Concussion

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Primary Care Sports Medicine

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Disclosures

- I have no financial interest, arrangement or relationship that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation


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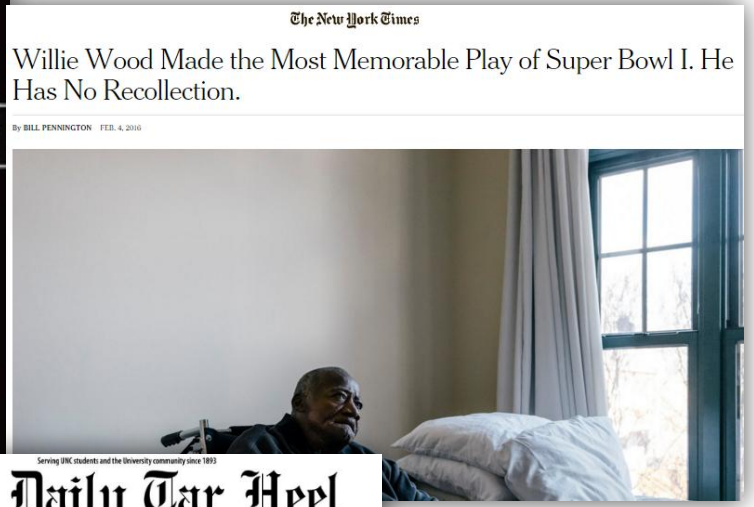
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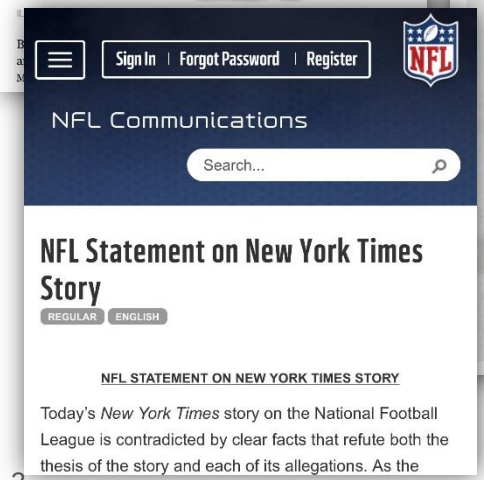
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THE HITS THAT ARE CHANGING THE GAME
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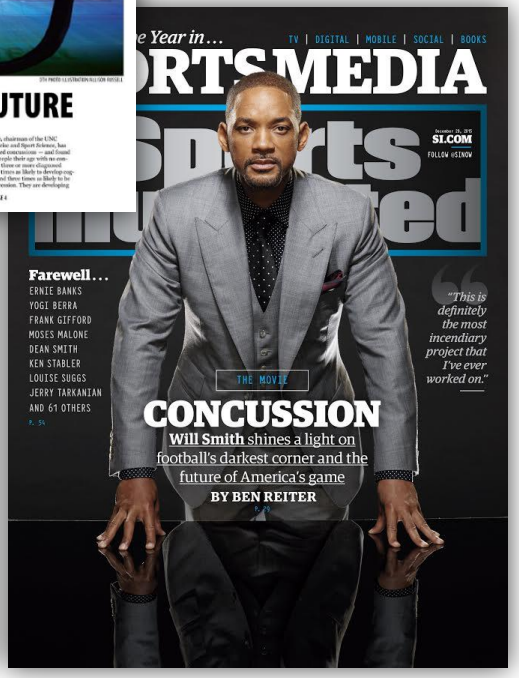
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President Obama Hosts the Healthy Kids and Safe Sports Concussion Summit

David Hudson
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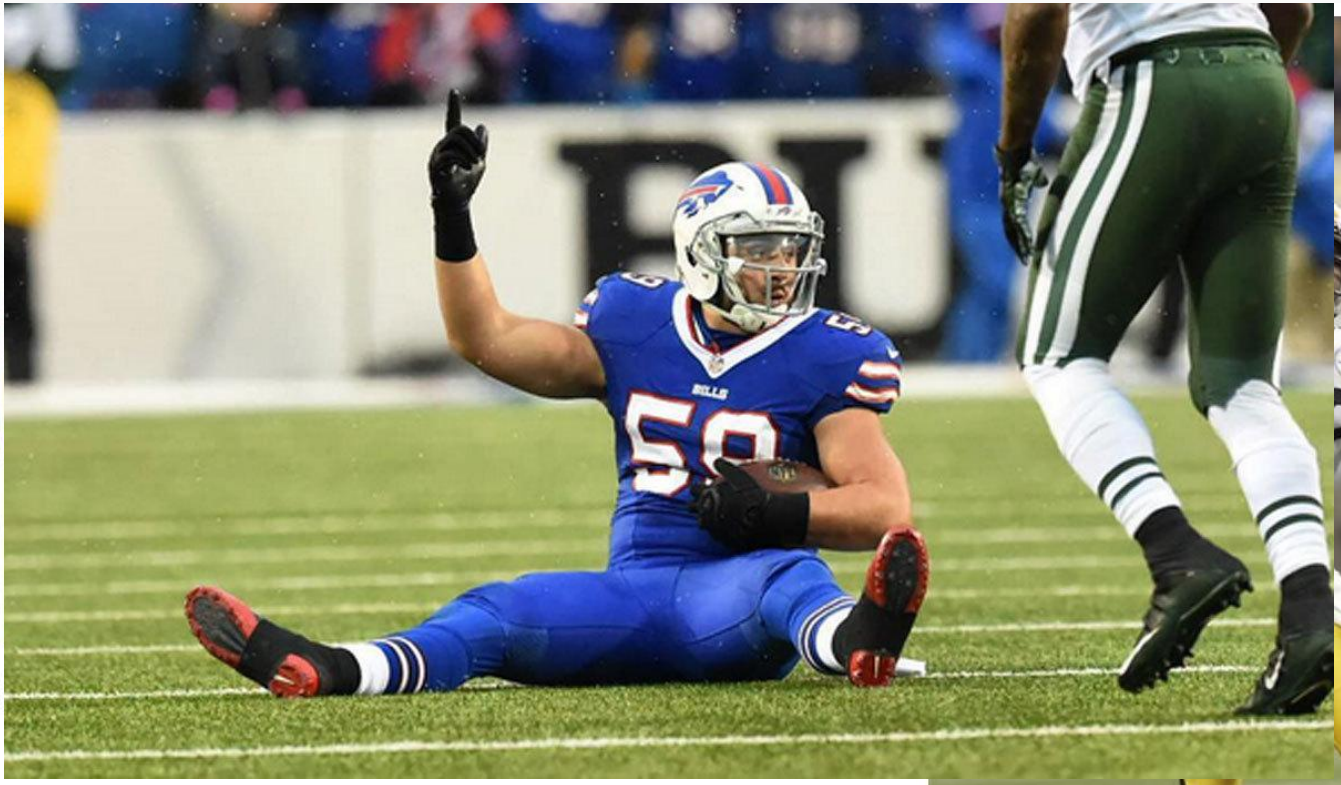
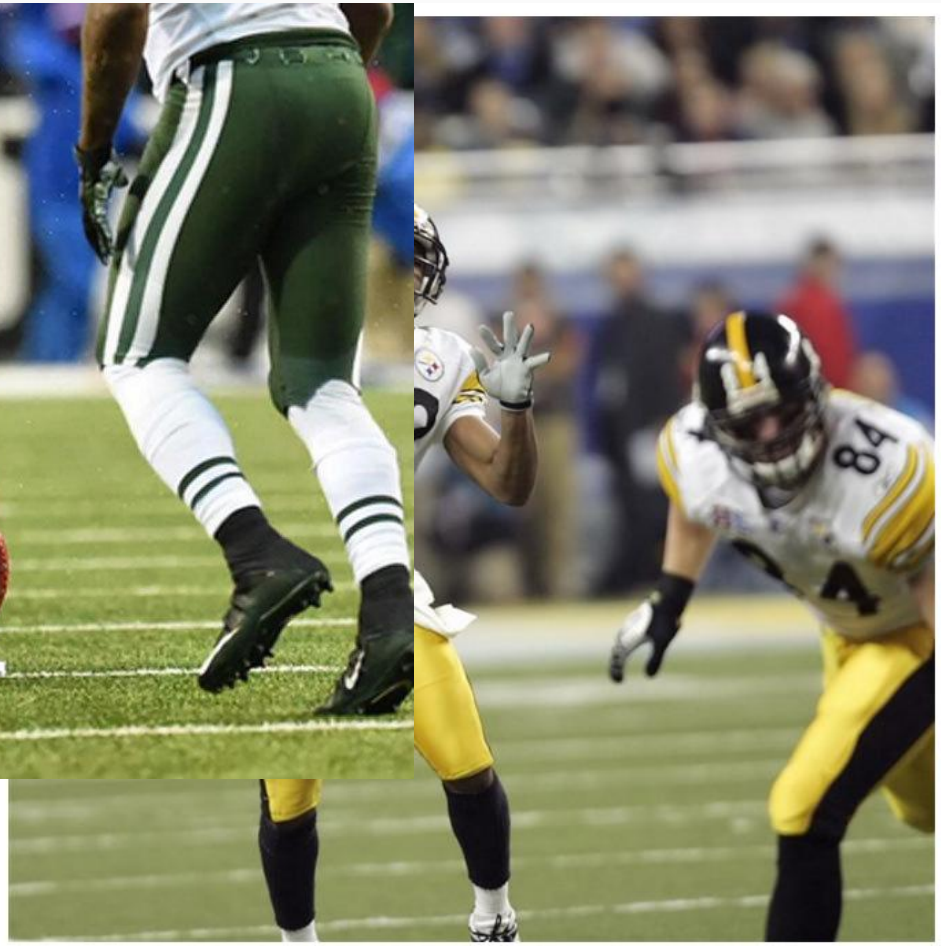
PHOTOS OF THE DAY

Bills LB A.J. Tarpley retires at 23, citing concussions

USA TODAY Sports 9:43 a.m. EDT April 7, 2016





Associated Press file photo

Antwaan Randle El throws a 43-yard touchdown pass in Super Bowl XL. If he had to go back and do it all again, he said he wouldn't play football.

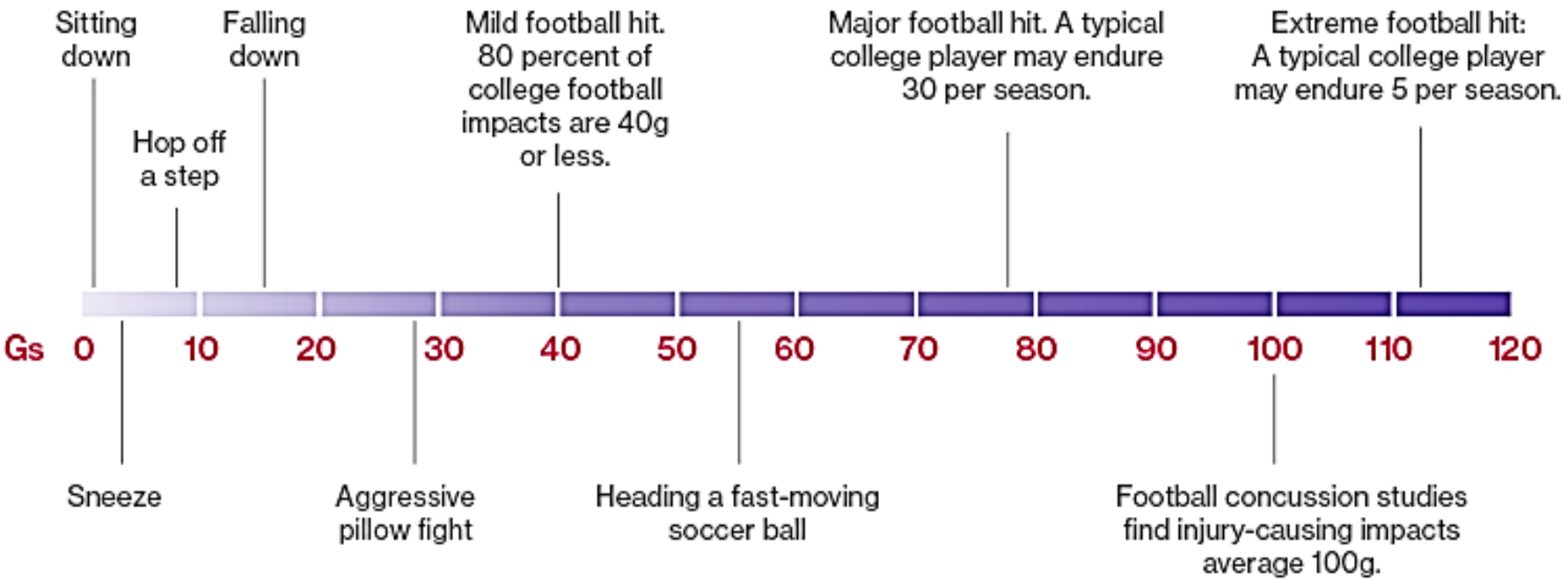
ESPN NFL NBA MLB NCAAM Soccer NHL ...

Youth football participation drops

Nov 14, 2013

Broglio et al J Neurotrauma 2011

- 30 mph car crash wearing seatbelt = 20g
- High school football players receive an average of 652 head blows > 15g of force



Sources: National Institutes of Health, Virginia Tech, National Safety Council

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Pop Warner News

> Pop Warner > About Us > Pop Warner News > Rule Changes Regarding Practice & Concussion Prevention

Rule Changes Regarding Practice & Concussion Prevention

By Pop Warner National Office
June 13, 2012

In our continuing efforts to provide the safest playing environment for our young athletes, and in light of developing concussion research, we would like to announce some important rule changes for the 2012 season.

With these rule changes, Pop Warner becomes the first youth football organization to officially limit contact during practices. The changes can be found in the 2012 Official Pop Warner Rule Book and are a result of the advice of our Medical Advisory Board and the direct input of Pop Warner regional and local administrators and coaches.

The New Rules Are as Follows:

1. No full speed head-on blocking or tackling drills in which the players line up more than 3 yards apart are permitted. (Having two linemen in stances immediately across the line of scrimmage from each other and having full-speed drills where the players approach each other at an angle, but not straight ahead in to each other are both permitted.) **However, there should be no intentional head-to-head contact!**

2. The amount of contact at each practice will be reduced to a maximum of 1/3 of practice time (either 40 minutes total of each practice or 1/3 of total weekly practice time). In this context, "contact" means any drill or scrimmage in which drills; down line vs. down line full -speed drills; and scrimmages.

June 13, 2012

ESPN College Football

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NCAA suggests contact limits

ESPN.com news services

Updated: July 8, 2014, 1:48 AM ET

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The NCAA is suggesting that football teams hold no more than two contact practices per week during the season in guidelines that grew out of a safety and concussion summit early this year.

Practice limits were among several recommendations released Monday by the NCAA, which called them guidelines that could change "in real time" rather than rules passed through legislation.

The practice guidelines also recommend four contact practices per week during the preseason and no more than eight of the 15 sessions during spring football. The NCAA already has legislation regarding preseason and spring practices.

The governing body of college sports is also suggesting that schools have independent doctors to evaluate injuries and a return-to-learn process for integrating athletes back into their academic work after they have been diagnosed with a concussion.

By recommending the regular-season limit of two contact practices per week, the NCAA is essentially joining a growing chorus in college football. It's already in place in the Ivy League and Pac-12, and many teams have cut back on the number of contact practices, defined as any workout involving tackling or full-speed blocking.

(+) Enlarge

AP Photo/Mark J. Terrill

The NCAA is suggesting guidelines that could limit how many contact practices schools can hold a week during the season.

July 8, 2014

California Passes Concussion Bill AB 2127

The California Concussion Bill, AB 2127, was signed into law this week by Gov. Brown. The legislation prohibits high school and middle school football teams from conducting more than two full-contact practices per week during the preseason and regular season. The bill also prohibits the full-contact portion of a practice from exceeding 90 minutes in any single day and completely prohibits full-contact practice during the off-season.

The bill specifically urges the California Interscholastic Federation to work in consultation with the American Academy of Pediatrics and AMSSM to develop and adopt rules and protocols in implementing return to play decisions. Past AMSSM President Cindy Chang, MD, was instrumental in the passage of this bill.

July 21, 2014

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Understanding Concussions

Concussion

A complex pathophysiological process affecting the brain, induced by biomechanical forces

- Either by direct blow to the head or elsewhere on the body with an ‘impulsive’ force transmitted to head
- No abnormality on standard neuroimaging studies
- Rapid onset of short-lived impairment of neurologic function that resolves spontaneously
- Acute symptoms largely reflect a functional disturbance rather than a structural injury

McCrory et al. Br J Sports Med 2013;47:250-258
(Zurich Consensus Statement, 2012)

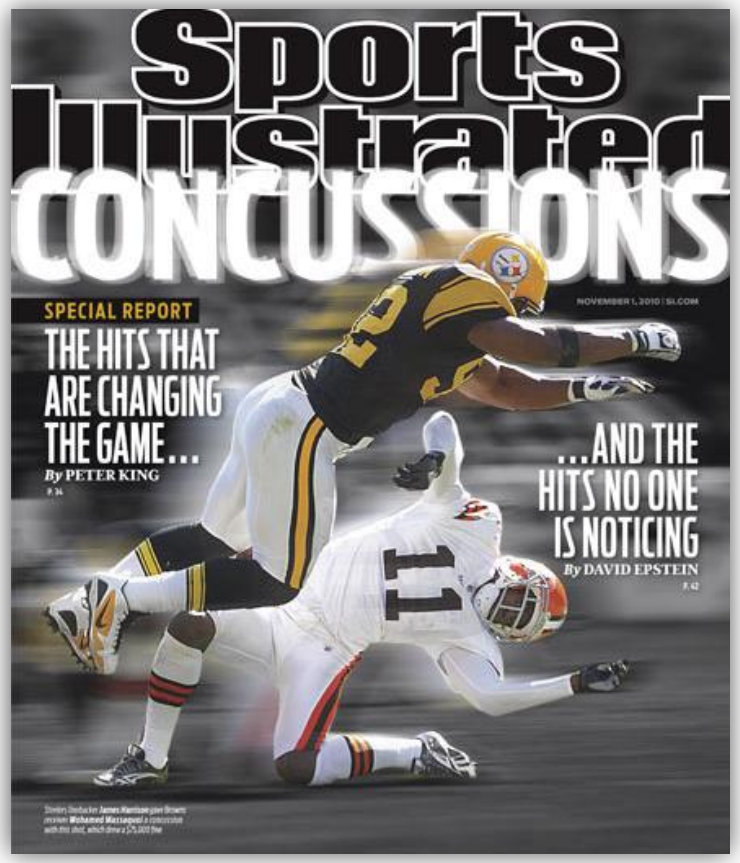
Concussion

- 1.6 million to 3.8 million athletes yearly (CDC estimate)
  - 5-9% of all sports injuries

    McCrea et al. Clin J Sports Med 2004;14(1)

- Often unreported
  - Only 47.3% high school football players reported their injury

    Harmon et al. Br J Sports Med 2013;47, 15-26



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HCAMP

Hawaii Concussion Awareness Management Program

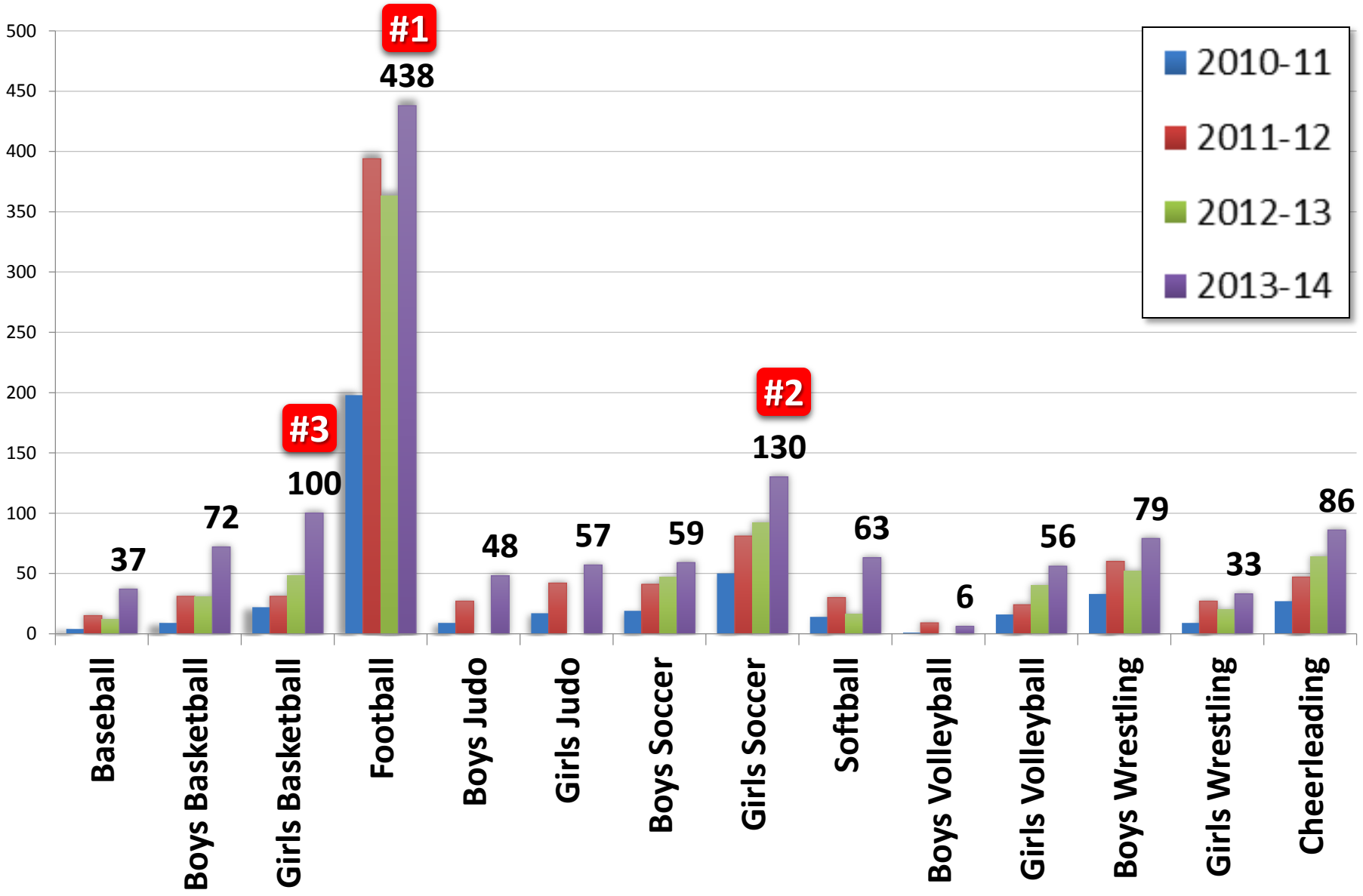
Nathan M. Murata, Ph.D. Principal Investigator

Department of Kinesiology & Rehab Science

Ross S. Oshiro, MS, ATC, CSCS Project Director

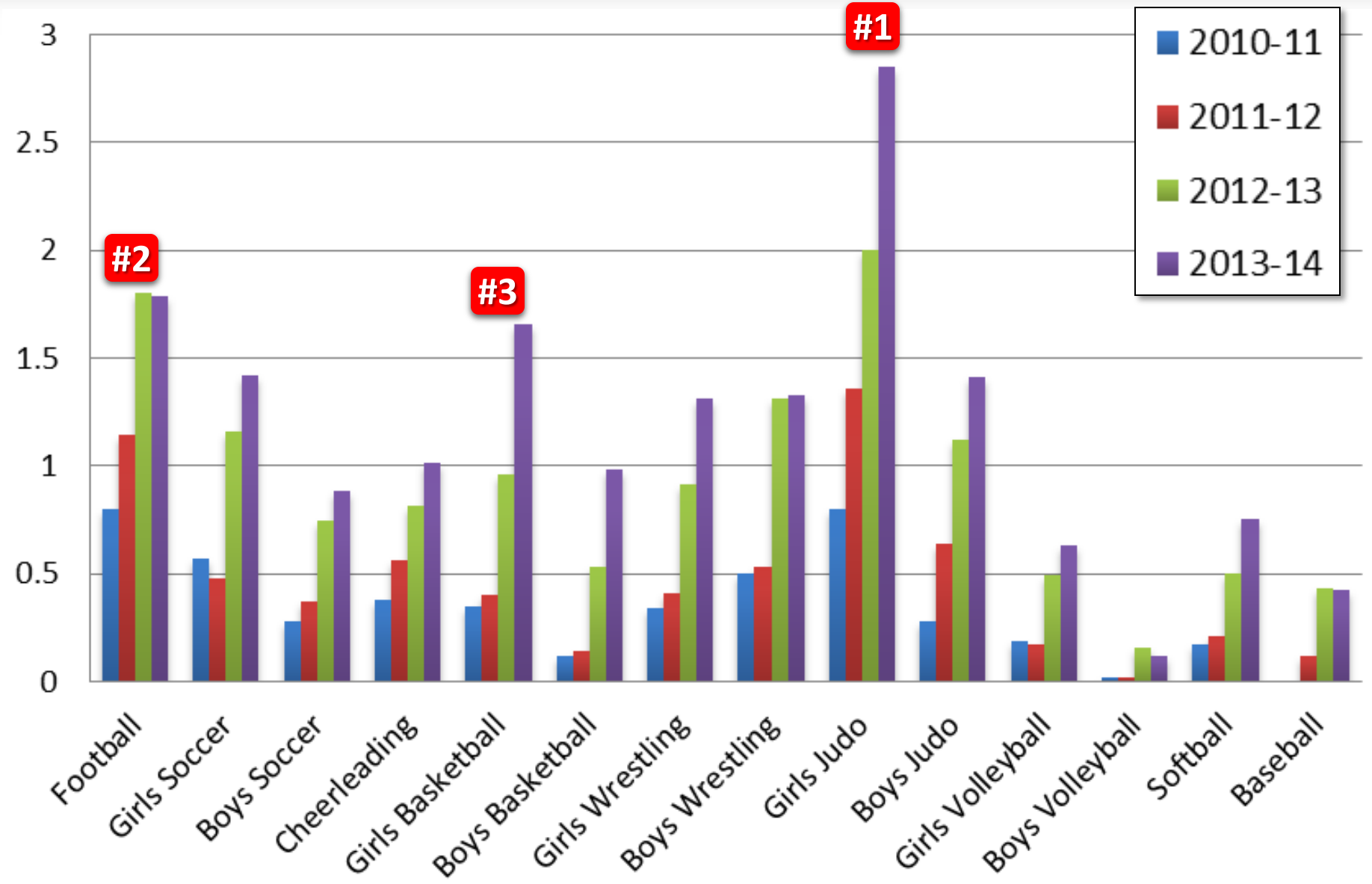
Troy M. Furutani, MS, ATC Co-Project Director

Number of Concussion by Sport SY 2010-14



HCAMP
Hawaii Concussion Awareness Management Program

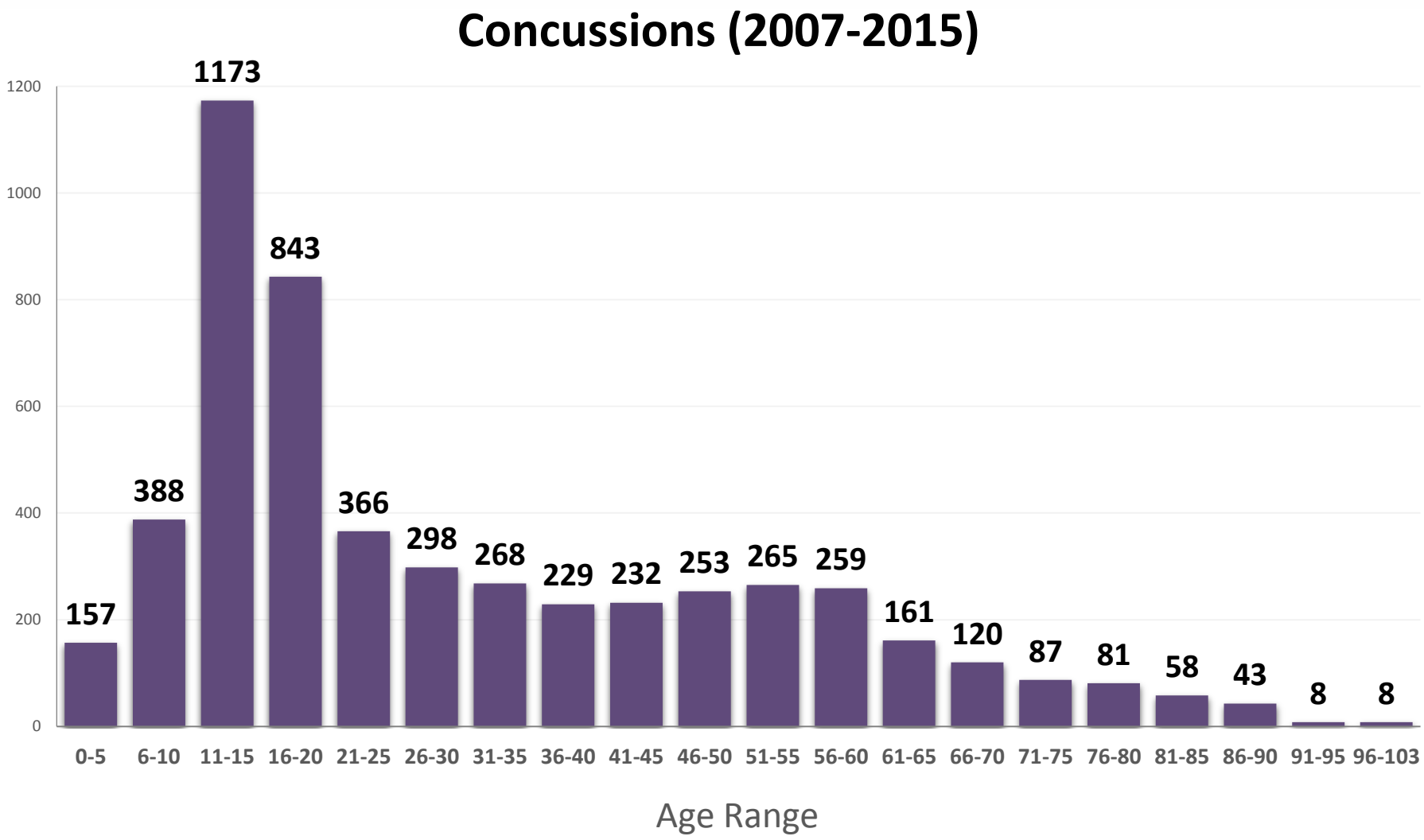
Concussion Injury Rate per 1000 Exposures for 14 Sports during School Years 2010-2014



KP Hawaii Data

Year	Concussions	Membership	% of Membership
2007	391	221,403	0.18%
2008	465	222,594	0.21%
2009	446	223,795	0.20%
2010	569	229,186	0.25%
2011	591	226,900	0.26%
2012	614	224,591	0.27%
2013	683	224,591	0.30%
2014	678	226,603	0.30%
2015	745	231,996	0.32%
Total	**5,182**		

KP Hawaii Data



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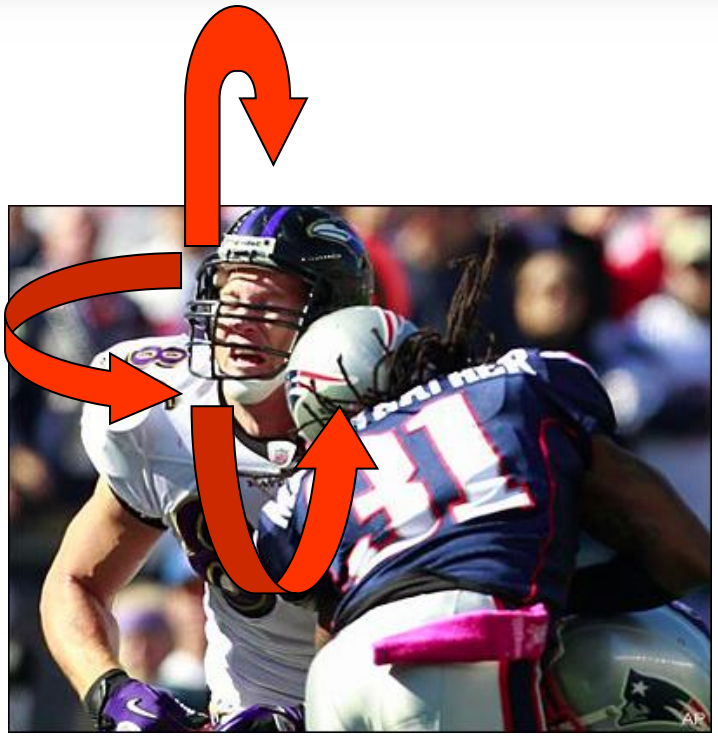
Concussion Biomechanics

- **Forces**
  - Contact
  - Inertial (acceleration)
    - Tissue strain
    - Rotational > Linear
- **Head Injury Mechanism**
  - Impact
    - Contact + inertial
  - Impulsive
    - Inertial only
    - Head does not have to strike object

Concussion Biomechanics

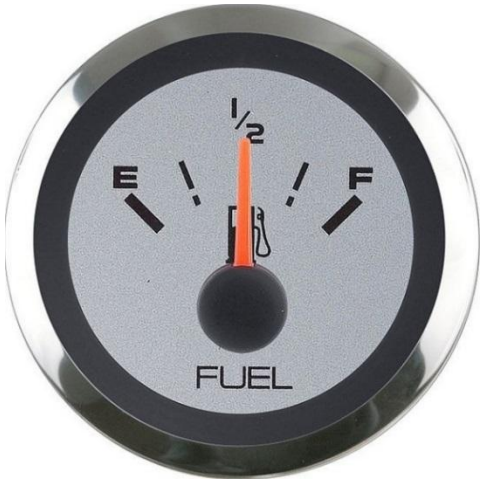
The patterns of tissue injury within the brain are different if the rotational acceleration occurs in a different plane



Understanding the Basis of Concussion

- What is the effect of these linear and rotational forces on the living tissue and neural networks?

Neurometabolic Cascade



- Energy (glucose) deficit and abnormal energy metabolism (mitochondrial dysfunction)
- Poor cerebral (brain) function

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Vulnerability

<u>The Bottom Line</u>:
While the brain is injured it is more vulnerable to additional injury

This is the fundamental basis guiding return to play guidelines and decision making

“when is it ok to hit my head again?”

Barkhoudarian et al. Clin Sports Med 2011;30:33-48

Number of Days Missed
Report from August 1, 2011 to July 31, 2014

Days Missed	MEAN	SD
August 1, 2013 – July 31, 2014 (n=1370)	**26.15**	**25.17**
August 1, 2012 - July 31, 2013 (n=1140)	**26.2**	**18.98**
August 1, 2011 - July 31, 2012 (n=845)	**23.5**	**16.5**

Concussion Evaluation “On the Field”

Recognize the Injury

The Big Hit?

Magnitude of impact does NOT correlate with clinical injury (CFB)

Guskiewicz et al. Neurosurgery 2007;61(6)

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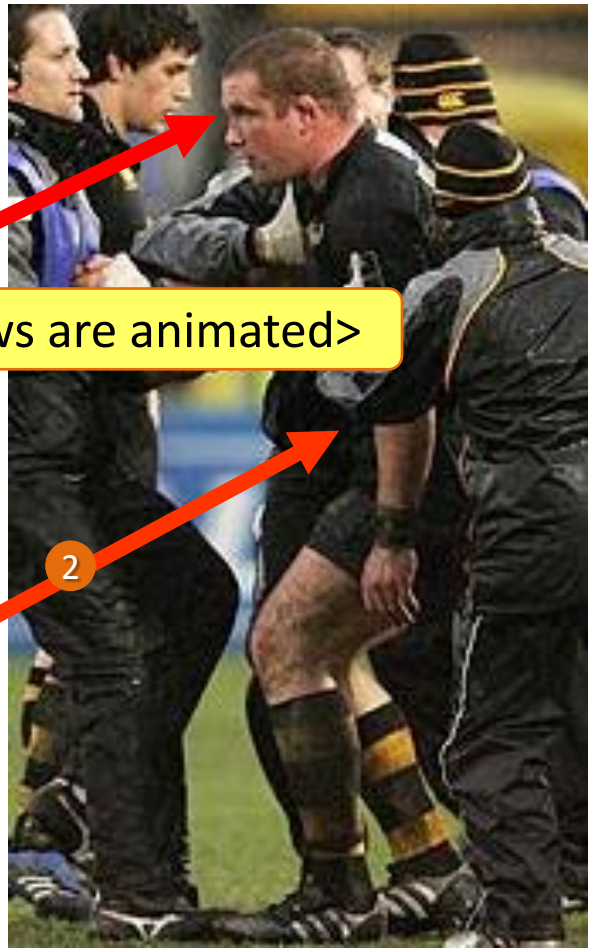
Loss of Consciousness

- ***Brief*** LOC does NOT correlate with concussion severity
- ***Prolonged*** LOC (> 1 minute) has been shown to be associated with more severe injury

McCrory et al. Br J Sports Med 2013;47:250-258
(Zurich Consensus Statement, 2012)

Physical Signs

- Loss of consciousness
- Concussive convulsion / impact seizure
- Amnesia
- Vacant stare / glassy eyed
- Significantly decreased playing ability
- Gait unsteadiness / loss of balance
- Poor coordination
- Vomiting
- Slurred speech



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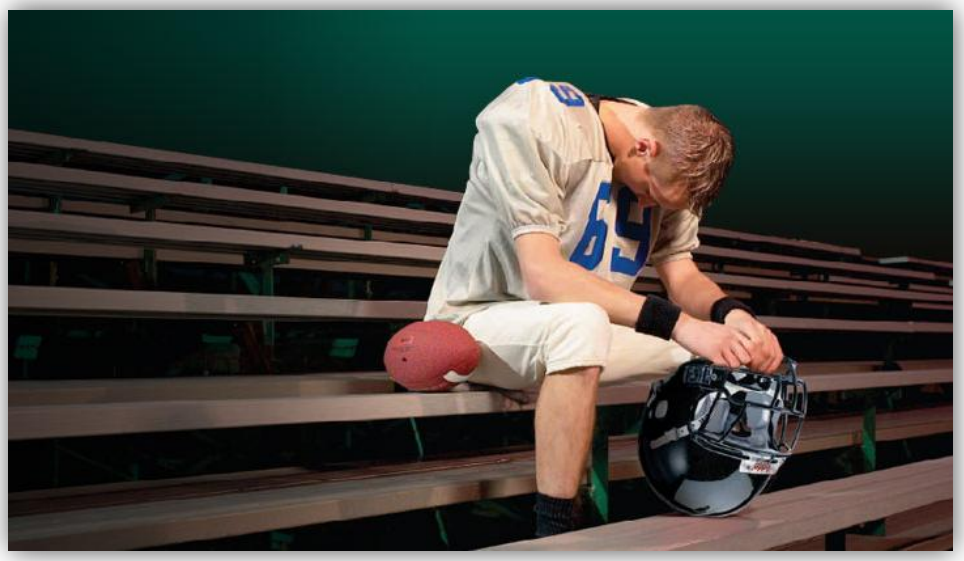
Cognitive Impairment

- Slowed reaction time
- Slow to answer questions or follow directions
- Confusion
- Difficulty concentrating / easily distracted
- Difficulty remembering

Behavioral Changes

- Irritability
- Emotional lability
- Displaying unusual or inappropriate emotions
- Personality changes
- Inappropriate playing behavior



Diagnosis

EXAMINATION

- **Concussion symptoms**
- **Physical Exam**
  - Head and neck
  - Skull fracture
  - Cervical spine injury
    - Neck pain or tenderness
    - Pain w/ neck movement
    - Weakness and/or numbness or tingling of extremities
- Intracranial injury
  - Neurologic examination
  - Cognitive assessment
  - Balance evaluation

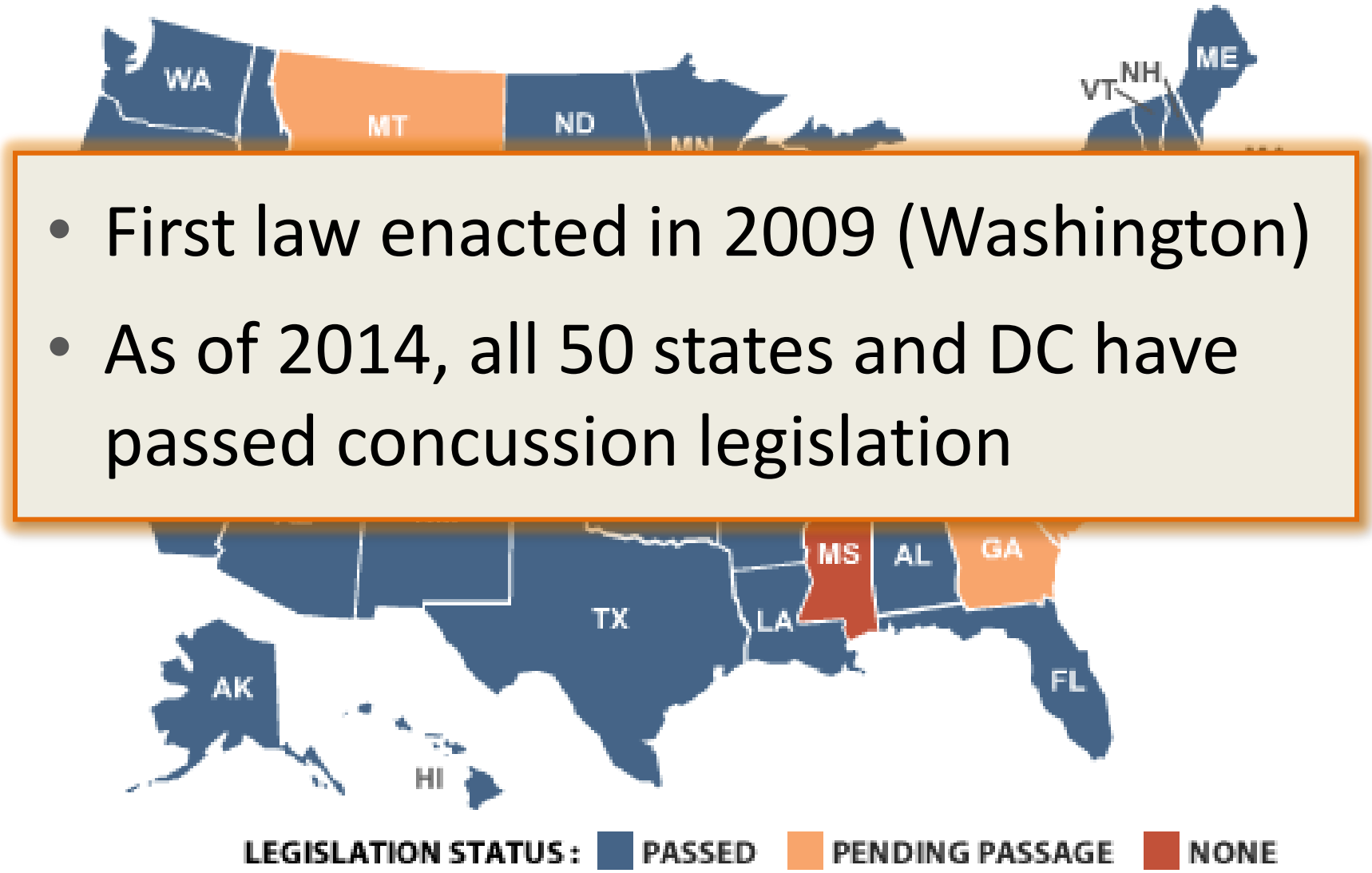
Disposition

- Athletes should be observed for the first few hours after injury and should not be left alone
- Monitor for deteriorating mental status or worsening symptoms
  - Worsening headache
  - Nausea or vomiting
  - Increased lethargy
  - Focal neurologic deficits

Disposition

WHEN IN DOUBT, SIT THEM OUT

Concussion Laws (2013)

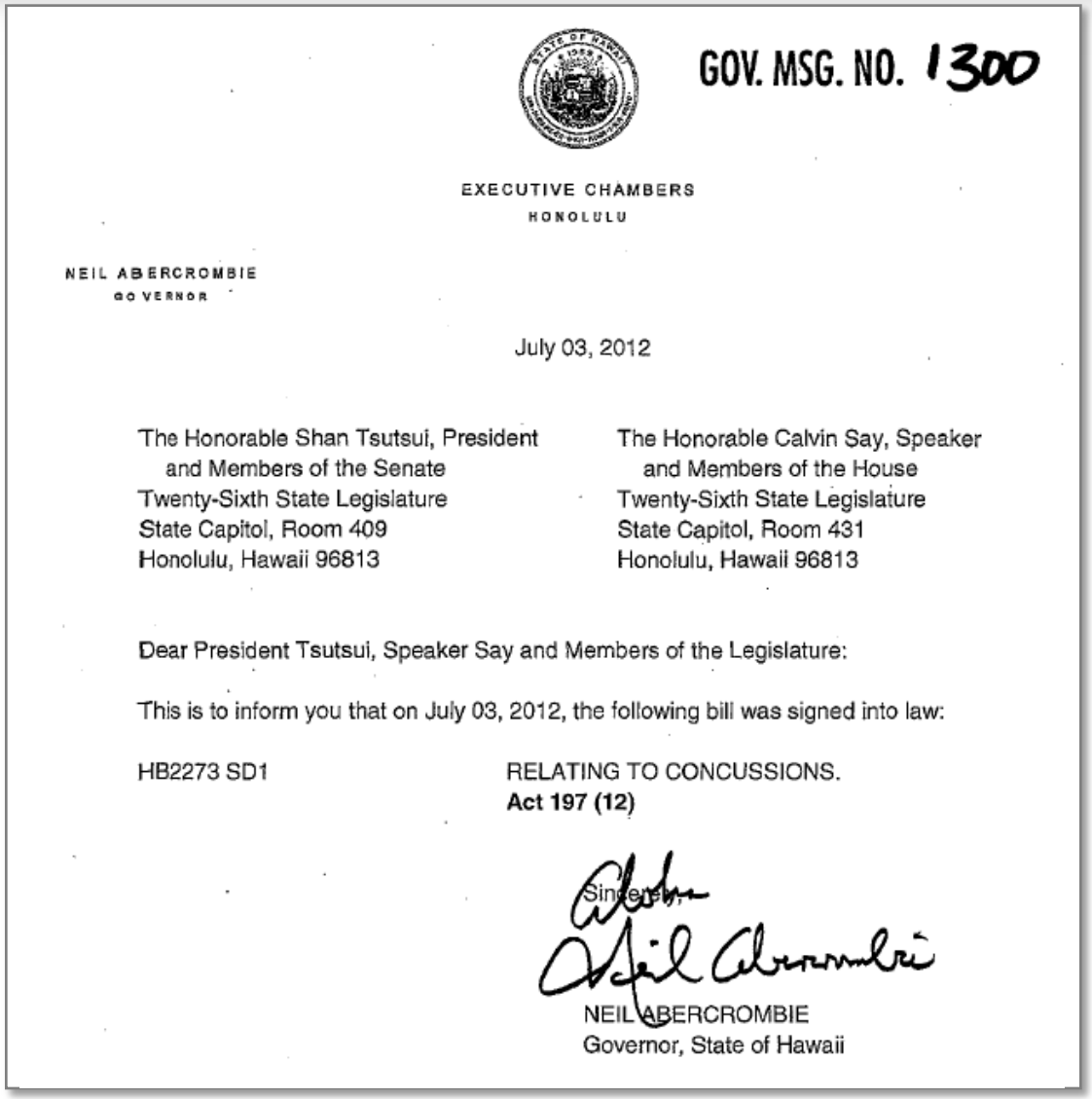


- First law enacted in 2009 (Washington)
- As of 2014, all 50 states and DC have passed concussion legislation

Concussion Legislation

Act 197(12)

Signed into law
July 3, 2012



GOV. MSG. NO. 1300

EXECUTIVE CHAMBERS
HONOLULU

NEIL ABERCROMBIE
GOVERNOR

July 03, 2012

The Honorable Shan Tsutsui, President
and Members of the Senate
Twenty-Sixth State Legislature
State Capitol, Room 409
Honolulu, Hawaii 96813

The Honorable Calvin Say, Speaker
and Members of the House
Twenty-Sixth State Legislature
State Capitol, Room 431
Honolulu, Hawaii 96813

Dear President Tsutsui, Speaker Say and Members of the Legislature:

This is to inform you that on July 03, 2012, the following bill was signed into law:

HB2273 SD1 — RELATING TO CONCUSSIONS.
Act 197 (12)

Sincerely,

NEIL ABERCROMBIE
Governor, State of Hawaii

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Concussion Legislation

Act 197(12)

Signed into law
July 3, 2012

Mandates concussion education at high school level

The purpose of this Act is to require the department of education and the Hawaii High School Athletic Association to develop a concussion educational program for students and student athletes who are fourteen to eighteen years old. The program shall include:

(1) Education of students, student athletes, parents, sports officials, school faculty and staff, and school administrators of the signs and symptoms of a concussion and what to do if someone demonstrates any of these signs or symptoms;

(2) An annual educational session for coaches and athletic trainers about the signs and symptoms of a concussion;

(3) The need for the mandatory removal of a student from the athletic activity that the student is

HB2273 SD1 LRB 12-2436.doc

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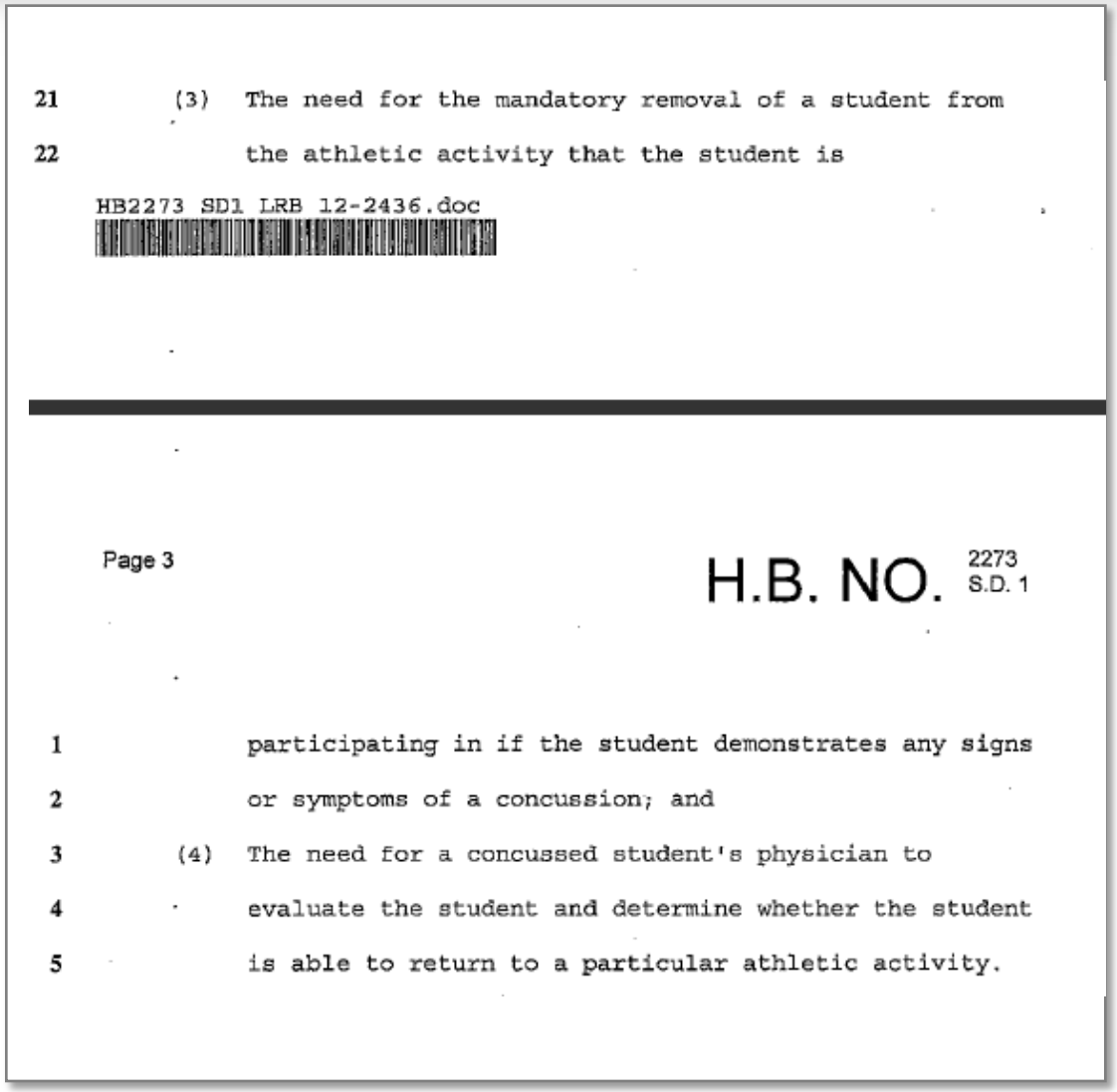
Concussion Legislation

Act 197(12)

Signed into law
July 3, 2012

Mandates removal of athlete from field of play

Requires medical evaluation and clearance for return to play



(3) The need for the mandatory removal of a student from the athletic activity that the student is

HB2273 SD1 LRB 12-2436.doc

Page 3

H.B. NO. 2273 S.D. 1

participating in if the student demonstrates any signs or symptoms of a concussion; and

(4) The need for a concussed student's physician to evaluate the student and determine whether the student is able to return to a particular athletic activity.

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A Quick Word on Brain Imaging

- Conventional brain scans are **normal** in concussive injury
- Noncontrast brain CT should be used whenever there is concern for skull fracture or intracranial bleeding
  - Prolonged loss of consciousness
  - Focal neurological deficit
  - Worsening symptoms / clinical deterioration

McCrory et al. Br J Sports Med 2013;47:250-258

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Concussion in the Doctor's Office

What Kind of Concussion Patient Will I Be?

- **"Obvious on the field"**
  - Immediate symptoms and/or functional deficits after collision/impact
- **"Becomes obvious on the field" (i.e. "I felt worse the longer I played")**
  - "I got my bell rung but I thought I was ok, so I kept playing, but then I started to feel bad"
- **"Not obvious on the field"**
  - Significant impact, but evaluation benign
  - "I was fine until I tried to go back to school / work on Monday"

Concussion Grading Scales

Concussion Grading Scales

GUIDELINE	CONCUSSION GRADES AND DEFINITIONS 1	2	3
Cantu[5] 1986	No loss of consciousness	Loss of consciousness for fewer than 5 minutes	Loss of consciousness for more than 5 minutes
	Post-traumatic amnesia for fewer than 30 minutes	Post-traumatic amnesia for more than 30 minutes	Post-traumatic amnesia for more than 24 hours
Colorado Medical Society[6] 1991	No loss of consciousness	No loss of consciousness	Loss of consciousness of any duration
	No post-traumatic amnesia Confusion	Post-traumatic amnesia Confusion	
American Academy of Neurology[7] 1997	No loss of consciousness	No loss of consciousness	Loss of consciousness of any duration
	Concussion symptoms for fewer than 15 minutes	Concussion symptoms for more than 15 minutes	

Kushner DS *Am Fam Physician.* 2001 Sep 15;64(6):1007-1015

Concussion Guideline Updates

- 4th International Conference on Concussion in Sport, Zurich, November 2012
  - 1st, Vienna 2001
  - 2nd, Prague 2004
  - 3rd, Zurich 2008

  McCrory et al. Br J Sports Med 2013;47:250-258

- Guideline update: evaluation and management of concussion in sports: **American Academy of Neurology**, 2013

  Giza et al. Neurology; published online before print March 18,2013; DOI 10.1212/WNL.0b013e31828d57dd

- **American Medical Society for Sports Medicine** position statement: concussion in sport, 2013

  Harmon et al. Br J Sports Med 2013;47, 15-26

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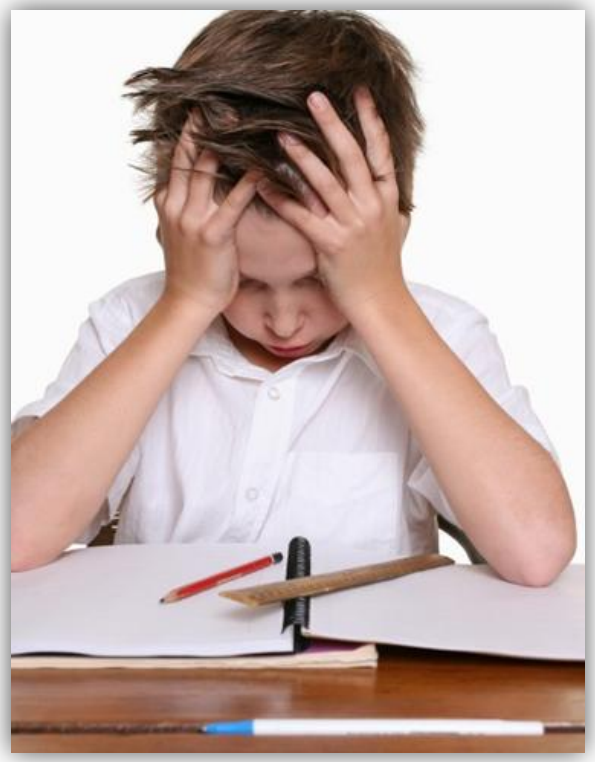
Concussion Management

- Physical and cognitive rest until acute symptoms resolve
- Graded program of exertion prior to medical clearance and return to play
- Athlete should be free of concussion symptoms at rest as well as during and after exertion before returning to full participation

McCrory et al. Br J Sports Med 2013;47:250-258
(Zurich Consensus Statement, 2012)

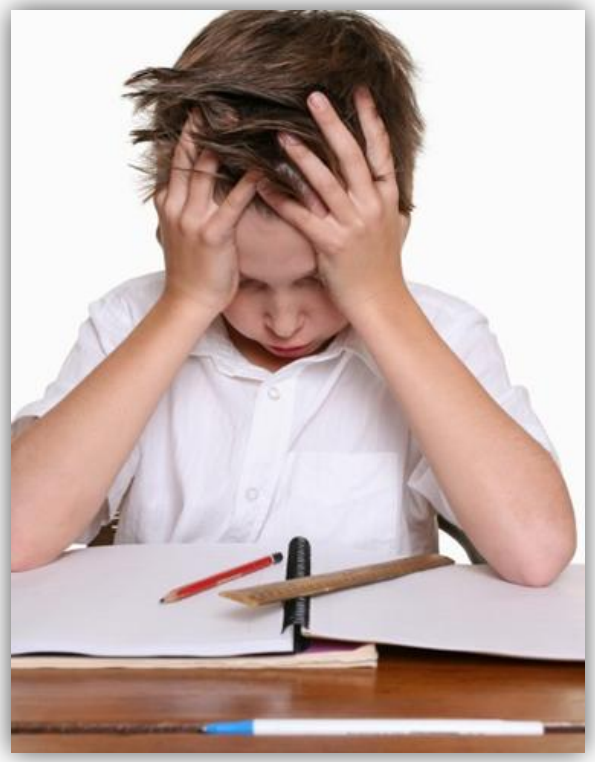
Concussion Evaluation

- **HISTORY**
  - Graded symptom checklist (GSS)
- **PHYSICAL EXAMINATION**
- **OBJECTIVE TESTING**
  - VOMS
  - BESS
  - +/- Neuropsychological Testing
- **ANTICIPATORY GUIDANCE**
  - Physical activity restrictions
  - Cognitive restrictions
  - School accommodations (504 plan)
- **COMMUNICATION WITH SCHOOL / TRAINING ROOM**
- **FOLLOW UP**



Concussion Evaluation

- **HISTORY**
  - Graded symptom checklist (GSS)



Symptoms

Somatic

- Headache
- “Pressure in head”
- Neck pain
- Nausea or vomiting
- Dizziness
- Blurred vision / double vision / “seeing stars”
- Balance problems / unsteadiness
- Sensitivity to light
- Sensitivity to noise
- Ringing in ears
- Fatigue or Low energy
- Drowsiness
- Trouble falling asleep

Cognitive

- Feeling slowed down
- Feeling like “in a fog”
- “Don’t feel right”
- Difficulty concentrating
- Difficulty remembering
- Confusion

Emotional

- More emotional
- Irritability
- Sadness
- Nervous or Anxious

Graded Symptom Check List for Concussed Athlete

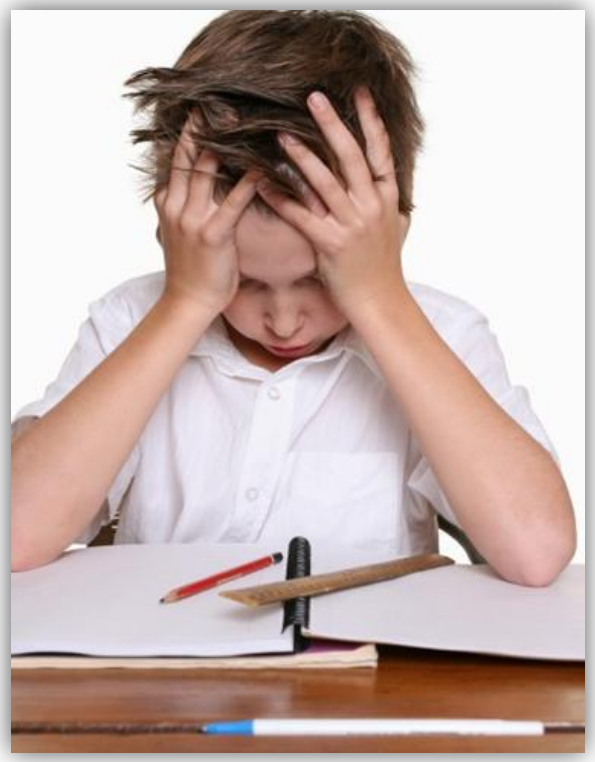
Score the concussed student athlete on the following symptoms, based on how your child feels now.
Scale of 0-6: 0 = not present, 1 = mild, 3 = moderate, and 6 = most severe.

Symptom	Time of Injury	2-3 Hours Post injury	24-Hours Post injury	48-Hours Post injury	72-Hours Post injury
Headache					
"Pressure in head"					
Neck pain					
Nausea or vomiting					
Dizziness					
Blurred vision					
Balance problems					
Sensitivity to light					
Sensitivity to noise					
Feeling slowed down					
Feeling like "in a fog"					
"Don't feel right"					
Difficulty concentrating					
Difficulty remembering					
Fatigue or low energy					
Confusion					
Drowsiness					
Trouble falling asleep (if applicable)					
More emotional					
Irritability					
Sadness					
Nervous or Anxious					
Symptom Severity Score					

White Copy (Athletic Health Care Trainer) Yellow Copy (Parent/Guardian)

Concussion Evaluation

- **HISTORY**
  - Graded symptom checklist (GSS)

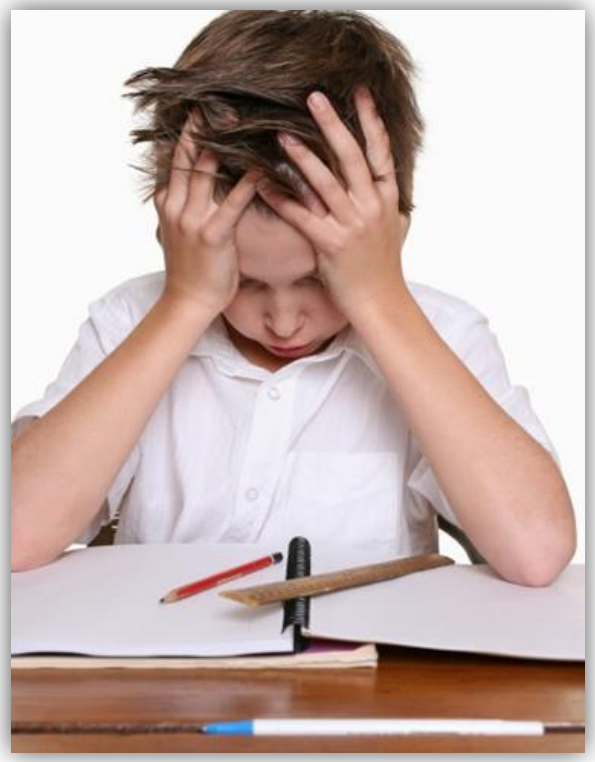


"Take me through your day."
"What do you feel?"
"What do you struggle with?"

Clinical pearl: in general, concussions don't seem to cause new clinical conditions, rather they "amplify" conditions that might be subclinical (e.g. ADHD, depression, etc.)

Concussion Evaluation

- HISTORY
  - Graded symptom checklist (GSS)
- **PHYSICAL EXAMINATION**
  - **Neurologic Exam**
- **OBJECTIVE TESTING**
  - VOMS
  - BESS
  - +/- Neuropsychological Testing
- ANTICIPATORY GUIDANCE
  - Physical activity restrictions
  - Cognitive restrictions
  - School accommodations (504 Plan)
- COMMUNICATION WITH SCHOOL / TRAINING ROOM
- FOLLOW UP



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Concussion Evaluation

- **HISTORY**
  - Graded symptom checklist (GSS)
- **PHYSICAL EXAMINATION**
- **OBJECTIVE TESTING**
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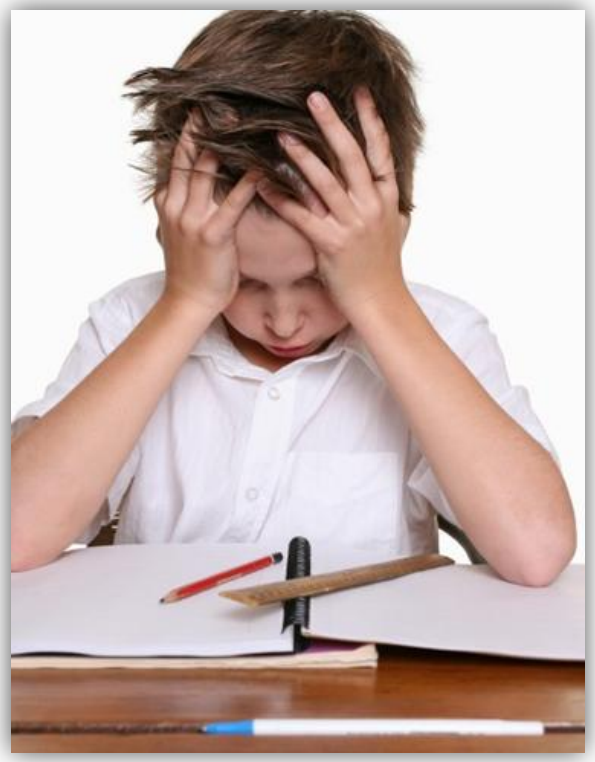


HCAMP

Hawaii Concussion Awareness Management Program

Graduated Return to Play Protocol

Step 1. Cognitive Rest
Recommended immediately post injury. Resting cognitively suggest no texting, no reading, no video games, and no computer time. May also need to avoid crowded areas like shopping malls, school hallways, and movie theaters. School adjustments maybe recommended.

Step 2. Return to School Full time
Athlete is able to return to school full time without any school adjustments or accomodations.

**To begin Step 3, a medical clearance should be obtain stating that student – athlete may begin physical activity. Each step is separated by 24 hours regardless if student-athlete feels normal.

Step 3. Begin light Aerobic Activity
Student – Athlete must be symptoms free for 24 hours. May ride stationary bike or jog for 20-30 minutes. If symptoms arise he/she should not progress to step 4.

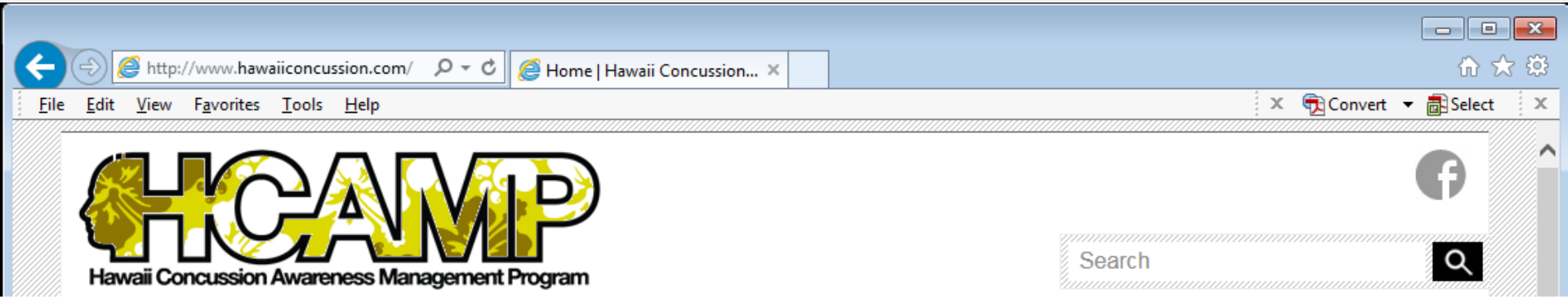
Step 4. Strenuous Aerobic Activity
Student – athlete may begin sprinting, long runs, and supervised sport specific drills without contact or equipment. If symptoms arise he/she should not progress to step 5.

Step 5. Non Contact Drills in Full Equipment
Student – Athlete may do non contact drills with team in full equipment. Weight training may begin. If symptoms arise he/she should not progress to step 6.

Step 6. Full contact Practice
Student – athlete may begin reasonable contact drills and practice. A progression of intensity and amount of contact drills and scrimmaging should be planned. If symptoms arise he/she should not progress to step 7

Step 7. No restrictions
Student – athlete has no restriction during practices and may play in game

Academic Accommodations – Return to Learn



How Can Educators Help?

ADJUSTMENTS

For most concussion cases, the student-athlete will need school adjustments for a short period – usually for a couple of weeks. Adjustments are modifications in school that can be done immediately and for a short period of time. Some adjustments that may be implemented are:

- Breaks as needed in a quiet place
- Preprinted class notes
- Additional time for assignments
- Additional help and tutoring
- Untimed or no testing until tolerating a full day of school

ACCOMMODATIONS

Accommodations are a formal modification of the student's academic curriculum, schedule and plan. Concussed student-athletes may require accommodations if experiencing prolonged recovery. With the consultation from a MD and the school's academic team, additional accommodations may be implemented.

How Do We Make These Decisions?

Get specific information on what bothers the patient and adjust accordingly

- Light / noise / crowds?
- Riding in a car?
- Physical exertion?
- Reading books?
- Looking at a computer screen or tablet?
- Texting?
- Social media?
- Video games?
- Specific school subjects?
- Physical exertion?

Relationship Between the Time in Each Step with the Return to Play Guideline

n = 375	2010 - 2012	2013 - 2014	
Cognitive Rest	3.0	3.0	Step 1 - 2
Return to School Full Time	**9.9**	**13.7**	Step 2 - 3
Light Exercise	2.0	2.3	Step 3 - 4
Run/No Equipment	2.1	2.2	Step 4 - 5
Non – Contact	2.6	2.8	Step 5 - 6
Full Contact / No restrictions	2.7	2.1	Step 6 - 7

Shimizu et al. NATA Abstract 2013

Think of Concussion Management as "Return to Life" = Concussion Rx

- Appropriate home/school accommodation
- Emphasis on sleep hygiene
- Appropriate nutrition

- Exercise
- Socialization
- Graduated return

Concussion Evaluation

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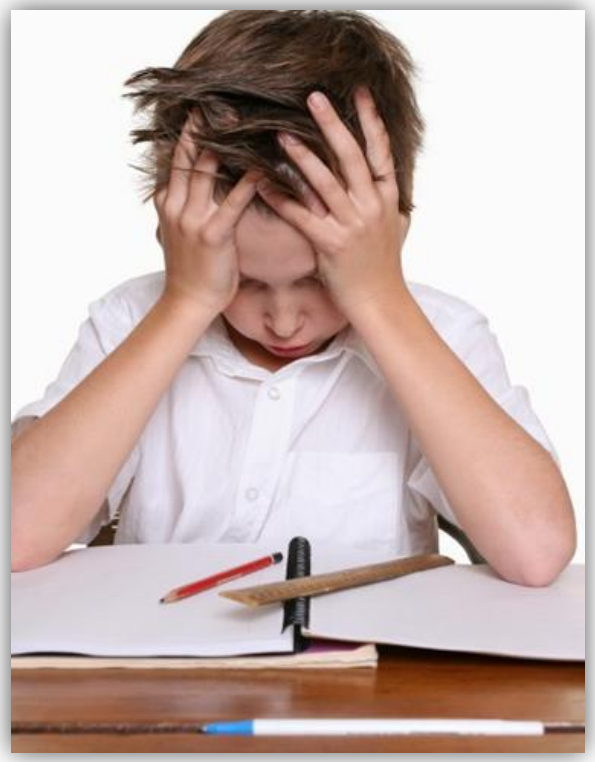


Communicate with the School / Coach: Medical Referral Form for Concussed Athlete

Return to Activity Plan (RTP):

Step 1. Complete cognitive rest. This may include staying home from school or limiting school hours and study for several days which would be determined by a physician or AHCT and supported by school administration. Activities requiring concentration and attention may worsen symptoms and delay recovery.

Step 2. Return to school full time.

Steps 3.-7. Will be supervised by the high school AHCT. ***(Each step is separated by a minimum of at least 24 hours.)***

Step 3. Light exercise. This step cannot begin until student athlete is cleared by the treating physician for further activity. At this point, the student athlete may begin walking or riding a stationary bike.

Step 4. Running in the gym or on the field.

Step 5. Non-contact training drills in full equipment. Weight training can begin.

Step 6. Full contact practice or training.

Step 7. Play in game.

Please Indicate Level of Clearance (To be filled out by Physician)

_____ **Cognitive and Physical Rest Only** Limit school attendance, computer, TV, and Phone/Texting time

_____ **Cleared to Return to School with NO Physical Activity**. **NO** physical education class or athletics

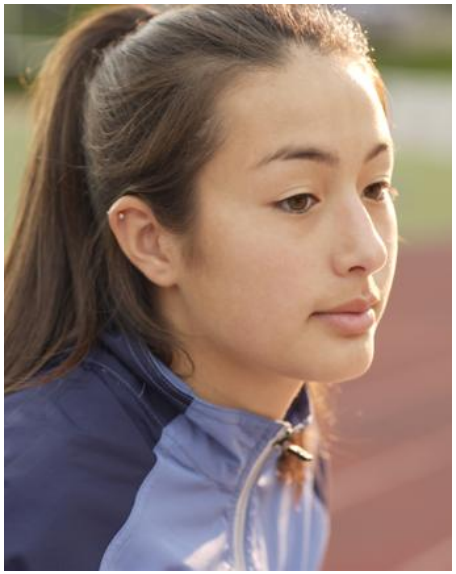
_____ **Follow up Appointment scheduled**

_____ **Cleared to begin "Return to Activity Plan"** (see above)

PHYSICIAN'S NAME: _____ Phone: _____

PHYSICIAN'S SIGNATURE: _____ Date: _____

When Do I Refer to Sports Medicine?



- **"Difficult to manage" concussion**
  - Atypical symptoms
- **Complicated concussion**
  - Symptoms persisting > 7-10 days in adults and > 3 weeks in youth
  - Failure to progress

Sports Medicine Clinic

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Chun, MD

Gale
Prentiss, MD

Garla
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Delailah
Tupinio, MA

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Behavioral Health

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Pediatrics

Kacy Nekoba, PT
Physical Therapy

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Sports Medicine

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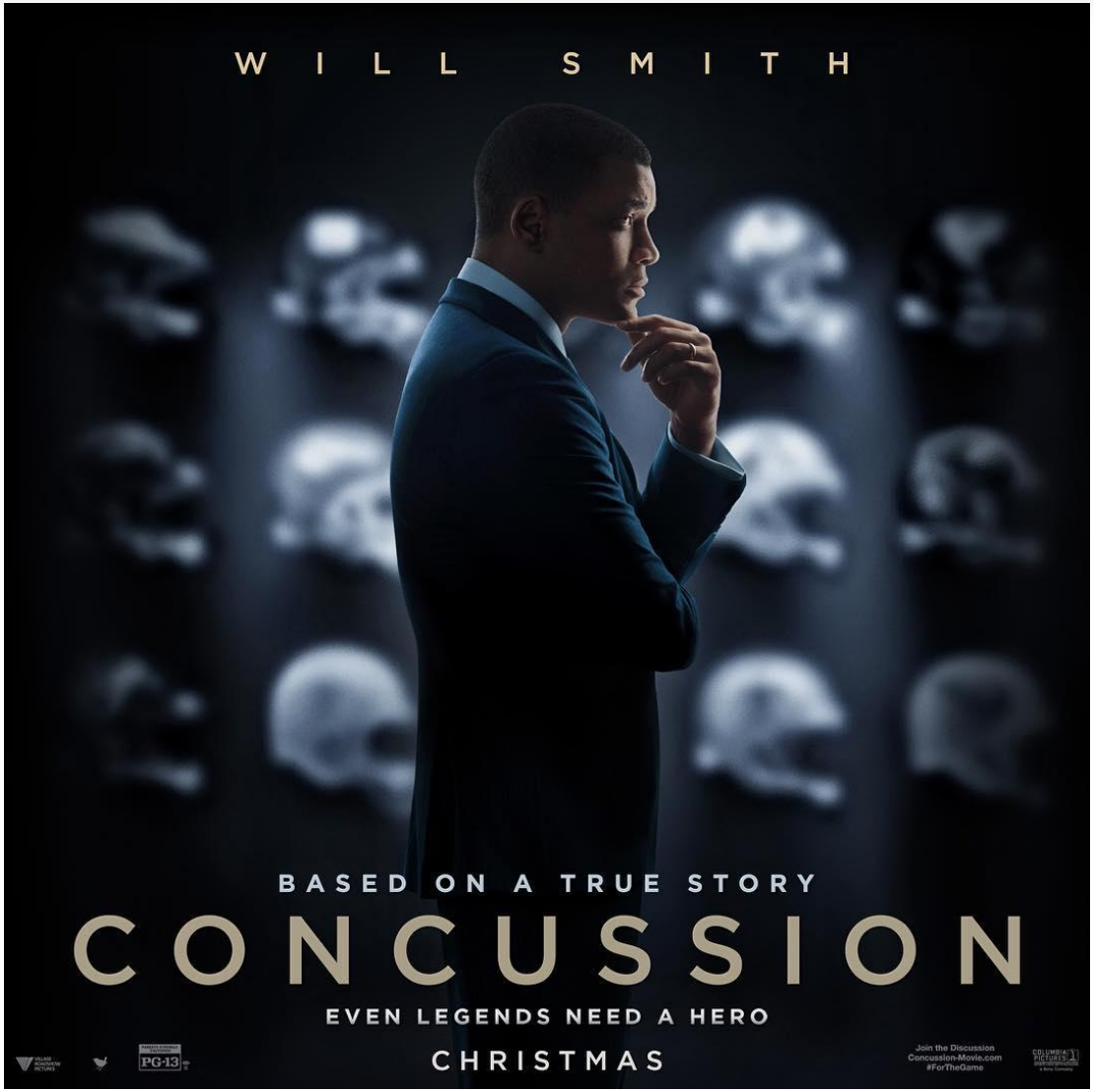
What about CTE?



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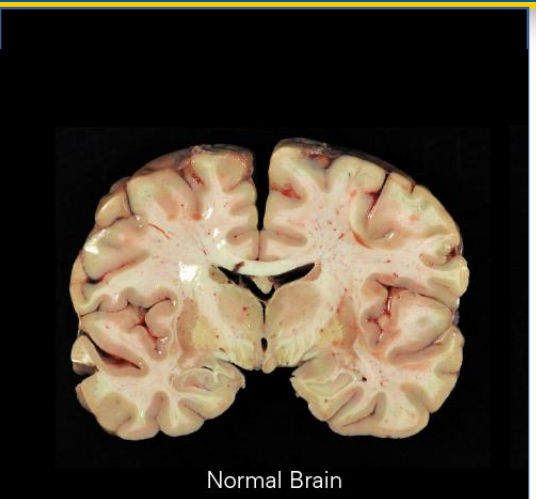
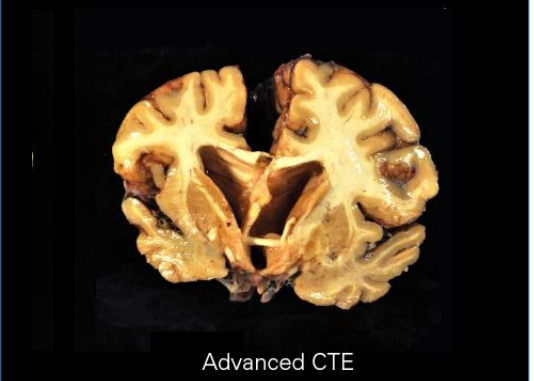
Chronic Traumatic Encephalopathy





Source: Boston University Center for the Study of Traumatic Encephalopathy

- Chronic traumatic encephalopathy (CTE) is a progressive neurodegenerative *disease* characterized by the abnormal accumulation of hyperphosphorylated tau (p-tau) protein within the brain
- At the present time, CTE remains a diagnosis that can only be made definitively upon neuropathological examination of the brain at autopsy

Acta Neuropathol. *2016 Jan;131(1):75-86. doi: 10.1007/s00401-015-1515-z. Epub 2015 Dec 14.*
The first NINDS/NIBIB consensus meeting to define neuropathological criteria for the diagnosis of chronic traumatic encephalopathy.
McKee AC

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Chronic Traumatic Encephalopathy

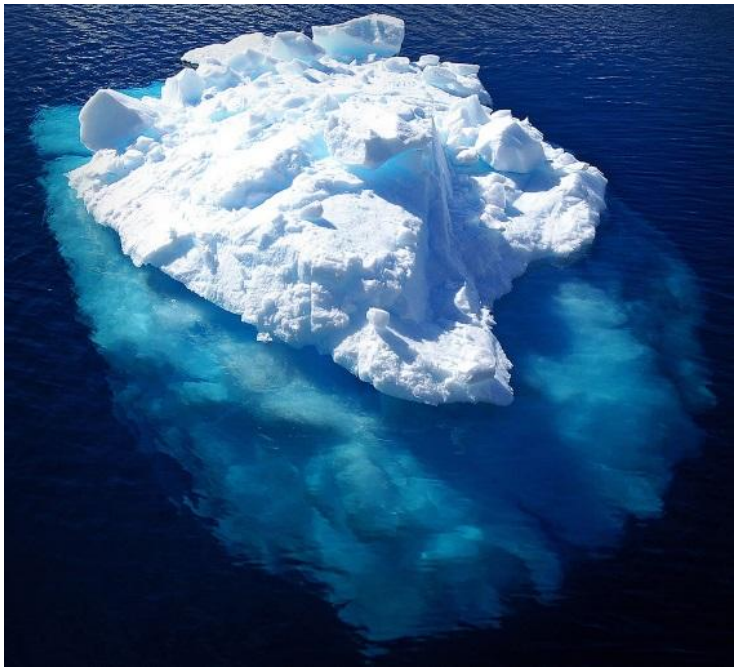
- All confirmed CTE has hx of repetitive brain impact (not necessarily professional athlete)
  McKee 2013
- CTE has not yet been found in anyone without a history of brain trauma/athletic exposure
  Montinegro 2015

Public Perception

- Is CTE common? **We don't know**
- Everyone that gets CTE has exposure to repetitive hits, but not everyone that gets hit gets CTE – what are the risks for CTE? **We don't know**
  - Age at first exposure
    - Age 9-12 averages 240 hits per season *Cobb 2013*
    - In former NFL starting football < 12 had worse memory and executive function vs. those starting > 12 years old *Stamm Neurology 2015*
- Difficult to answer any of these questions until we are able to diagnose CTE during life

What's the Big Concern?

- How many are at risk?
- The incidence of repetitive subconcussive blows is much greater than concussion incidence



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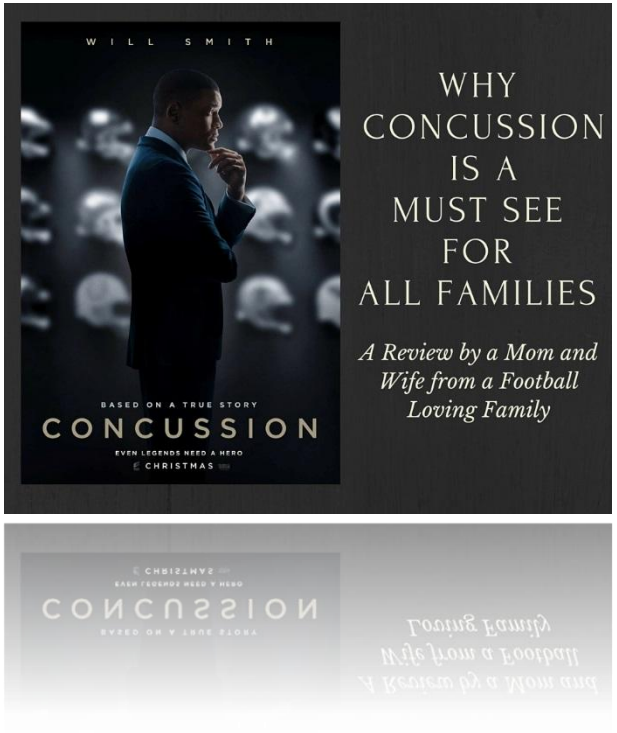
What Do I Tell Parents about CTE?

- Activities that result in impacts to the brain carry some risk of development of CTE and neurodegenerative disease, but we don't know how much (informed consent)
- We don't know what factors contribute to a person's individual susceptibility to developing CTE or what determines whether that person will suffer from clinically apparent neurocognitive decline, or how much
- Consider avoiding head contact sports until after age 12



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Thank You!

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Primary Care Sports Medicine

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Primary Care Sports Medicine

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Helmets

- Effective at reducing linear acceleration forces
  - Skull fracture
  - Intracranial bleeding
- Poor at reducing angular acceleration forces

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J Neurosurg. 2014 Apr;120(4):919-22. doi: 10.3171/2014.1.JNS13916. Epub 2014 Jan 31.

Can helmet design reduce the risk of concussion in football?

Rowson S[1], Duma SM, Greenwald RM, Beckwith JG, Chu JJ, Guskiewicz KM, Mihalik JP, Crisco JJ, Wilcox BJ, McAllister TW, Maerlender AC, Broglio SP, Schnebel B, Anderson S, Brolinson PG.

Author information

Abstract

Of all sports, football accounts for the highest incidence of concussion in the US due to the large number of athletes participating and the nature of the sport. While there is general agreement that concussion incidence can be reduced through rule changes and teaching proper tackling technique, there remains debate as to whether helmet design may also reduce the incidence of concussion. A retrospective analysis was performed of head impact data collected from 1833 collegiate football players who were instrumented with helmet-mounted accelerometer arrays for games and practices. Data were collected between 2005 and 2010 from 8 collegiate football teams: Virginia Tech, University of North Carolina, University of Oklahoma, Dartmouth College, Brown University, University of Minnesota, Indiana University, and University of Illinois. Concussion rates were compared between players wearing Riddell VSR4 and Riddell Revolution helmets while controlling for the head impact exposure of each player. A total of 1,281,444 head impacts were recorded, from which 64 concussions were diagnosed. The relative risk of sustaining a concussion in a Revolution helmet compared with a VSR4 helmet was 46.1% (95% CI 28.1%-75.8%). When controlling for each player's exposure to head impact, a significant difference was found between concussion rates for players in VSR4 and Revolution helmets ($\chi(2) = 4.68$, $p = 0.0305$). This study illustrates that differences in the ability to reduce concussion risk exist between helmet models in football. Although helmet design may never prevent all concussions from occurring in football, evidence illustrates that it can reduce the incidence of this injury.

- 2005 – 2010: 8 collegiate football teams
  - 64 concussions in 1,281,444 head impacts
- Relative risk of concussion 46.1% in Riddell Revolution helmet vs Riddell VSR4 helmet

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Am J Sports Med. 2014 Oct;42(10):2470-8. doi: 10.1177/0363546514541926. Epub 2014 Jul 24.

Protective equipment and player characteristics associated with the incidence of sport-related concussion in high school football players: a multifactorial prospective study.

McGuine TA[1], Hetzel S[2], McCrea M[3], Brooks MA[4].

Author information

Abstract

BACKGROUND: The incidence of sport-related concussion (SRC) in high school football is well documented. However, limited prospective data are available regarding how player characteristics and protective equipment affect the incidence of SRC.

PURPOSE: To determine whether the type of protective equipment (helmet and mouth guard) and player characteristics affect the incidence of SRC in high school football players.

DESIGN: Cohort study; Level of evidence, 2.

METHODS: Certified athletic trainers (ATs) at each high school recorded the type of helmet worn (brand, model, purchase year, and recondition status) by each player as well as information regarding players' demographics, type of mouth guard used, and history of SRC. The ATs also recorded the incidence and days lost from participation for each SRC. Incidence of SRC was compared for various helmets, type of mouth guard, history of SRC, and player demographics.

RESULTS: A total of 2081 players (grades 9-12) enrolled during the 2012 and/or 2013 football seasons (2287 player-seasons) and participated in 134,437 football (practice or competition) exposures. Of these players, 206 (9%) sustained a total of 211 SRCs (1.56/1000 exposures). There was no difference in the incidence of SRC (number of helmets, % SRC [95% CI]) for players wearing Riddell (1171, 9.1% [7.6%-11.0%]), Schutt (680, 8.7% [6.7%-11.1%]), or Xenith (436, 9.2% [6.7%-12.4%]) helmets. Helmet age and recondition status did not affect the incidence of SRC. The rate of SRC (hazard ratio [HR]) was higher in players who wore a custom mouth guard (HR = 1.69 [95% CI, 1.20-2.37], $P < .001$) than in players who wore a generic mouth guard. The rate of SRC was also higher (HR = 1.96 [95% CI, 1.40-2.73], $P < .001$) in players who had sustained an SRC within the previous 12 months (15.1% of the 259 players [95% CI, 11.0%-20.1%]) than in players without a previous SRC (8.2% of the 2028 players [95% CI, 7.1%-9.5%]).

CONCLUSION: Incidence of SRC was similar regardless of the helmet brand (manufacturer) worn by high school football players. Players who had sustained an SRC within the previous 12 months were more likely to sustain an SRC than were players without a history of SRC. Sports medicine providers who work with high school football players need to realize that factors other than the type of protective equipment worn affect the risk of SRC in high school players.

Helmets

- 2012 – 2013: High school football
- 2081 players
- 211 concussions
- No difference in concussion incidence between Riddel, Schutt, or Xenith helmets
- Rate of concussion higher in players wearing custom mouth guard vs generic

McGuine et al. Am J Sports Med. 2014

Mouth Guards

- No strong evidence exists for the use of mouth guards to prevent concussions

HCAMP Website

http://www.hawaiiconcussion.com/ Home | Hawaii Concussion...

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HCAMP
Hawaii Concussion Awareness Management Program

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Welcome to Hawaii Concussion Awareness and Management Program.

Hawaii Concussion Awareness and Management Program (HCAMP) is an organization intended to provide Hawaii's physically active community and medical community with evidence based research education, support and resources to manage concussions. Learn More

Upcoming Events

Please check back soon!

HCAMP Highlights