# Evaluation and Management of Sports Concussion

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# OBJECTIVES

- Define Concussion
- Summary: Consensus Statement on Concussion in Sports
- Clinical Evaluation: Critical Components
- Concussion Treatments
- Topic Discussion: CTE

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# CONCUSSION

- Blow or force to the head or body that changes the way the brain normally works
- Pathophysiological process induced by biomechanical forces caused by direct or indirect force to the head resulting in neurometabolic dysfunction
- As many as 3.8 million sports and recreation related concussions in the U.S. per year
- Typically functional rather than a structural injury

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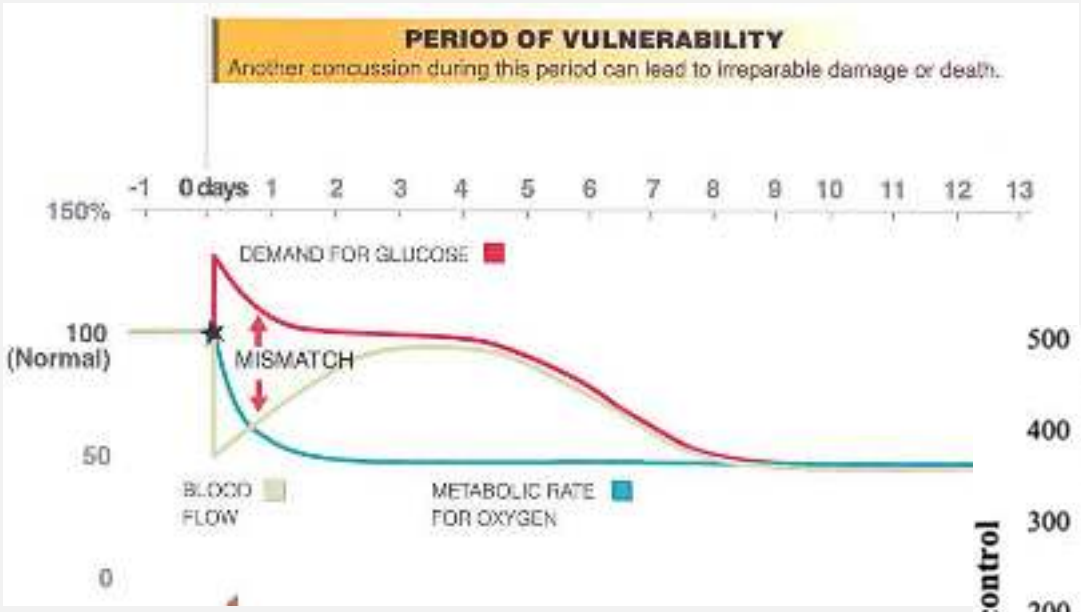
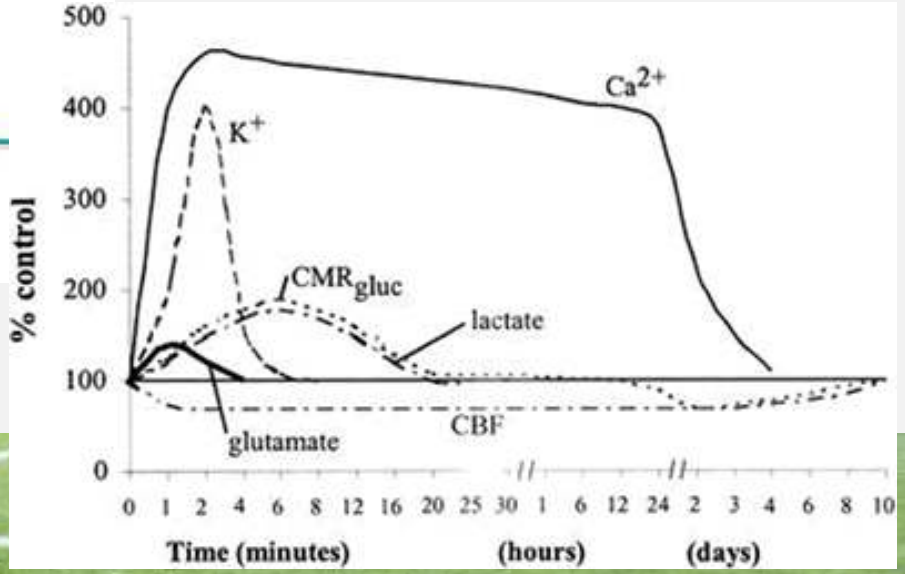
# Pathophysiology




Result = metabolic mismatch




ENERGY CRISIS

Giza, C & Hovda, D (2001)

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| THINKING/ REMEMBERING | PHYSICAL | EMOTIONAL/ MOOD | SLEEP DISTURBANCE |
|---|---|---|---|
| • Difficulty thinking clearly | • Headache<br>• Nausea or energy<br>• Sensitivity to noise or light | • Irritability<br>• Sadness | • Sleeping more than usual |

# MULTI-DOMAIN ASSESSMENT

cdc.gov/concussion/HeadsUp

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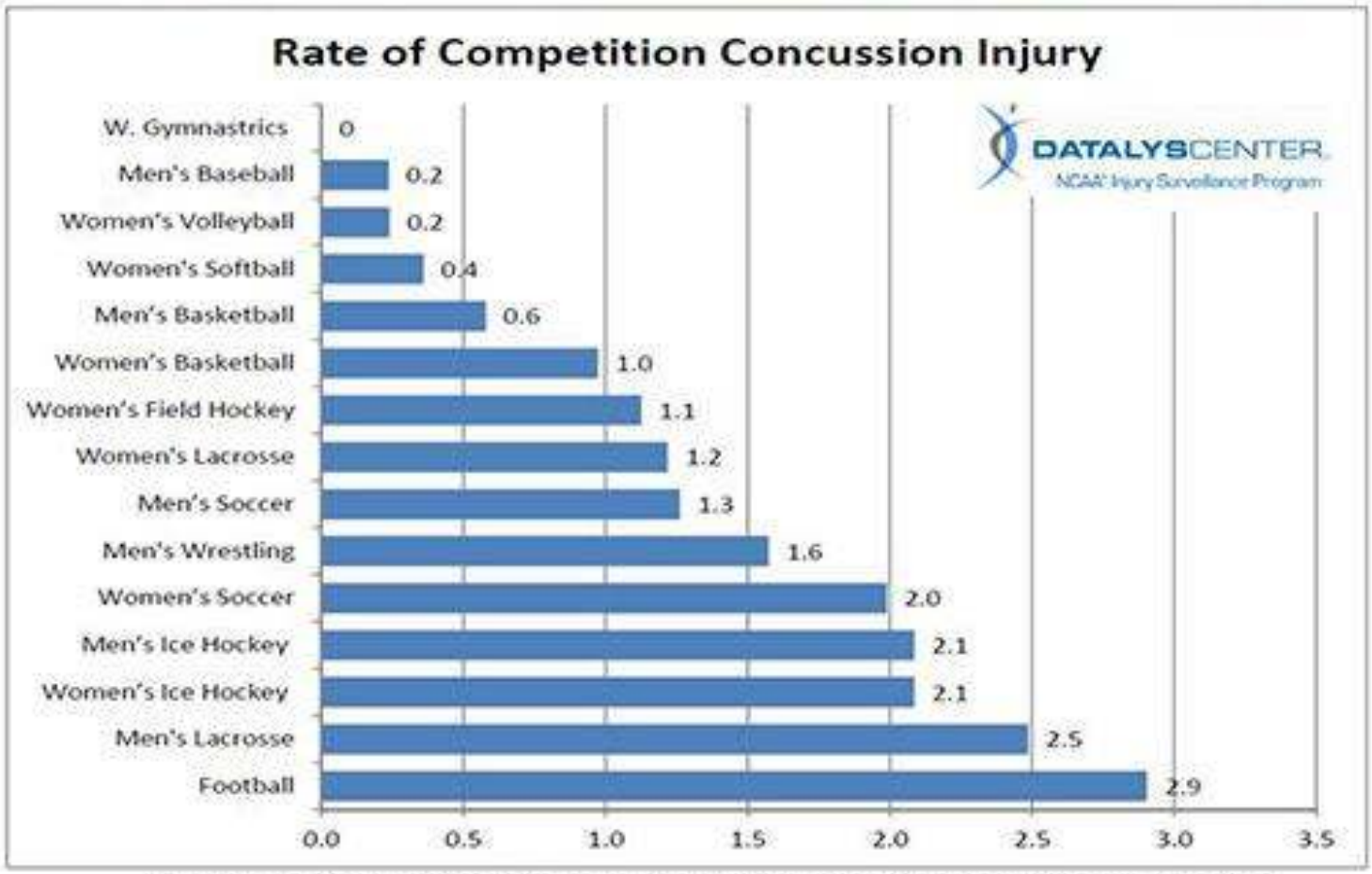
# Causes of Sports Concussion

**Figure 1. Rate of Competition Concussion Injury**

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*British Journal of Sports Medicine, 2017*

Consensus statement

# Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016

Paul McCrory,[1] Willem Meeuwisse,[2] Jiří Dvorak,[3,4] Mark Aubry,[5] Julian Bailes,[6] Steven Broglio,[7] Robert C Cantu,[8] David Cassidy,[9] Ruben J Echemendia,[10,11] Rudy J Castellani,[12] Gavin A Davis,[13,14] Richard Ellenbogen,[15] Carolyn Emery,[16] Lars Engebretsen,[17] Nina Feddermann-Demont,[18,19] Christopher C Giza,[20,21] Kevin M Guskiewicz,[22] Stanley Herring,[23] Grant L Ive[illegible] James Kissick,[26] Jeffrey Kutcher,[27] John J Leddy,[28] Da[illegible] Michael Makdissi,[30,31] Geoff Manley,[32] Michael McC[illegible] Sinji Nagahiro,[36] Jon Patricios,[37,38] Margot Putukian,[illegible] Allen Sills,[41,42] Charles H Tator,[43,44] Michael Turner,[45]

## The Concussion Recognition Tool 5th Edition (CRT5)

Ruben J Echemendia,[1,2] Willem Meeuwisse,[3] Paul McCrory,[4] Gavin A Davis,[5] Margot Putukian,[6] John Leddy,[7,8] Michael Makdissi,[9] S John Sullivan,[10] Steven P Broglio,[11] Martin Raftery,[12] Kathryn Schneider,[13,14,15] James Kissick,[16,17,18] Michael McCrea,[19] Jiri Dvorak,[20] Allen K Sills,[21] Mark Aubry,[22] Lars Engebretsen,[23] Mike Lossemore,[24] Gordon Fuller,[25] Jeffrey Kutcher,[26] Richard Ellenbogen,[27] Kevin Guskiewicz,[28] Jon Patricios,[29,30] Stanley Herring[31]

## The Sport Concussion Assessment Tool 5th Edition (SCAT5)

## The Child Sport Concussion Assessment Tool 5th Edition (Child SCAT5)

Gavin A Davis,[1,7] Laura Purcell,[3] Kathryn J Schneider,[4,5,6] Keith Owen Yeates,[7] Gerard A Gioia,[8,9] Vicki Anderson,[1] Richard G Ellenbogen,[10] Ruben J Echemendia,[11] Michael Makdissi,[2,12] Allen Sills,[13] Grant L Iverson,[14] Jiri Dvorak,[15] Paul McCrory,[2] Willem Meeuwisse,[16] Jon Patricios,[17,18] Christopher C Giza,[19] Jeffrey S Kutcher[20]

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# 5th International Consensus Conference on Concussion in Sport (McCrory et. al, 2017)

- Stresses multi-disciplinary nature of treatment
- Examination of **symptoms, neurologic function, cognition, balance, vision, sleep and mood**
- Rest 24-48 hours, gradual return to activity
- Return to Play
- Return to Learn
- Benefits of **active rehabilitation**
- Normal Recovery 10 – 14 days: adults

  2 – 4 weeks: kids

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# Clinical Evaluation: Critical Components

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# Injury → Outcome

Risk factors → Concussion → Clinical Assessment → Treatment and rehab pathways

- Previous Concussions
- Migraines – family hx
- LD/ADHD
- Psychiatric/Mood
- Female Gender
- Age
- Neuro Hx
- Motion sensitivity, Ocular Hx?

- Vestibular → 
- Ocular
- Cognitive/ Fatigue → 
- Migraine/ H/A
- Anxiety/ Mood → 
- Cervical

*Based on model of Collins et. al, 2014*

# Clinical Evaluation: Critical Components

- Mechanism of Injury
- Immediate & Current Symptoms
- Risk Factors for Delayed Recovery
- Examination of:
  - Neurologic function
  - Cognition
  - Balance
  - Vestibular screening
  - Sleep
  - Mood

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# Clinical Evaluation: Critical Components (and you only have 15 minutes)

- Comprehensive Screening Tools
  - Acute Concussion Evaluation (Gioia et. al., 2006)
  - Sport Concussion Assessment Tool 5 (SCAT5) (Eschemendia et al, 2017)
    - SCAT3 - Not sensitive after 3-5 days
- Post Concussion Symptom Inventory (PCSI)
- Neurological Screen – Cranial Nerve Exam
- Balance
  - Double leg, single leg, tandem stance (not only Romberg)
- Vestibular Ocular Screening
- Examination of Mood and Emotional Functioning
  - BSI-18 or others

# Clinical Evaluation: Critical Components

- *Individualized* clinical assessment and tracking
  - Let the symptoms guide you
  - 80% athletes will recover "normally"
    - Follows a 2 week timeline based on the science of the cellular regulation
    - However, education and **early intervention** based on symptoms = best outcome

- *Active* treatment at home and school
  - Balanced amount of activity
  - Goldilocks prescription

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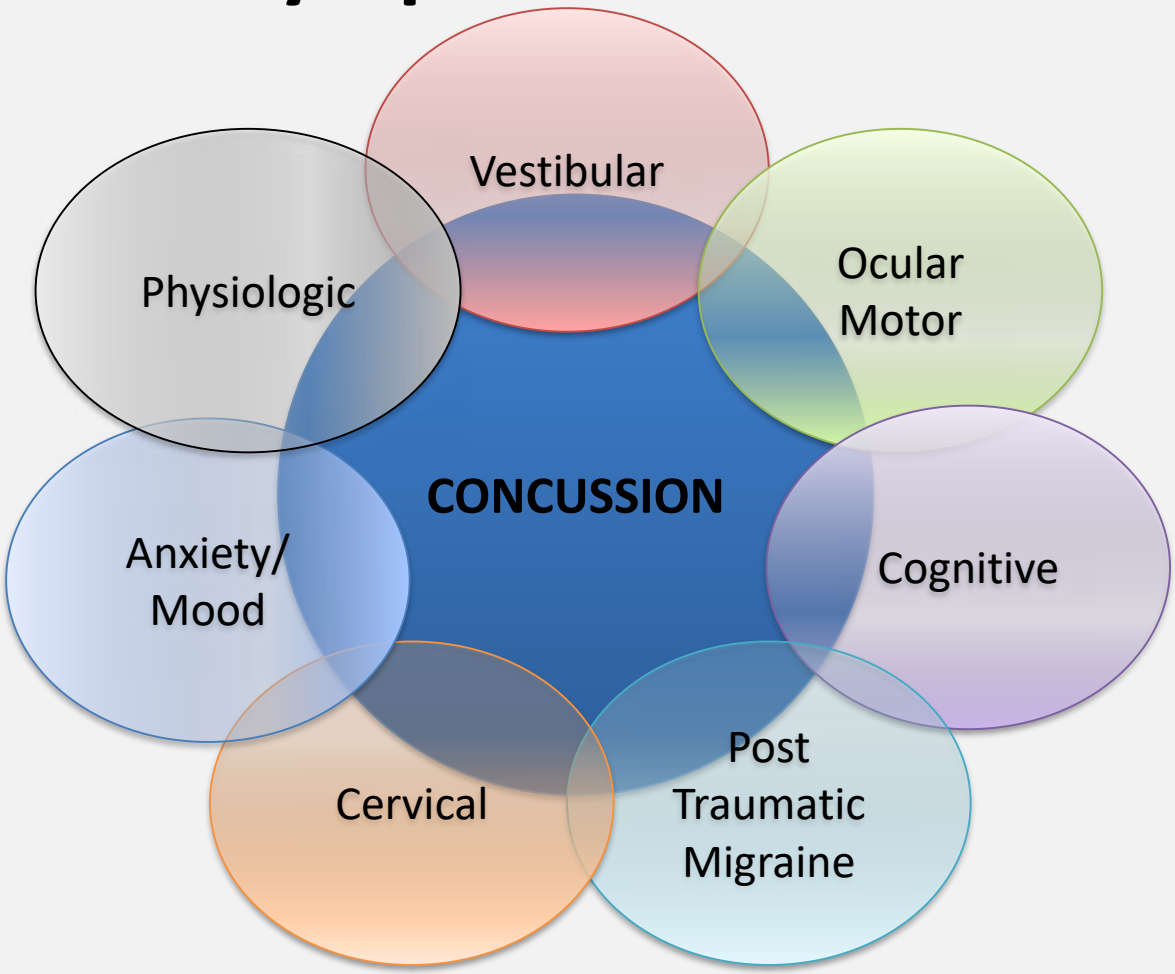
# Clinical Trajectories
# Symptom Clusters




**Referral: 1-2 weeks, continued symptoms, narrow down trajectory, make referral**
**Access to Concussion Clinic may choose to refer sooner**

*Based on model of Collins et. al, 2014*

# *Concussion is a treatable injury*

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# Concussion Treatment: General Considerations

- **Rest versus activity are not well defined in concussion management literature**
- Art to science of how to balance rest and activity
- Even “normal” recovery needs modified physical and cognitive activity to achieve recovery
  - Less protracted recovery when treatment plan is implemented early
  - Ex. ankle sprain – going to strengthen to support recovery

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# Rest vs. Gradual Activity

**Post Concussion Symptoms Score**

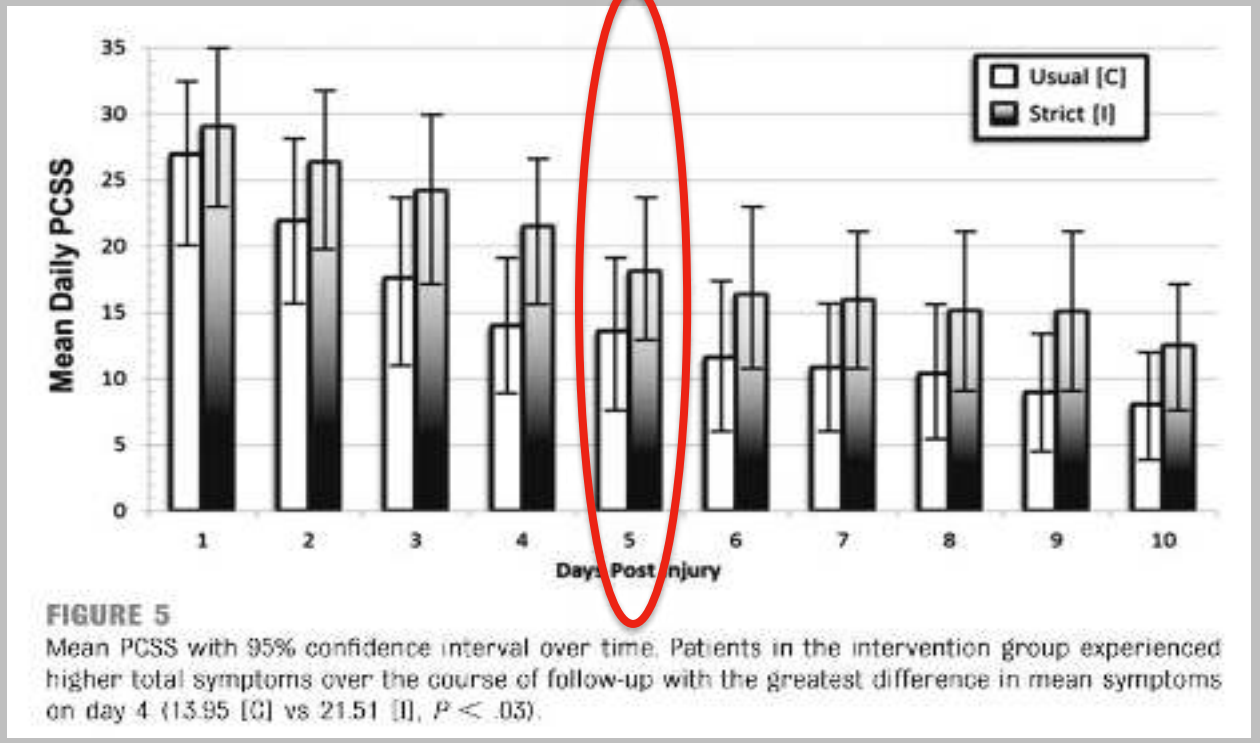


FIGURE 5
Mean PCSS with 95% confidence interval over time. Patients in the intervention group experienced higher total symptoms over the course of follow-up with the greatest difference in mean symptoms on day 4 (13.95 [C] vs 21.51 [I], $P < .03$).

**Strict Rest** = no school, work or physical activity for 5 days, stepwise return to activity

**Control** = Rest 1-2 days, then gradual return to school and physical activity

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Thomas, Apps, Hoffmann, McCrea, Hammeke (2015) Benefits of strict rest after acute concussion: A Randomized controlled trial. *Pediatrics, 135 (2)*

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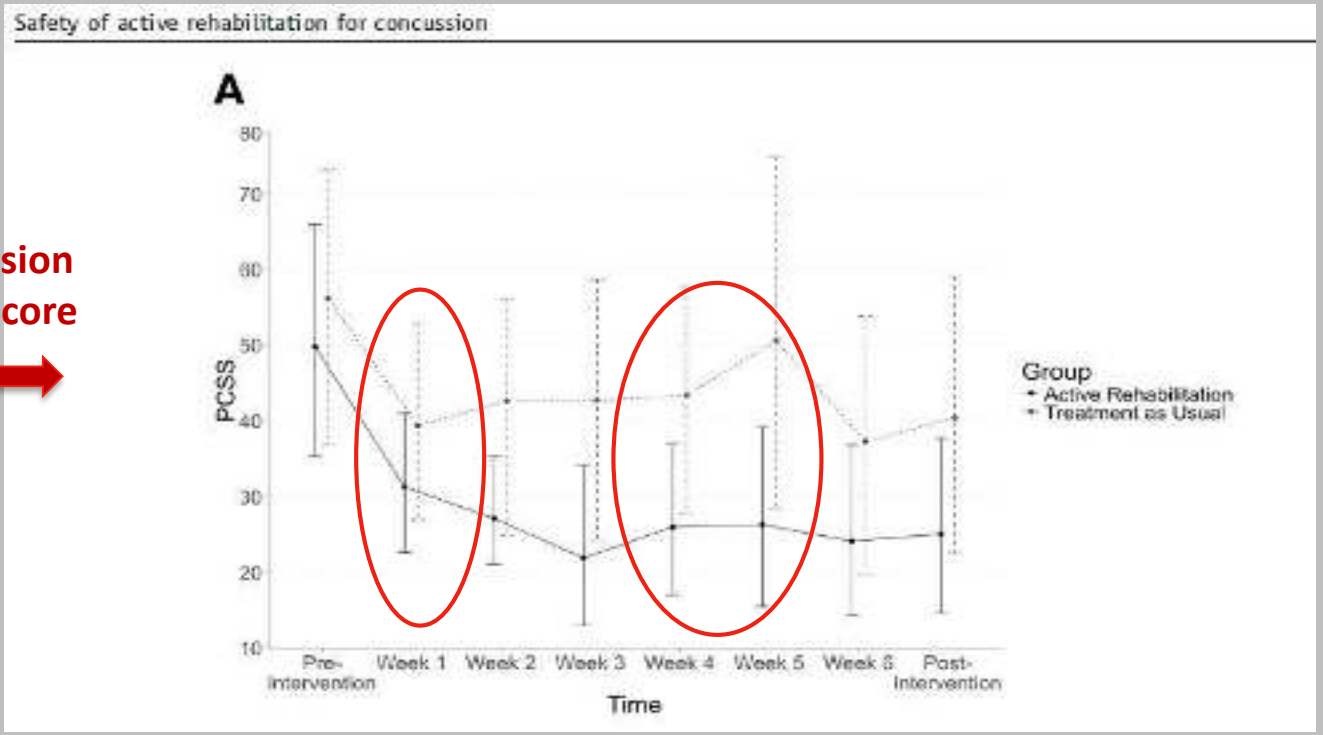


**Patients ≥ 4 weeks post injury; ≥ 2 weeks persistent symptoms**

***TAU*** **= educational session, return to learn and referral to community therapists**

***Active Rehab*** **= TAU + submax aerobic training, light sport specific exercises, visualization/imagery, HEP**

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Chan, Iverson, Purtzki, et. al, (2017)

# Concussion Treatment: General Considerations

- *All patients* benefit from an individualized recovery plan
- Modifications for:
  - Sleep
    - Neural systems related to arousal, alertness, attention vulnerable after TBI (Ponsford, 2012)
    - Perceived sleep disturbance related to greater symptom burden and lower neurocognitive scores (Kostyun, 2014)
  - Nutrition
  - Mental Activity - RTS
  - Emotional Function
  - Physical Activity
    - Sport specific exercise program

***Lay the foundation early = best chance for + outcome***

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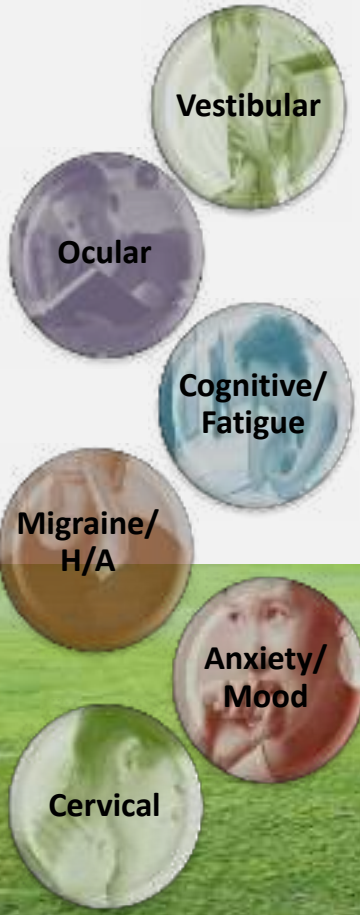
# Concussion Treatment: Specific Treatment Pathways

**Clinical Assessment** → **Treatment and rehab pathways**




- Cervical/Vestibular Therapy with PT/OT
- Targeted exercise program
- Academic strategies for prolonged cognitive fatigue
- Medications for sleep or headache – PCP
- Cognitive behavioral therapy/Educational intervention
- Vision Therapy

*Based on model of Collins et. al, 2014*

# Concussion Treatment: Specific Treatment Pathways

- For athletes with slowed or prolonged symptoms
- Multi-disciplinary team
- Individualized symptom limited aerobic exercise
  - Those with autonomic instability or physical deconditioning
  - Supports neuroplasticity/cortical connectivity
- Targeted physical therapy
  - Cervical/vestibular issues
- Cognitive Behavioral Therapy/Educational Intervention
  - Persistent mood issues

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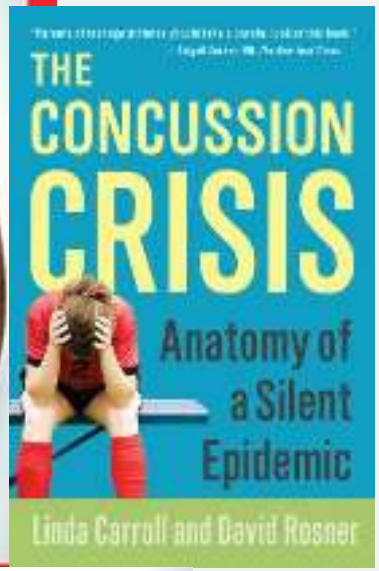
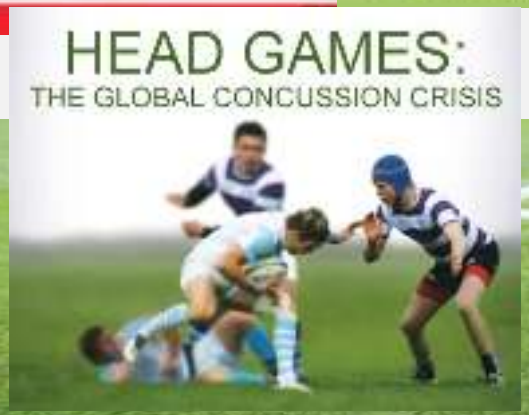
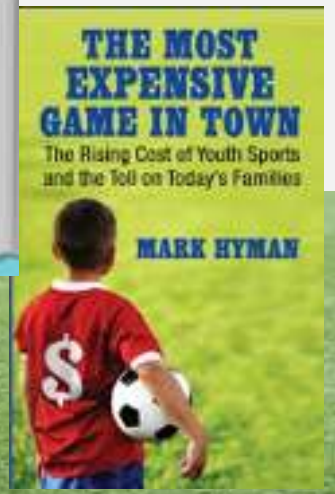
# Topic Discussion: CTE




How Kids' Sports Became a $15 Billion Industry



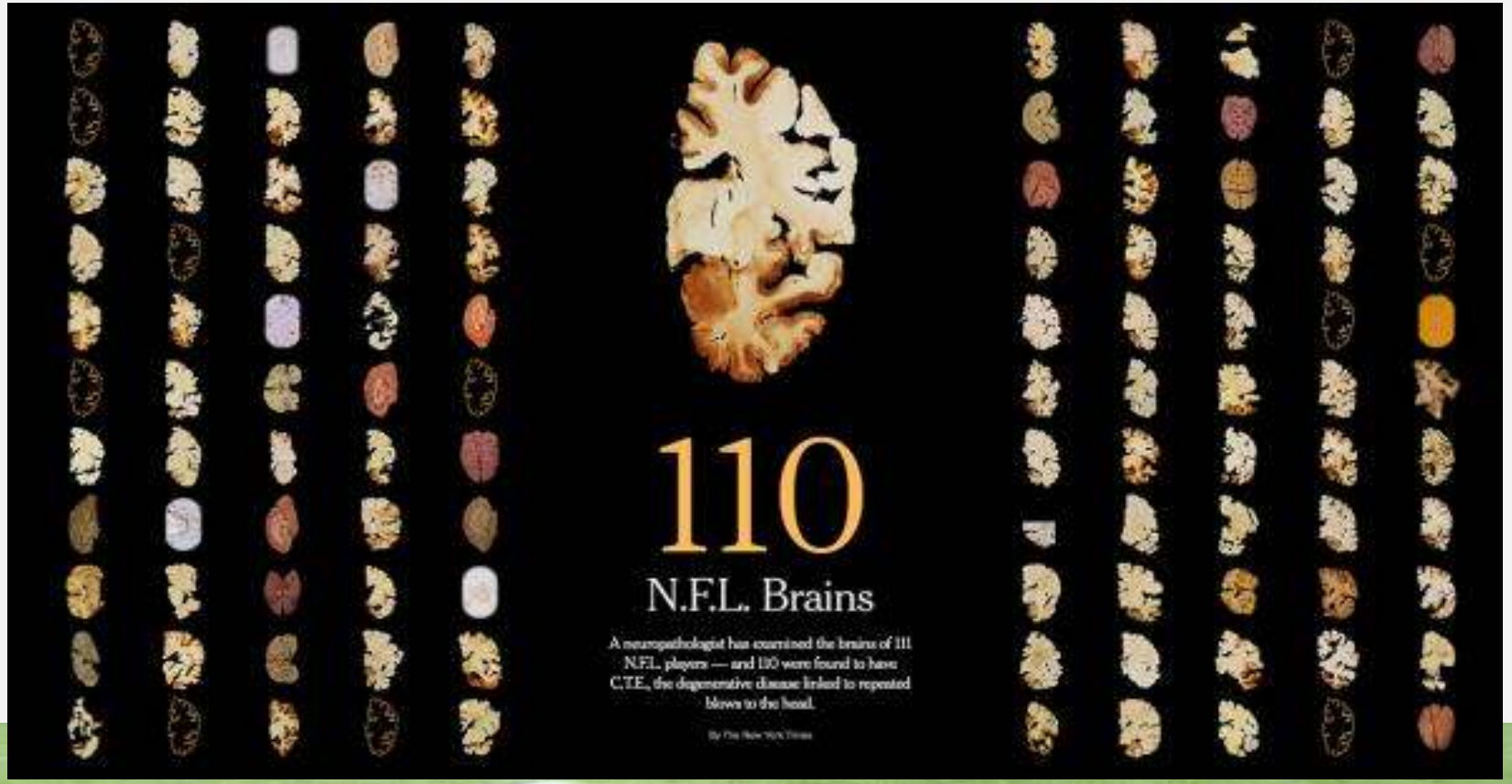
# Topic Discussion: CTE

- Chronic Traumatic Encephalopathy
  - Pathology of abnormal tau protein deposition
  - Can ONLY be diagnosed posthumously
  - No definitive cause and effect relationship established between repetitive head trauma and CTE pathology in scientific literature
  - Media reports are misleading
  - It appears that multiple biological/environmental/lifestyle factors could also produce the brain abnormalities found in CTE
    - Epilepsy
    - Anabolic steroid/Opioid abuse
    - Normal aging
    - Psychosocial trauma…… among at least 20 others

# Topic Discussion: CTE

- Clinical features:
  - Described in the literature = personality changes, depression, cognitive problems, suicide
  - But…no agreed upon clinical criteria
- What we know based on the literature: (Manley, 2017):
  - Some former athletes in contact sport suffer from depression and cognitive deficits later in life and there may be an association between deficits and history of multiple concussion
  - Multiple factors identified in this small group of patients dx with CTE – not a large enough "N" to parse cause and effect
  - Former athletes not at increased risk of suicide

# Topic Discussion: CTE




Based on article by Mez, et.al, 2017
Photo: New York Times, 2017

***Summary of scientific literature written for the lay population:***

***CTE: A Q and A Fact Sheet***
***www.sportsneuropsychologysociety.com***

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# Conclusions

- Concussion is typically a functional injury
- Best Practices: Examination of symptoms, neurologic function, cognition, balance, vision, sleep and mood
- Let symptoms guide you in assessment and treatment
- Concussion is a treatable injury
- Balance of rest and activity in recovery
- Consider exercise, targeted physical therapy, psychotherapy for prolonged recovery

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