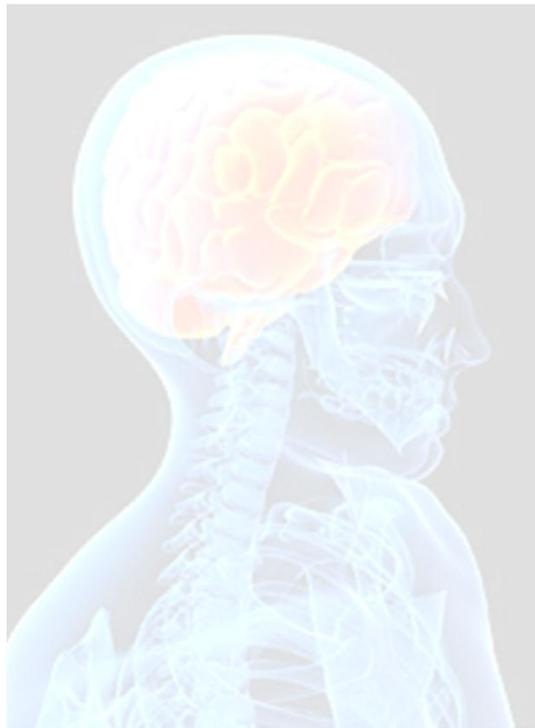


Advances in Concussion Management



Presented by
The University of Kansas Hospital

Incidence

“ In 2009, an estimated 446,788 sports-related head injuries treated in U.S. Hospital Emergency Rooms

“ Top 10 categories

- . Cycling
- . Football
- . Baseball and Softball
- . Basketball
- . Water Sports
- . Powered Recreational Vehicles
- . Soccer
- . Skateboards/Scooters
- . Fitness/Exercise/Health Club
- . Winter Sports



Concussion

- “ New definition set forth by Zurich Conference
 - . Concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury including:

Common Features

1. Caused by direct blow with impulsive force transmission.
2. Rapid onset of short lived impairment.
3. Functional disturbance rather than a structural injury.
4. Graded clinical symptoms, sequential course.
5. No neuroimaging abnormalities.

Signs and Symptoms

- “ Appears dazed or stunned
- “ Headache or “pressure” in head
- “ Is confused about assignment
- “ Nausea or vomiting or position
- “ Balance problems or dizziness
- “ Forgets sports plays
- “ Double or blurry vision
- “ Is unsure of game, score, or opponent
- “ Sensitivity to light
- “ Moves clumsily
- “ Sensitivity to noise
- “ Answers questions slowly
- “ Feeling sluggish, hazy, foggy,
- “ Loses consciousness (even briefly) or groggy
- “ Shows behavior or personality
- “ Concentration or memory problems changes
- “ Confusion
- “ Can’t recall events prior to hit or fall
- “ Does not “feel right”
- “ Can’t recall events after hit or fall

Pathophysiology of Concussion

- “ Changes in intracellular and extracellular environment
- “ Amino acid induced ionic shifts lead to hyperglycolysis
- “ Causes increased energy demand within the brain
- “ Decreased cerebral blood flow, unknown mechanism
 - . Possibly accumulation of endothelial calcium causing vasoconstriction

Pathophysiology of Concussion

- “ Mismatch of supply and demand (O₂ and glucose)
- “ Brain cells more vulnerable to:
 - . Increased ICP
 - . Changes in CBF
- “ Changes may last 2 weeks or longer
- “ Another “hit” during this time may lead to:
 - . Second Impact Syndrome
 - . Post Concussion Syndrome

Post Concussion Syndrome (PCS)

- “ In the military theater, known as “shell shock”
- “ Occurs in many mild TBI cases (30-80%)
- “ For many, symptoms last 3-6 months, sometimes longer
- “ Symptoms may occur immediately or appear spontaneously weeks or months after the injury

PCS Symptoms

- “ Physical:
 - . Headache
 - . Dizziness
 - . Sensitivity to light or noise
 - . Fatigue
- “ Cognitive
 - . Difficulty concentrating
 - . Memory problems
- “ Emotional/behavioral changes
 - . Irritability
 - . Depression
 - . Anxiety
 - . Poor judgment

Second Impact Syndrome (SIS)

- “ Involves:
 - . An athlete suffering post-concussive symptoms following a head injury.
 - . Return-to-play too soon with second head injury
- “ Edema, swelling, herniation, and/or death
- “ Rare condition not well documented in literature
- “ Minor blow vs. Major blow to the head

Chronic Traumatic Encephalopathy (CTE)

- “ Progressive neurological deterioration previously termed “dementia pugilistica” or “punch-drunk” syndrome
- “ Associated with:
 - . Memory disturbances
 - . Behavioral and personality changes
 - . Parkinsonism
 - . Speech and gait abnormalities
 - . Atrophy
 - . Tau-immunoreactive neurofibrillary tangles

Characteristic	Alzheimer's	Chronic Traumatic Encephalopathy
Progressive Neurological Disorder	YES	YES
Early Behavioral and Personality Changes	YES	YES
Disinhibition	YES	YES
Irritability	YES	YES
Dementia	YES	YES
Appears Late in Life	YES	YES
Protein Beta-Amyloid Found on Autopsy	YES	NO
Protein Tau Found on Autopsy	YES	YES
Result of a Endogenous Disease	YES	NO
Result of Repetitive Brain Injury	NO	YES

Quality vs. Quantity

- “ Major Blow vs Minor Blow
- “ Repetitive hits lead to:
 - . Slowed thought process
 - . Dementia
 - . Depression
 - . Suicide

NFL Phone Survey

- “ Age 50 and older
 - . Five times national average
- “ Age 30-49
 - . Nineteen times national average

Apolipoprotein (Apo E)

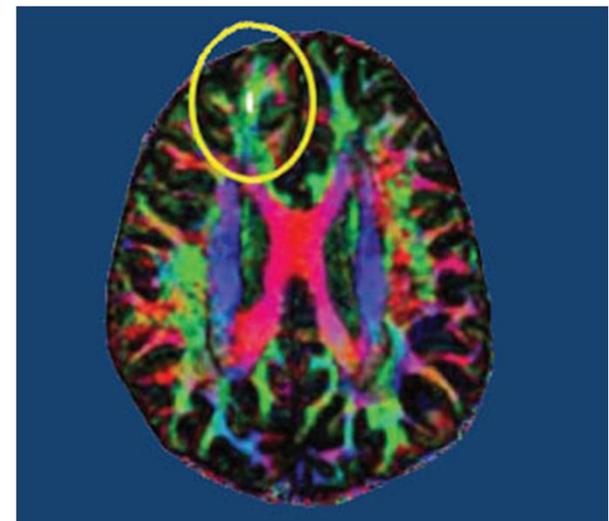
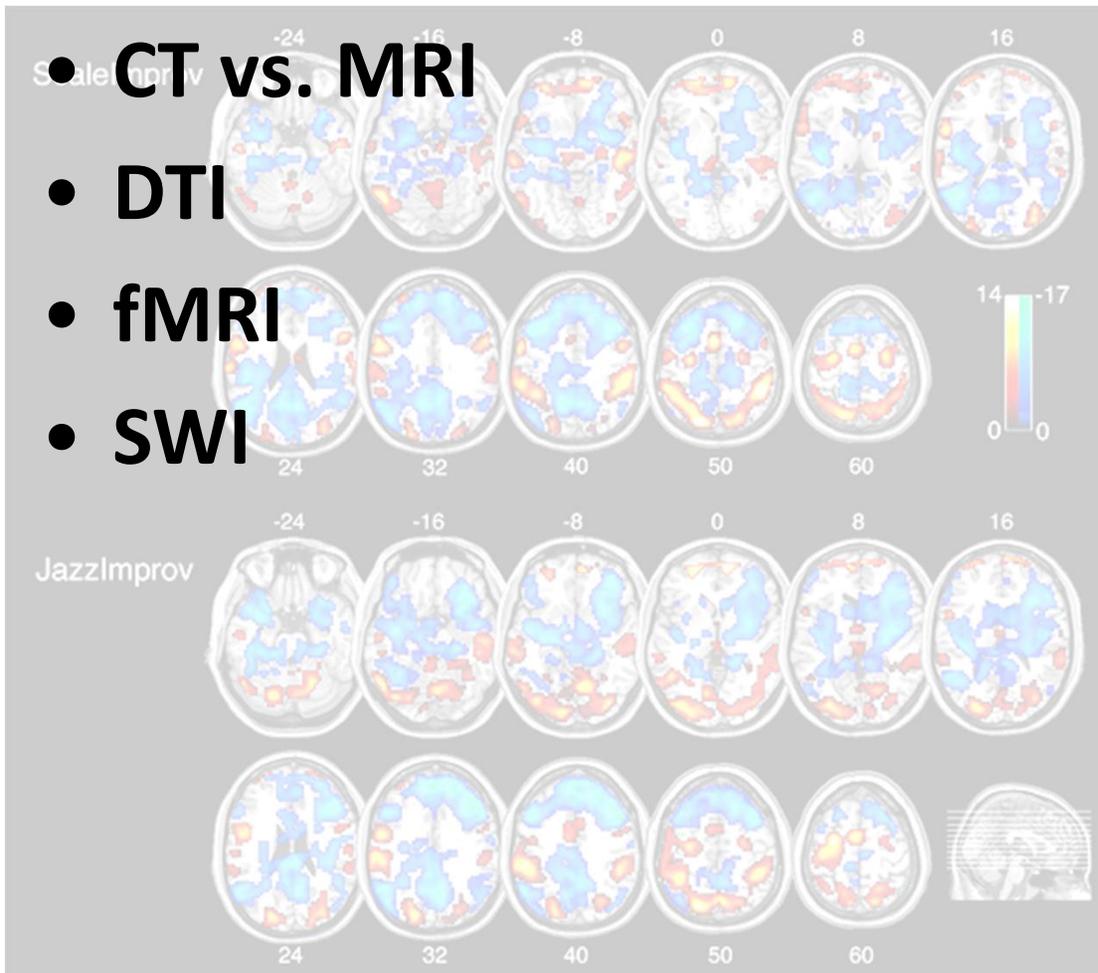
“ APOE e3

- . May aid recovery

“ APOE e4

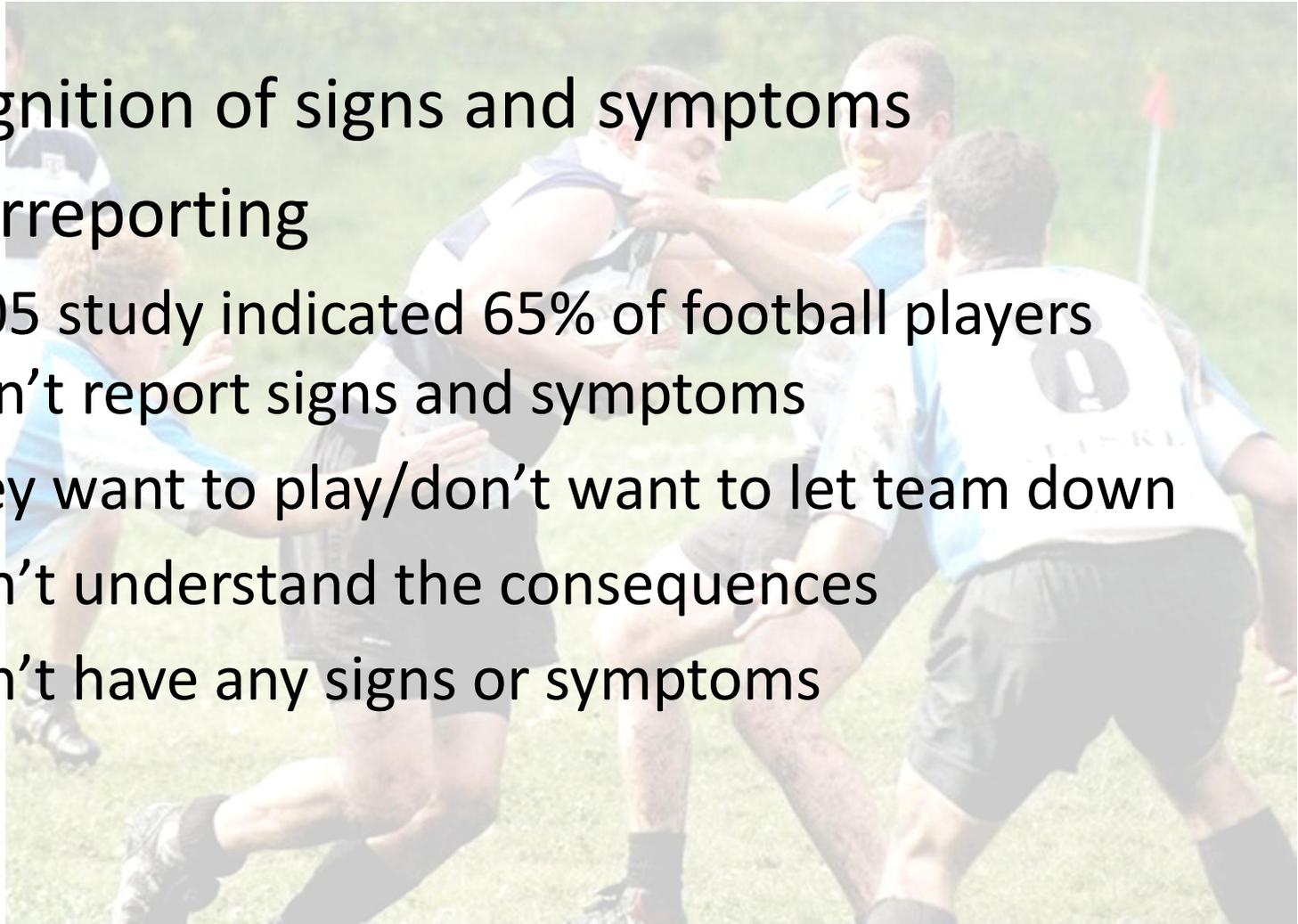
- . Known risk factor for Alzheimer's Disease
- . Associated with poorer outcome after traumatic brain injury
- . Unfavorable recovery

Neuroimaging



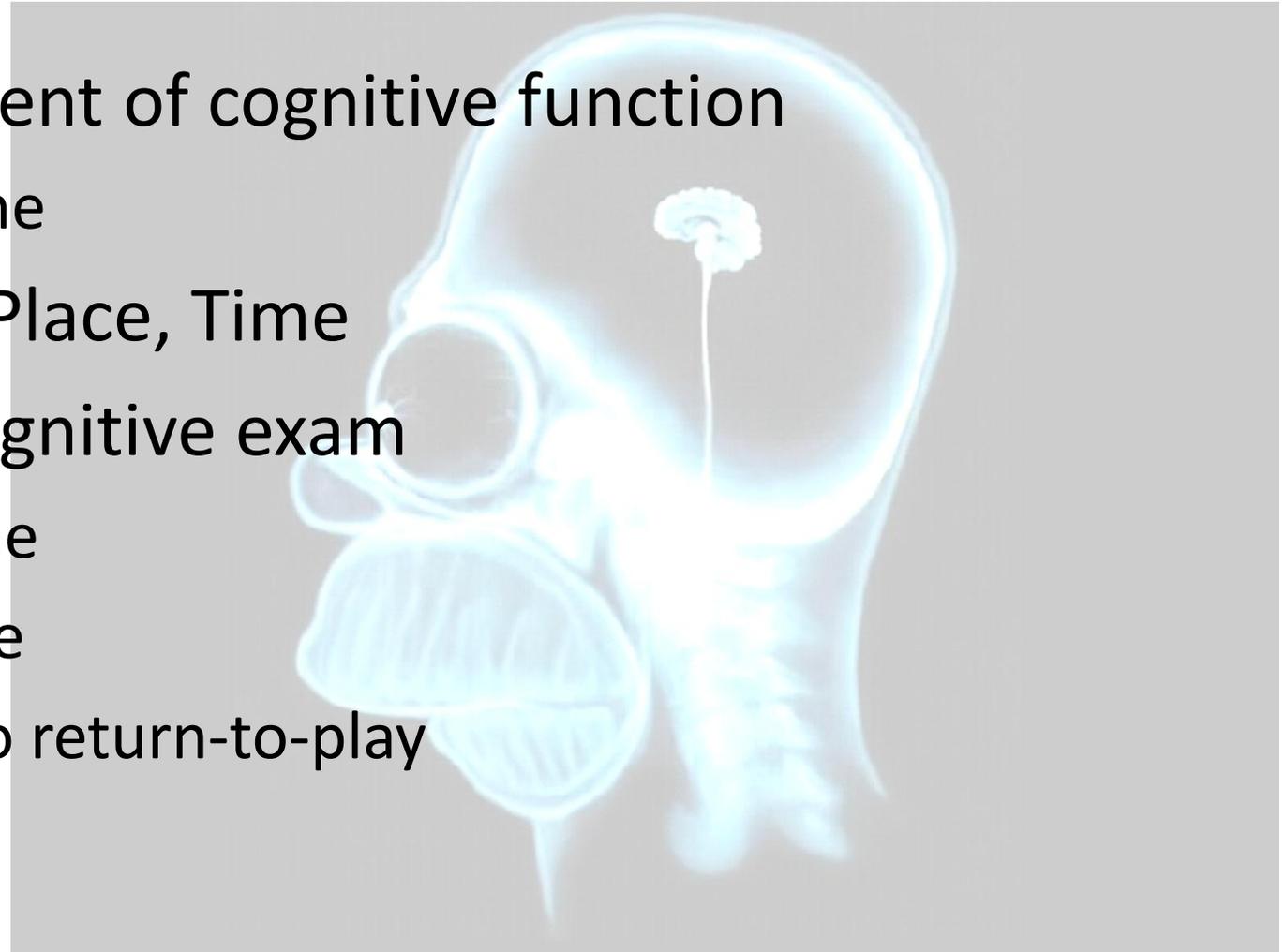
Concussion Management: Physical

- “ Recognition of signs and symptoms
- “ Underreporting
 - . 2005 study indicated 65% of football players didn't report signs and symptoms
 - . They want to play/don't want to let team down
 - . Don't understand the consequences
 - . Don't have any signs or symptoms



Concussion Management: Cognition

- “ Assessment of cognitive function
 - . Timeline
- “ Person, Place, Time
- “ Neurocognitive exam
 - . Baseline
 - . Sideline
 - . Prior to return-to-play



Neurocognitive Testing: ImPACT



Neurocognitive Testing: SCAT2

SCAT2

Sport Concussion Assessment Tool 2



Name: _____
 Sport/team: _____
 Date/time of injury: _____
 Date/time of assessment: _____
 Age: _____ Gender: M F
 Year of education completed: _____
 Examiner: _____

Symptom Evaluation

You should score yourself on the following symptoms, based on how the feel now.

Symptom	0	1	2	3	4
Headache	<input type="checkbox"/>				
"Pressure in head"	<input type="checkbox"/>				
Nausea/vomiting	<input type="checkbox"/>				
Blurred vision	<input type="checkbox"/>				
Balance problems	<input type="checkbox"/>				
Sensitivity to light	<input type="checkbox"/>				
Sensitivity to noise	<input type="checkbox"/>				
Feeling dazed/dog	<input type="checkbox"/>				
Feeling like "in a fog"	<input type="checkbox"/>				
Difficulty concentrating	<input type="checkbox"/>				
Difficulty remembering	<input type="checkbox"/>				
Fatigue or low energy	<input type="checkbox"/>				
Concussion	<input type="checkbox"/>				
Dizziness	<input type="checkbox"/>				
Things falling when you eat/drink	<input type="checkbox"/>				
Motion sickness	<input type="checkbox"/>				
Slurred speech	<input type="checkbox"/>				
Incontinence	<input type="checkbox"/>				
Nausea or dizziness	<input type="checkbox"/>				

What is the SCAT2?

This tool represents a standardized method of evaluating injured athletes for concussion and can be used in athletes aged from 10 years and older. It is endorsed by the Standardized Assessment of Concussion (SAC)™ team and the Macklecks guidelines for sideline concussion assessment.

Instructions for using the SCAT2

The SCAT2 is designed for the use of medical and health professionals. Provision baseline testing with the SCAT2 can be helpful for interpreting post injury test scores. Words in **italics** throughout the SCAT2 are the instructions given to the athlete by the tester.

What is a concussion?

A concussion is a disturbance in brain function caused by a direct or indirect force to the head. It results in a variety of neuro-specific symptoms (like those listed below) and often does not involve loss of consciousness. Concussion should be recognized in the presence of **any one or more** of the following:

- Symptoms such as headache, or
- Physical signs (such as unsteadiness), or
- Abnormal behaviour.

Any athlete with a suspected concussion should be REMOVED FROM PLAY, immediately assessed, movement for deterioration (i.e., should not be left alone) and should not drive a motor vehicle.

Overall rating
 If you think the athlete was prior to the injury, how different is the athlete compared to how they usually feel? How often does the athlete have any symptoms with minimal activity? Y N
 Do the symptoms get worse with minimal activity? Y N
 Do the symptoms get worse with normal activity? Y N

Cognitive & Physical Evaluation

1. Symptom score (from page 1)

Sum of all symptoms: **0-22**

2. Physical signs score

Has there been a loss of consciousness? Y N
 Any loss of memory? Y N
 Has there been a seizure? Y N
 Physical signs score (1 point for each negative response): **0-12**

3. Glasgow coma scale (GCS)

Best eye response (E): **1-4**
 Best verbal response (V): **1-5**
 Best motor response (M): **1-6**
 Total score: **3-15**

4. Sideline Assessment – Maddocks Score

I am going to read you a series of five questions, please listen carefully and give your best effort.

Modified Maddocks questions (1 point for each correct answer):

What month is it now? 0 1 2 3 4

What month did you last get married? 0 1 2 3 4

What month did you last get divorced? 0 1 2 3 4

What month did you last get married or divorced? 0 1 2 3 4

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What month did you last get married or divorced? 0 1 2 3 4

What month did you last get married or divorced? 0 1 2 3 4

5. Cognitive assessment

1 point for each correct answer

What is the date today? 0 1 2 3 4

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6. Balance examination

1 point for each correct answer

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What

SCAT2 Example

Cognitive Rest

- “ Athlete’s role as a student
- “ Therapeutic goal = tolerable level
- “ What is cognitive rest?
- “ Individualized assessment



Return-to-play Guidelines

- “ **Graduated return-to-play**
 - . Physical and cognitive stepwise approach
 - . Each step over 24 hours
 - . If symptomatic with progression, regress one step
- “ **Final clearance by licensed medical personnel.**

Seven Steps to Safe Return

- ” **Step 1.** *Complete cognitive rest.*
- ” **Step 2.** *Return to school full-time.*
- ” **Step 3.** *Light exercise.*
- ” **Step 4.** *Running in the gym or on the field.*
- ” **Step 5.** *Non-contact training drills in full equipment.*
- ” **Step 6.** *Full contact practice or training.*
- ” **Step 7.** *Play in game.*

Remember...

“ It is not about return-to-play, but about

RETURN-TO-PRACTICE

Culture Change

- “ Kyle Turley, Offensive Lineman NFL 1998-2007
 - . “That’s football. You’re told either that you’re hurt or that you’re injured. There is no middle ground. If you are hurt, you can play. If you are injured, you can’t, and the line is whether you can walk and if you can put on a helmet and pads.”
 - . Culture of Courage has been built around the ability to play through pain and injury

“the brutality of
the prize ring has
invaded college
football, and
could end up
destroying it.”

As stated in 1905
by President
Theodore
Roosevelt



Save our Sports (SOS)

10 Point Plan for Safer Sports

1. Encourage mandatory brain trauma education for coaches, athletic trainers, parents and athletes.
2. Develop better methods of concussion detection and diagnosis
3. Develop better methods of concussion management
4. Reevaluate how the game is practiced
5. Reevaluate protective equipment
6. Reevaluate techniques of play
7. Reevaluate the rule
8. Reevaluate rule enforcement and the role of referees
9. Reconsider the culture of the game
10. Consider minimum medical resources



Minimum Recommended Guidelines

7 Steps for Brain Safety

1. Preseason Education for Coaches
2. Preseason Education for Athletes
3. Preseason Education for Parents
4. Coaches Use CDC's Heads Up Materials
5. Adopt CDC's Concussion Action Plan for Removal and Return-to-Play
6. Prevention through Neck Strengthening
7. Prevention through Overall Brain Trauma Reduction

CDC Concussion Action Plan

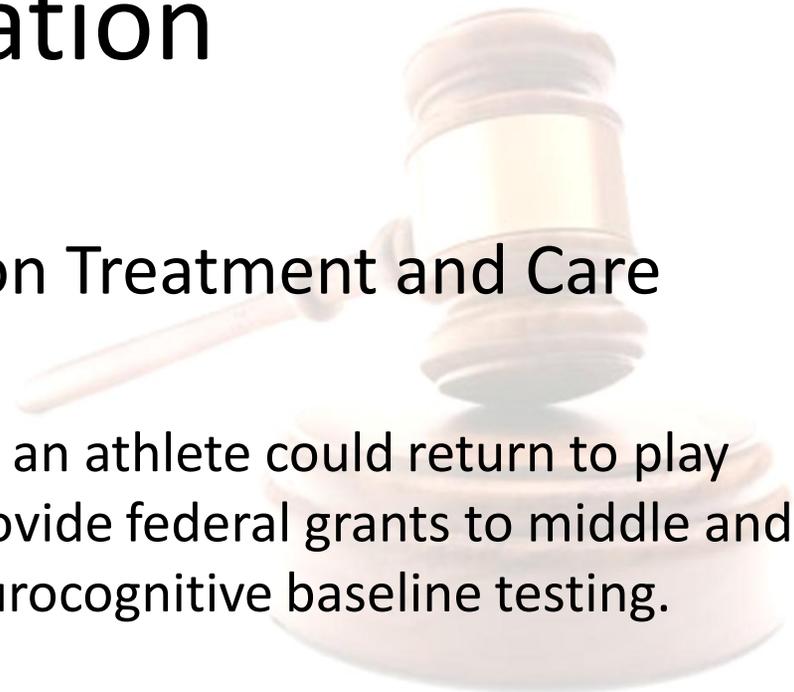
ACTION PLAN

If you suspect that a player has a concussion, you should take the following steps:

1. Remove athlete from play.
2. Ensure athlete is evaluated by an appropriate health care professional.
Do not try to judge the seriousness of the injury yourself.
3. Inform athlete's parents or guardians about the known or possible concussion and give them the fact sheet on concussion.
4. Allow athlete to return to play **only** with permission from an appropriate health care professional.

Legislation

- “ Zachery Lystedt Act
- “ Federal HR 1347 Concussion Treatment and Care Tools Act (ConTACT Act)
 - set federal standards for when an athlete could return to play following a head injury and provide federal grants to middle and high schools to implement neurocognitive baseline testing.
- “ Kansas HB 2095/SB 33
 - Basically Zachery Lystedt Act, just pull them from game if concussion suspected
 - Passed Senate Committee on Public Health and Welfare as of 2/17/2011 to go to Senate floor for vote



Updated Concussion References/Research

- **Functionally-Detected Cognitive Impairment in High School Football Players Without Clinically-Diagnosed Concussion**
 - Thomas M. Talavage, PhD et al. Journal of Neurotrauma; 2010 Oct 1. [Epub ahead of print]
- 17% of players were missed for diagnosis
- Higher number of top-front head collision

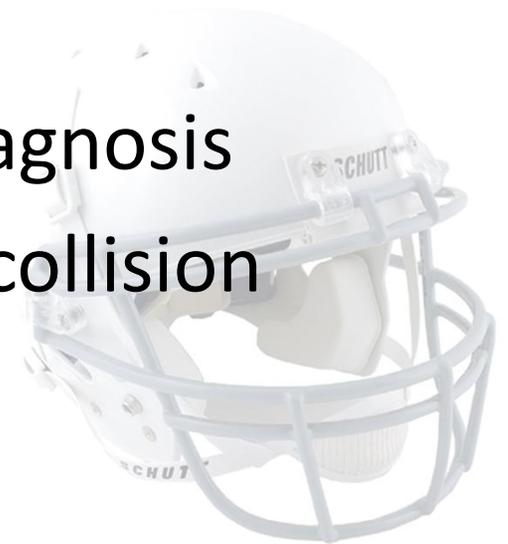
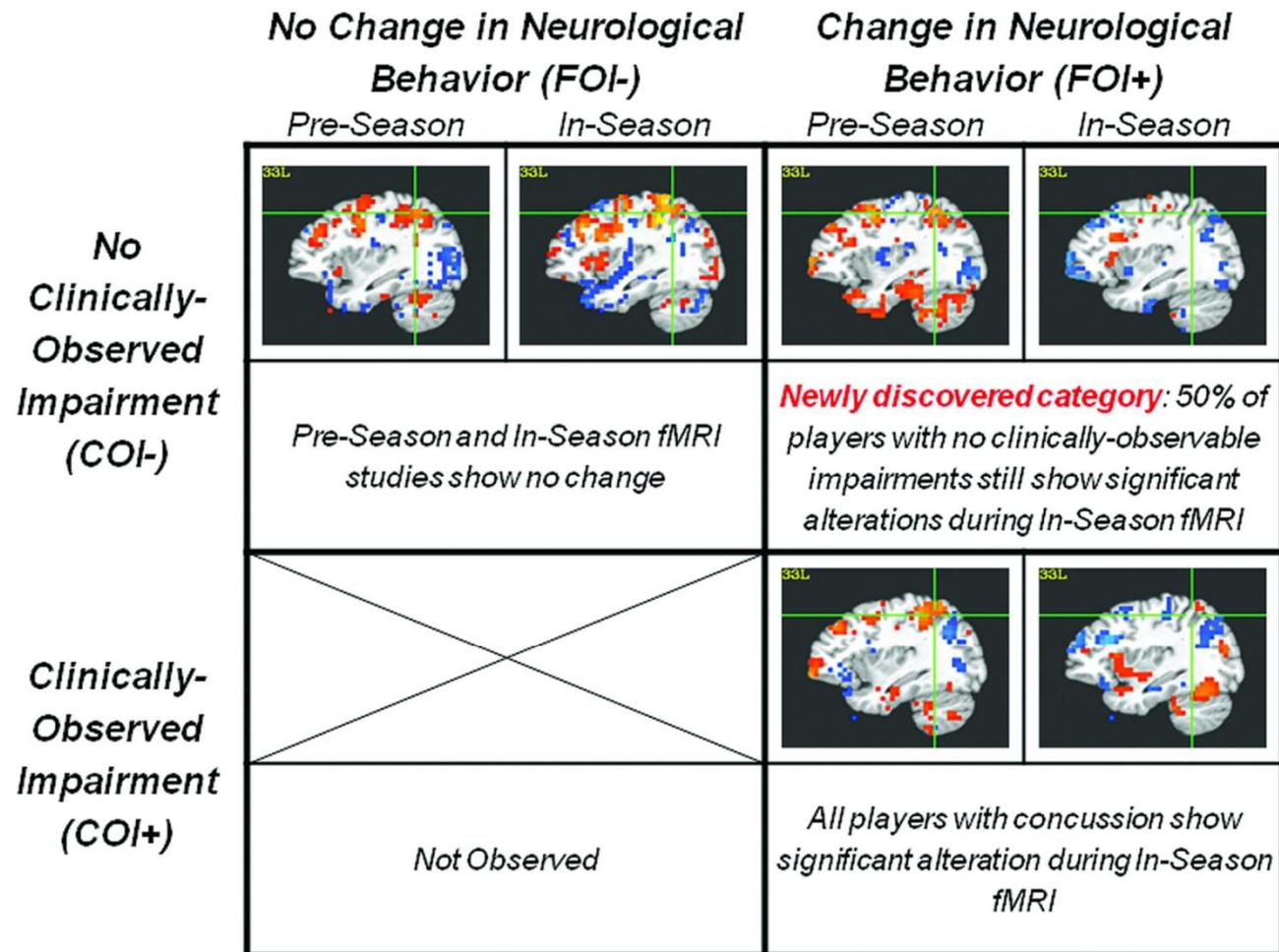


Figure 1



Helmet Studies

- “ University of North Carolina HITS system
 - . G-Force measurement
 - . No g-force determines concussion
 - . Repetitive hits
- “ HITS data suggests in an average football season, a lineman could be struck in the head 1000 times.
 - . For a 10-year NFL player, that’s 18,000 hits
- “ Does better helmets = more reckless play?

Case Study: Preston McFarland

- “ March 26th Concussed in baseball game
- “ March 27th 45 Minute eval by Family Doctor
- “ March 29th ImPACT Test; Ortho doc reads
- “ March 30th Seattle Sports Concussion Clinic; graduated return
- “ March 31st Takes Stats
- “ April 5th Second ImPACT; cleared by Sports Med Dr. and Neuropsychologist
- “ April 6th First game; Symptom free for 10 days, graduated return to play; remains symptom free



What Worked

- ” Athlete Education
- ” Coach and Team Education
- ” Parent Education
- ” Physician Concussion Education
- ” Repeat ImPACT test compared to baseline
- ” Return-to-play ImPACT test
- ” Concussion specialists
- ” Graduated return-to-play guidelines

Evidence Based Recommendations for Health Care Providers

- “ Educate the patient and family about
 - . Post-concussive symptoms and management
 - . Where to seek further help
 - . Risk of further serious injury with subsequent head trauma
- “ Make sure that ED physician/PCP recommends current step-wise return to play guidelines
- “ Advocate for pt. access to neurocognitive testing

Evidence Based Recommendations for Parents

- “ When in doubt, sit them out
- “ Medical clearance before return to play
- “ Yearly sports waivers and parent education, if your school does do this – insist on it
- “ Advocate
 - . Legislation
 - . Community
 - . Be a voice

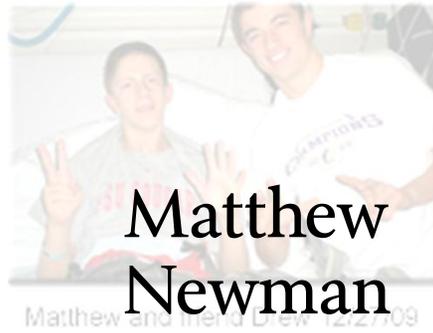
And for the Athletes

- “ Reporting your symptoms is important, tell a parent and/or coach
- “ Being out for a couple of games is better than missing the whole season or more
- “ Use protective equipment according to manufacturers guidelines

The Faces of Concussion

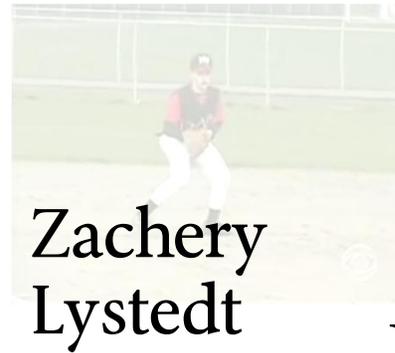


Dylan
Mello

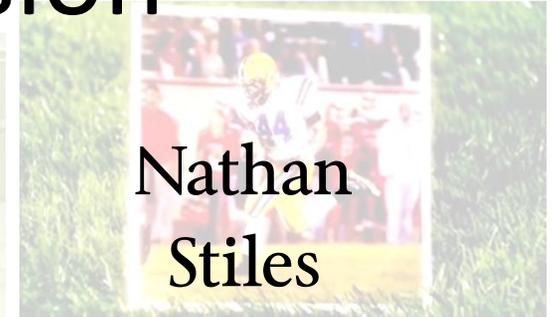


Matthew
Newman

Matthew and friend Drew 12/27/09



Zachery
Lystedt



Nathan
Stiles

William
Summa



Joe
Bonitatebus



Michelle
Pelton



Preston
Plevretes



Lindsey
Vonn

Thank you

For more information, contact:
Jennie Vargas, RN, BSN, BS, MPA
Injury Prevention and Trauma Education
Specialist
Trauma and Burn Services
The University of Kansas Hospital
(913) 588-6536
jvargas2@kumc.edu