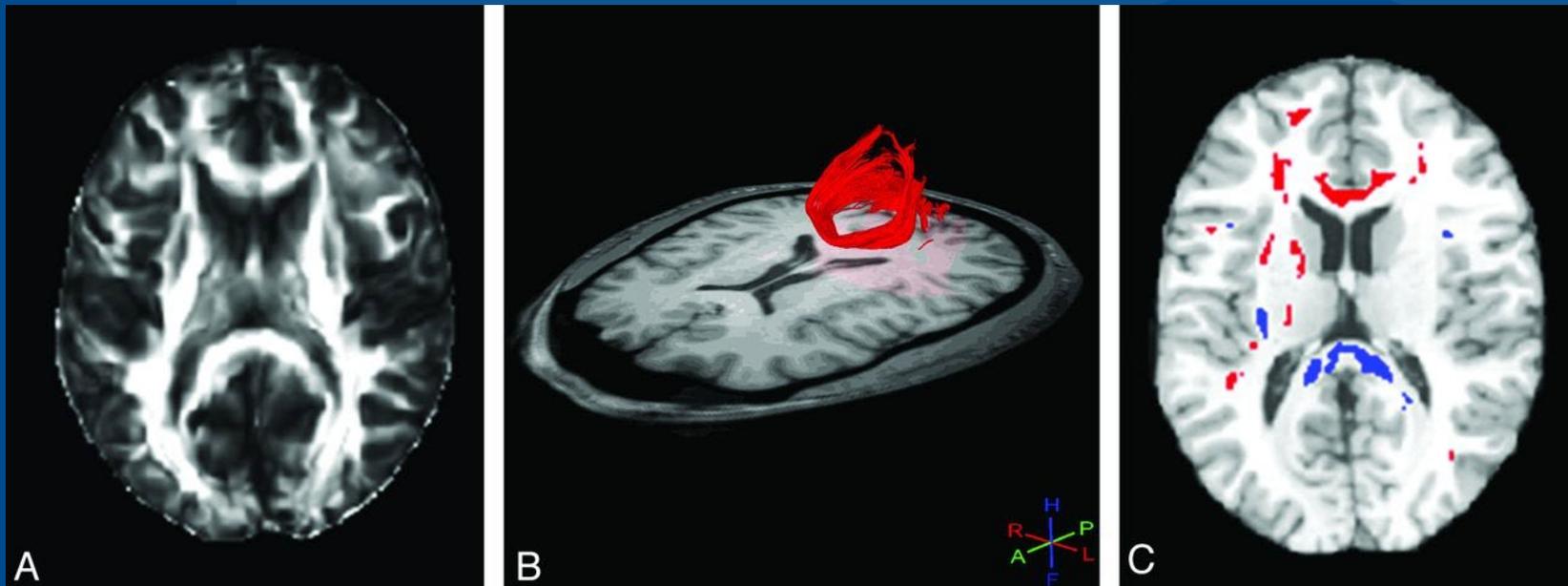
Neuroimaging

- Conventional MRI and CT assess **macroscopic** injuries



Neuroimaging

- Diffusion tensor imaging can assess **microstructural** injuries.



Hulkower, Am Journal Neurorad, 2013



Neuroimaging

- **“Seven different neuroimaging methods were investigated in included studies. The most frequently used method, diffusion tensor imaging (41%), had heterogeneous findings with respect to the specific regions and tracts that showed group differences”**



Diagnosis

- **“Although there is increasing interest in finding objective measures of injury and recovery, emerging imaging and serum biomarkers are not ready for routine clinical use.”**
(Eisenberg, Curr Opin Peds, 2018)
- **“...in recent systematic reviews, the overall level of evidence is low for using fluid biomarkers for diagnosis of SRC.”**
(Harmon, et al, BJSM, 2019)



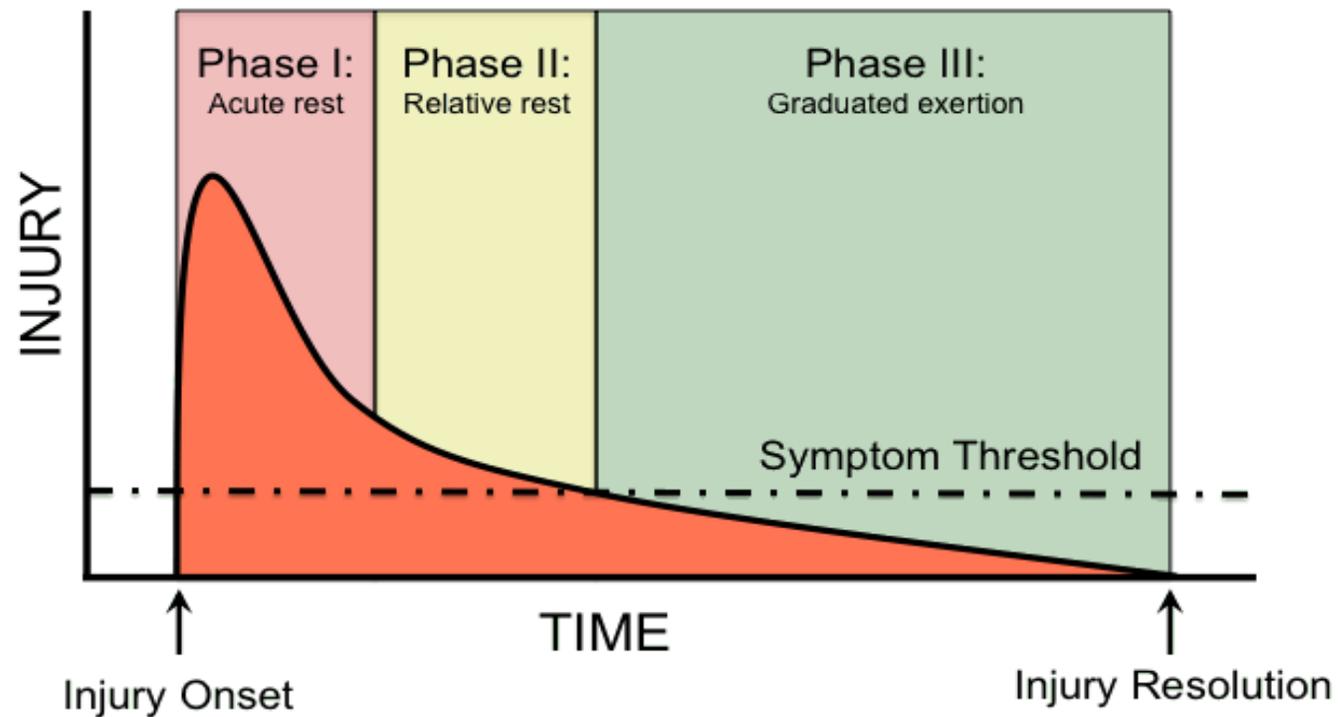
Goals of management

- **Protect from further harm**
- **Ensure resumption of cognitive loading activities in a timely fashion**
- **Ensure resolution of metabolic injury prior to returning to risk**
- **Address psychosocial and physical impairments, adding treatment when appropriate**



3 Phases of recovery

Figure 2: Three phases of concussion management



Treatment

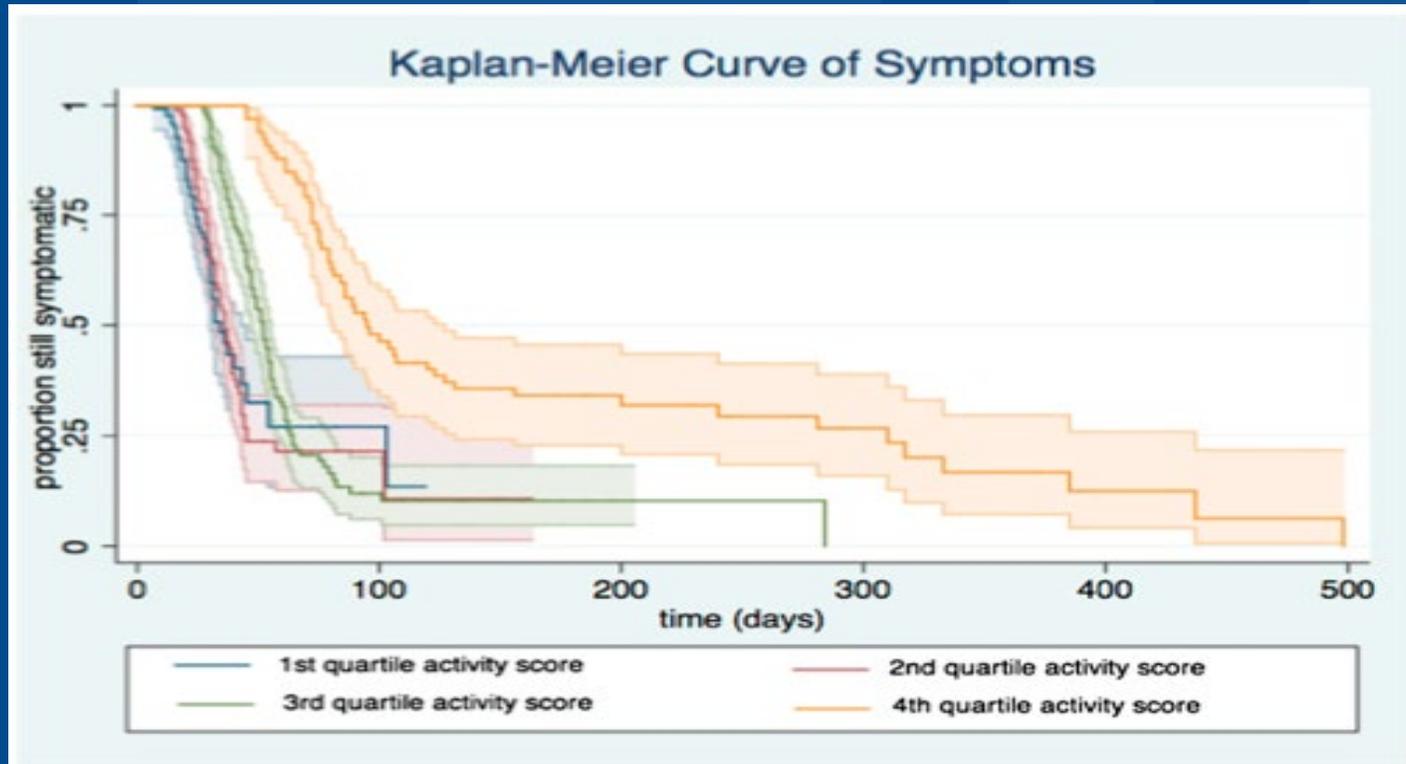


FIGURE 1
Duration of symptoms by quartile of cognitive activity-days. Shaded area represents 95% confidence intervals for the curve.

(Brown, et al, Pediatrics, 2014)



Management

- **“Earlier time to aerobic exercise is associated with faster recovery following acute sport concussion” (Lawrence, et al, PLOS One, 2018)**
- **“...individualized subsymptom threshold aerobic exercise treatment prescribed to adolescents with concussion symptoms during the first week after SRC speeds recovery and may reduce the incidence of delayed recovery.” (Leddy et al, JAMA Ped, 2019)**



Treatment

Currently, there is limited evidence to support the use of pharmacotherapy. If pharmacotherapy is used, then an important consideration in return to sport is that concussed athletes should not only be free from concussion-related symptoms, but also should not be taking any pharmacological agents/medications that may mask or modify the symptoms of SRC. Where pharmacological therapy may be begun during the management of an SRC, the decision to return to play while still on such medication must be considered carefully by the treating clinician.

McCroory, BJSM, 2017



Treatment

- “There is no human evidence that nutraceuticals prevent or ameliorate concussion in athletes.” (Harmon, BJSM, 2019)



From: <https://brain-armor.com/products/vegan-softgels/>



Treatment – acute symptom management

- Cognitive behavioral therapy
- Vestibular therapy
- Vision therapy
- Manual therapy
- Symptom management – nausea, headache, sleep
 - Zofran 4-8 mg ODT
 - NSAIDs, Acetaminophen, triptans?, TCAs (nortriptyline 10-25 mg qhs)
 - Melatonin 1-10 mg qhs



Treatment

- **“In both adults and children, the only intervention that has demonstrated reasonably consistent success in reducing morbidity is the provision of psychoeducation, advice, and reassurance soon after injury.” (Kirkwood, J Peds, 2017)**



Treatment – return to learn

- **General loss of efficiency in most things**
- **Need to accommodate physical, emotional, cognitive, and sleep/fatigue issues associated with concussion**
- **“If they have to take a test before they’re recovered, they’re just testing the concussion, not knowledge.” –Jeff Kutcher MD**



Treatment - accommodations

- **Accommodations often times are very different depending on the student, their academic performance history, current symptoms, grade level, family support or lack of support, etc.**
- **Concussions typically exacerbate pre-concussion academic difficulties**



Treatment – return to learn

Stage	Aim	Activity	Goal
1	Daily activities at home that are symptom free	Reading, texting, screen time that don't increase symptoms (start at 5-15 minutes)	Gradual return to daily activities
2	School Activities	Homework, reading, or other cognitive activities outside of the classroom	Increase tolerance to cognitive tasks
3	Return to school (part-time)	Gradual intro to schoolwork. May need increased breaks	Increase academic activity
4	Return to school (full-time)	Gradual progression of school activities until patient can tolerate a full day	Return to full academic activity



Treatment - accommodations



St. Luke's Sports Medicine Concussion Clinic

Academic Recovery Plan & Athletic Recommendations

Patient Name: _____ Date: _____
School: _____

The above patient was evaluated after sustaining a concussion on _____.
GENERAL CONSIDERATIONS: Although there is significant variability in symptom presentation and duration, all individuals who sustain a concussion will need time for their brains to recover. It is not unusual to experience headaches and difficulties with attention, concentration and memory. These symptoms resolve over time. However, if individuals return to pre-injury activity levels too quickly, there is the potential for long-term impact. Getting more rest than usual, modifying daily routines, and managing expectations can all help facilitate recovery and minimize symptom severity.

EDUCATIONAL ACCOMMODATIONS: The symptoms associated with concussion may affect academic performance. The cognitive exertion that school requires can provoke symptoms. Therefore, the following accommodations are recommended:

School Re-entry/Attendance:

- Full days as tolerated ½ days, may advance as tolerated
 No school until _____, then attempt half/full days as tolerated.

**Full or partial days missed due to post-concussion symptoms should be medically excused.

Academic Testing: *Students recovering from a concussion often demonstrate difficulties with memory, attention, and processing speed. Highly demanding activities such as testing may exacerbate other symptoms.*

- Extra time to complete tests Testing in a quiet environment
 Allow testing across multiple sessions Reduce length of tests
 Eliminate tests when possible Defer standardized or high stakes testing
 Reformat from free response to multiple-choice or provide cueing (e.g., use of a note card for helpful formulas)
 Schedule no more than one test per day

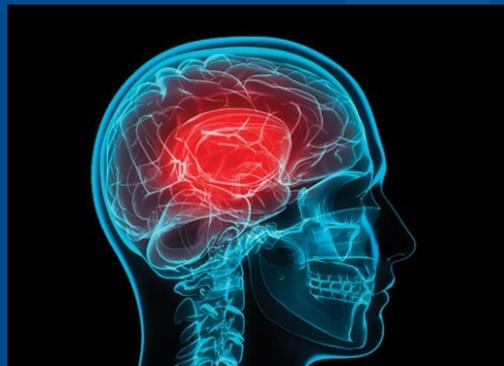
Curriculum Accommodations:

- Extended time:** Allow student extended time to turn in assignments. *While experiencing symptoms and whenever symptoms increase, students are advised to rest, and therefore may need a modified schedule for completing assignments.*
- Workload reduction:** Reduce overall amount of make-up work, class work, and homework. *Examples of how to shorten work include reducing the length of essays, have the student do every other problem in a homework assignment, or highlight key concept areas for testing while eliminating testing on less critical topics.*
- Make up/Keep up:** Develop a systematic plan for balancing the "make up/keep up" challenge of recovery. The process of making up missed work can be anxiety provoking and needs to be undertaken over time, with support and supervision.



Recovery

- **What is recovery?**
 - **Very likely that clinical and neurological recovery are 2 different things**
 - **Clinical recovery defined as a return to normal activities (work/school/sport)**
 - **Neurological recovery is normalization of all objective testing – neurocognitive, imaging, etc.**
 - **Difference between clinical and neurological recovery supports a “buffer zone” of activity**
 - **Gradual increases in activity before full contact**



Recovery

- **As such, using multiple markers of recovery prior to discharge is optimal**
 - Family/school/work/peer input
 - Symptom scale
 - Physical exam
 - Neurocognitive testing
 - Balance/vestibular testing
 - Oculomotor testing

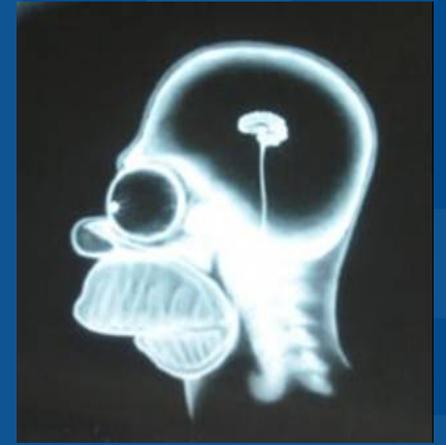


Treatment – return to sport

Stage	Aim	Activity	Goal of Each Step
1	Symptom-limited activity	Daily activities that do not provoke symptoms	Gradual reintroduction of work/school activities
2	Light Aerobic Exercise	Walking or Stationary Cycling at slow to medium pace. No resistance training	Increase Heart Rate
3	Sport-Specific Exercise	Running/Skating Drills allowed. No head impact	Add movement
4	Non-Contact Training Drills	Harder Training. Start progressive resistance training	Exercise, Coordination, and increased thinking
5	Full Contact Practice	Following medical clearance, participate in normal training activities	Restore Confidence and assess functional skills by coaching staff
6	Return to Sport	Normal Game Play	



Summary



- **Concussions are common**
- **Concussions can be associated with diverse neurophysiological impairments and as such can be a challenge to diagnose.**
- **Reducing risk of further harm while initiating therapies for emotional, cognitive, vestibular, and physical effects is the standard of care.**
- **Because of this, care is optimal when coordinated between the patient, treating provider/ATC, coaches, school, family.**



How to Manage a Concussion

- **If a concussion is suspected, remove the patient from risk for further injury**
- **Evaluate the patient**
- **Decide what initial interventions are necessary after thorough evaluation**
- **See the patient back weekly and reassess**
- **Continue aiding with accommodations at each visit; define trajectories if the patient has persistent symptoms; treat those symptoms.**



Questions and Answers

