

Concussion and the NCAA: An Update from the Chief Medical Officer

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Concussion Matters

- There are 43 working definitions of concussion. Only one is evidence-based.
- We do not define concussion neurologically.
- We do not understand the natural history of concussion.
- We have little, if any, data on neurobiological recovery following concussion.
- The medical – and neurological – community enabled a culture that did not address concussion.



43rd Working Definition of Concussion

Concussion is:

- a change in brain function,
- following a force to the head, which
- may be accompanied by temporary loss of consciousness, but is
- identified in awake individuals, with
- measures of neurologic and cognitive dysfunction.



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2009-2014 Academic Years Reported Concussion Rate, by Division

Division	Rate per 1000 AEs
I	0.30
II	0.32
III	0.29
TOTAL	0.30

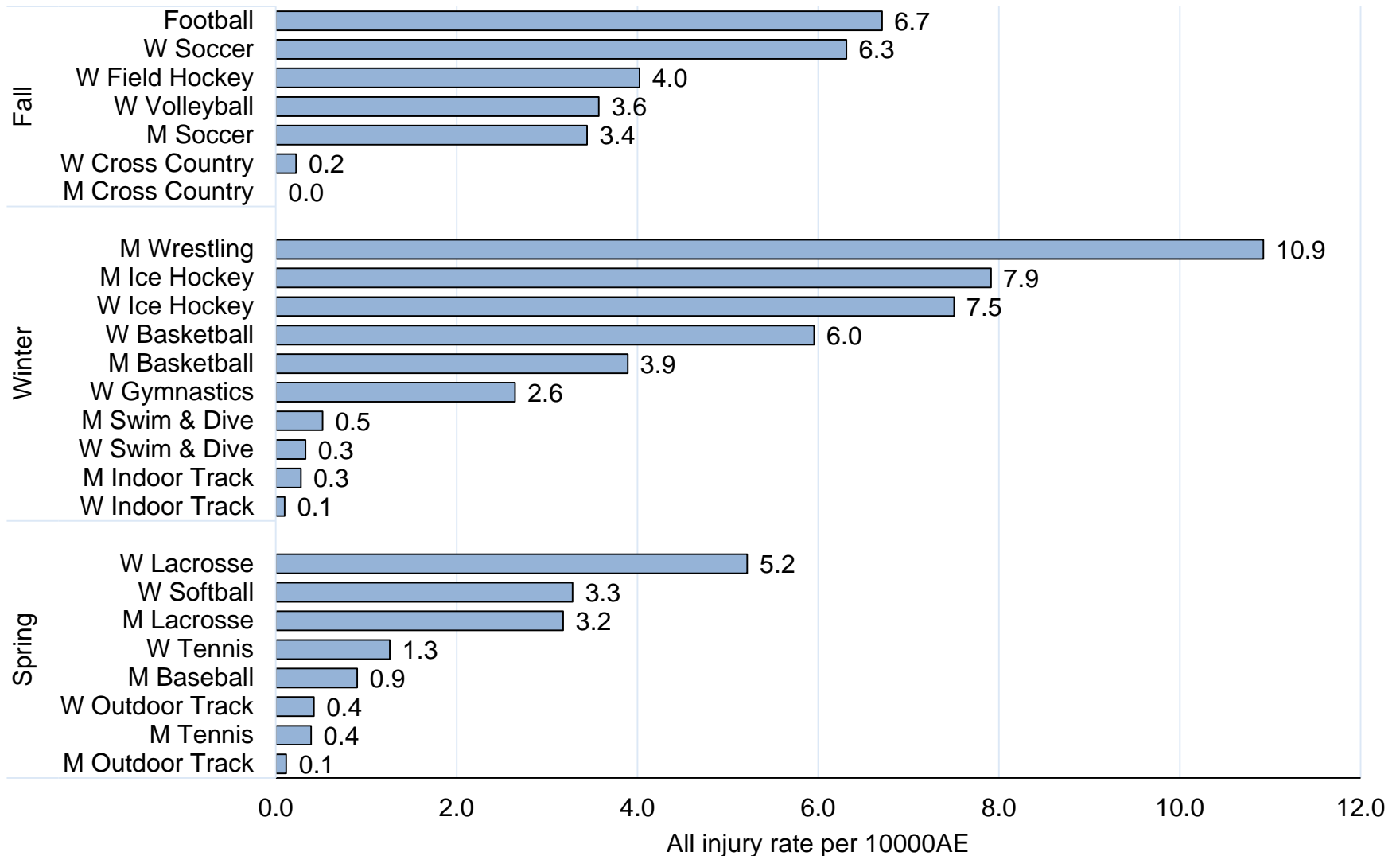
AE=Athlete-exposure: 1 athlete's participation in 1 practice or 1 competition



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Concussion rates per 10000AE, 2009/10-2013/14



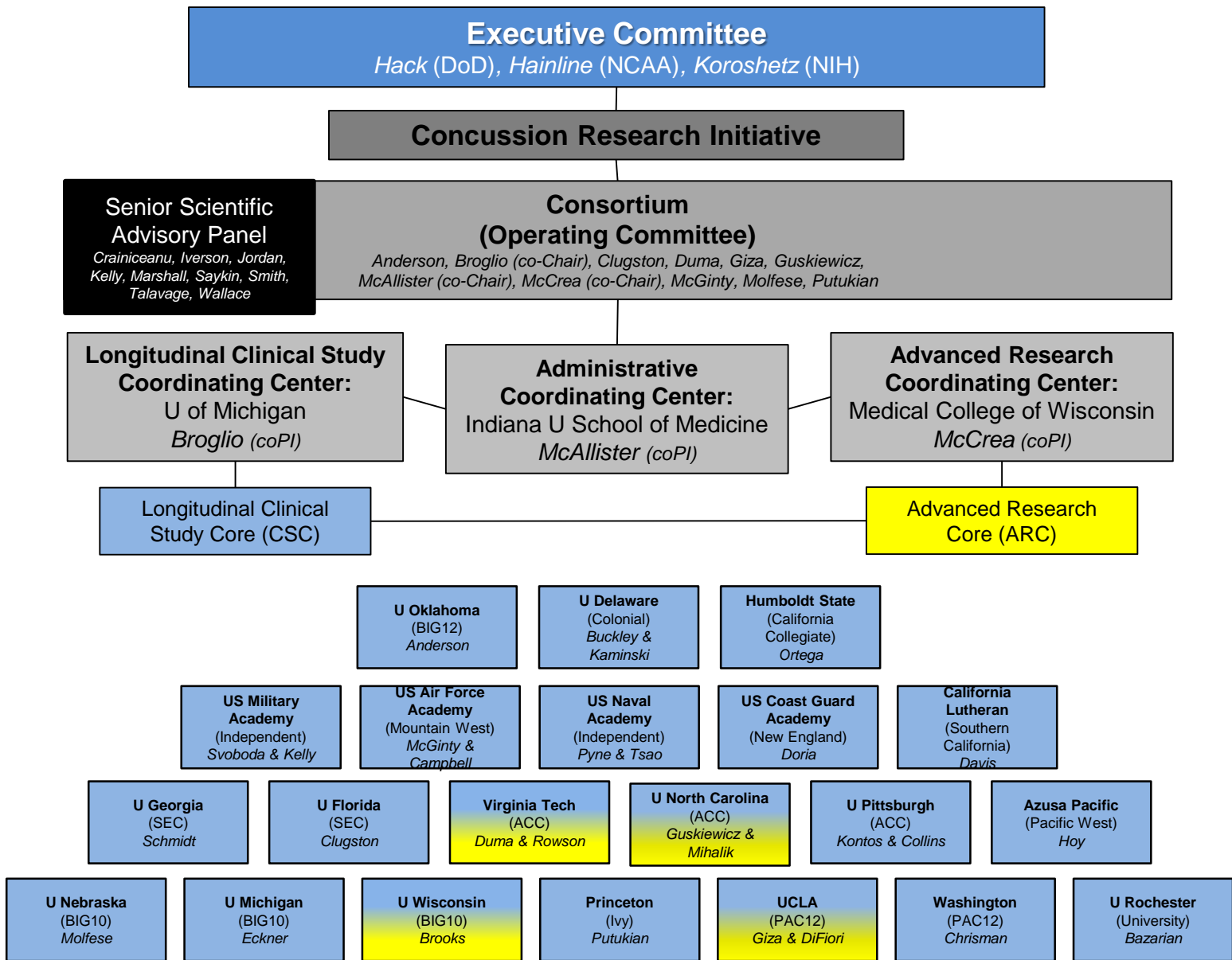
NCAA and DoD Joint Endeavor

- >97% of military TBIs are concussions.
- 85% of military concussions are biomechanically similar to sport-related concussion.
 - 15% are from blast injuries.
- College s-a and military service are similar in age, athleticism, risk taking and pushing to the edge of excellence.
- The military theatre is poorly controlled; college sports are a much more controlled environment.



The Timeline

- Numerous meetings at NCAA member institutions.
- December 2013 meeting: Consensus on questions to answer:
 - What is the natural history of concussion?
 - What are the best tools to change the culture of concussion for athletes, coaches, parents and stakeholders?
- April 2014 meeting: Clinical protocols vetted and applications accepted.
- May 29, 2014: Announcement at White House Summit.
- August 2014: Clinical protocol started.
- November 2014: Educational Grand Challenge launched.



Clinical Study Aims

Clinical Study Core (CSC)

- To conduct a prospective, longitudinal, multi-center, multi-sport investigation that delineates the natural history of concussion in both men and women by incorporating a multi-dimensional assessment of standardized clinical measures of post-concussive symptomatology, performance-based testing (cognitive function, postural stability), and psychological health.

Advanced Research Core (ARC)

- Utilize the framework of the CSC to conduct advanced scientific studies which integrate biomechanical, clinical, neuroimaging, neurobiological and genetic markers of injury to advance our understanding of neurophysiological effects and recovery after sport-related concussion in college student-athletes.



Assessment Categories

BASELINE	IMMEDIATE POST-CONCUSSION (<6hrs)	POST-CONCUSSION FOLLOW-UP (24-48hrs; >80% Symptom Free; Unrestricted Return to Play; 6 Months)
LEVEL A*		
<ul style="list-style-type: none"> • Demographics • Personal and Family History • Neurocognitive Assessment • Neurological Status • Postural Stability • Symptoms 	<ul style="list-style-type: none"> • Neurological Status • Postural Stability • Symptoms 	<ul style="list-style-type: none"> • Neurocognitive Assessment • Neurological Status • Postural Stability • Symptoms
LEVEL B*		
<ul style="list-style-type: none"> • Advanced Postural Stability • Reaction Time • Oculomotor / Oculovestibular • Smell/Vision • Quality of Life 	<ul style="list-style-type: none"> • Reaction Time • Oculomotor / Oculovestibular • Smell/Vision 	<ul style="list-style-type: none"> • Advanced Postural Stability • Reaction Time • Oculomotor / Oculovestibular • Smell/Vision • Quality of Life

*All LEVEL A items will be completed by all institutions, but schools may select LEVEL B items at their discretion.



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Assessment Measures: ARC

- Head Impact Sensors
 - Head Impact Telemetry (HIT) System and X-Patch
- Neuroimaging Studies (3T MRI)
 - T1 SPGR anatomical images.
 - T2 FLAIR for general pathological detection.
 - Diffusion weighted MRI (DTI and DKI) for microscopic white and gray matter injury.
 - SWI to identify microhemorrhage.
 - Pseudo-continuous arterial spin labeling (pCASL) for cerebral blood flow.
- Genotyping
 - APOE, GDNF, COMT, etc
- Blood Biomarker Studies
 - Acute Biomarkers
 - UCH-L1 (ubiquitin C-terminal hydrolase L1; *neuronal protein*).
 - GFAP (glial fibrillary acid protein; *astrocytic protein*).
 - SBDP150 (calpain cleaved fragment of alpha II-spectrin breakdown product 150; *a neural cell cytoskeleton structural protein*).
 - S100B (S100 calcium binding protein B; *astrocytic protein*).
 - Micro RNA
 - Chronic Biomarkers
 - MAP-2 (microtubule associated protein-2; *marker of axonal damage*).
 - CNPase (2,3-cyclic-nucleotide 3-phosphodiesterase; *marker of oligodendrocytes*).
 - Micro RNA



CARE Assessments

		Pre-Season	Acute Concussion		Sub-Acute Concussion			Post-Concussion
		Baseline	<6hrs Post-Injury	24-48hrs Post-Injury	Asymptomatic / Cleared for Return to Play Progression	Unrestricted Return to Play	7 days following Return to Play	6 Months Post-Injury
Clinical Study Core (CSC)	Neurocognitive and Behavioral Testing	X	X	X	X	X	X	X
	Blood Biomarker & DNA Collection	X	X	X	X		X	X
Advanced Research Core (ARC)	Multi-modal MRI Studies			X	X		X	X



Estimated Enrollment

- Participating schools: All NCAA varsity student-athletes from all sports, including contact/collision and non-contact sports.
 - Beginning year 2: All Service Academy Students.
- Estimated 600 student-athletes per site
 - CSC: 30 sites and ~ 35,000 student-athletes.
 - ARC: 4 sites and ~1600 student-athletes.
- Concussion Incidence:
 - Estimate 2% injury rate across all sports and student-athletes.
 - ~750 concussions over 3 years for CRC.
 - ~75 concussions over 3 years for ARC.



Current Status

- 3906 baseline studies completed.
- 198 concussions captured.
- Between May 6-22: enroll 3750 cadets.
- Developmental stage of youth concussion registry and rollout of study to youth.
- Developmental stage to extend study to 50+ years (to become the Framingham study of concussion).



NCAA-DoD Mind Matters Educational Grand Challenge

Executive Committee

Leadership from NCAA (B. Hainline), DoD (D. Hack), NIH (Walter Koroshetz)

Educational Grand Challenge

Consortium

(Operating Committee)

NCAA: Amy Dunham, Latrice Sales, Dana Thomas

DoD: Tara Cozzarelli, Stephanie Maxfield-Parker, Kathleen Quinkert

CDC: Kelly Sarmiento

Nine Sigma: Amy Jo Beighley, Denys Resnick, Eloise Young

Immediate Impact Challenge

Long-Term Impact Challenge

Mind Matters Challenge

Goal: To change important concussion safety behaviors and the culture of concussion reporting and management by funding research to better understand behavior change strategies and by identifying novel educational approaches.

- Aim 1 (Immediate Impact Challenge)
 - Develop a multi-media educational program based on the best evidence currently available about how to change culture in young and emerging adults.
- Aim 2 (Long-term Impact Challenge)
 - Identify key factors and ways to affect change in the culture and behavior of young and emerging adults and their influencers around concussion.



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Inter-Association Guidelines

- Independent Medical Care
 - Autonomous decision-making for MDs and ATCs.
 - Socialize interdisciplinary team concept.
- Year-Round Football Practice Contact
 - Differentiates live contact from full pad practice.
 - Takes into account skill level and potential unintended consequences.
 - NCAA-DoD study may make such guidelines obsolete.
- Concussion Diagnosis and Management
 - Now legislation for autonomous 5 conferences (ACC, Big-10, Big-12, Pac-12, SEC).
 - Mirror Best Practices for rest of DI plus DII and DIII.



Concussion Diagnosis and Management

- Education.
- Pre-participation assessment: one-time:
 - Brain injury/concussion history.
 - Symptom evaluation.
 - Cognitive assessment.
 - Balance evaluation.
 - Team physician determines pre-participation clearance.
- Recognition and diagnosis.
- Post-concussion management.
- Return to activity:
 - Return-to-play.
 - Return-to-learn.



Guidelines Endorsements

- American Academy of Neurology
- American College of Sports Medicine
- American Association of Neurological Surgeons
- American Medical Society for Sports Medicine
- American Orthopaedic Society for Sports Medicine
- American Osteopathic Academy for Sports Medicine
- College Athletic Trainers' Society
- Congress of Neurological Surgeons
- National Athletic Trainers' Association
- NCAA Concussion Task Force
- Sports Neuropsychological Society
- American Football Coaches Association
- Football Championship Subdivision Executive Committee
- National Association of Collegiate Directors of Athletics
- National Football Foundation



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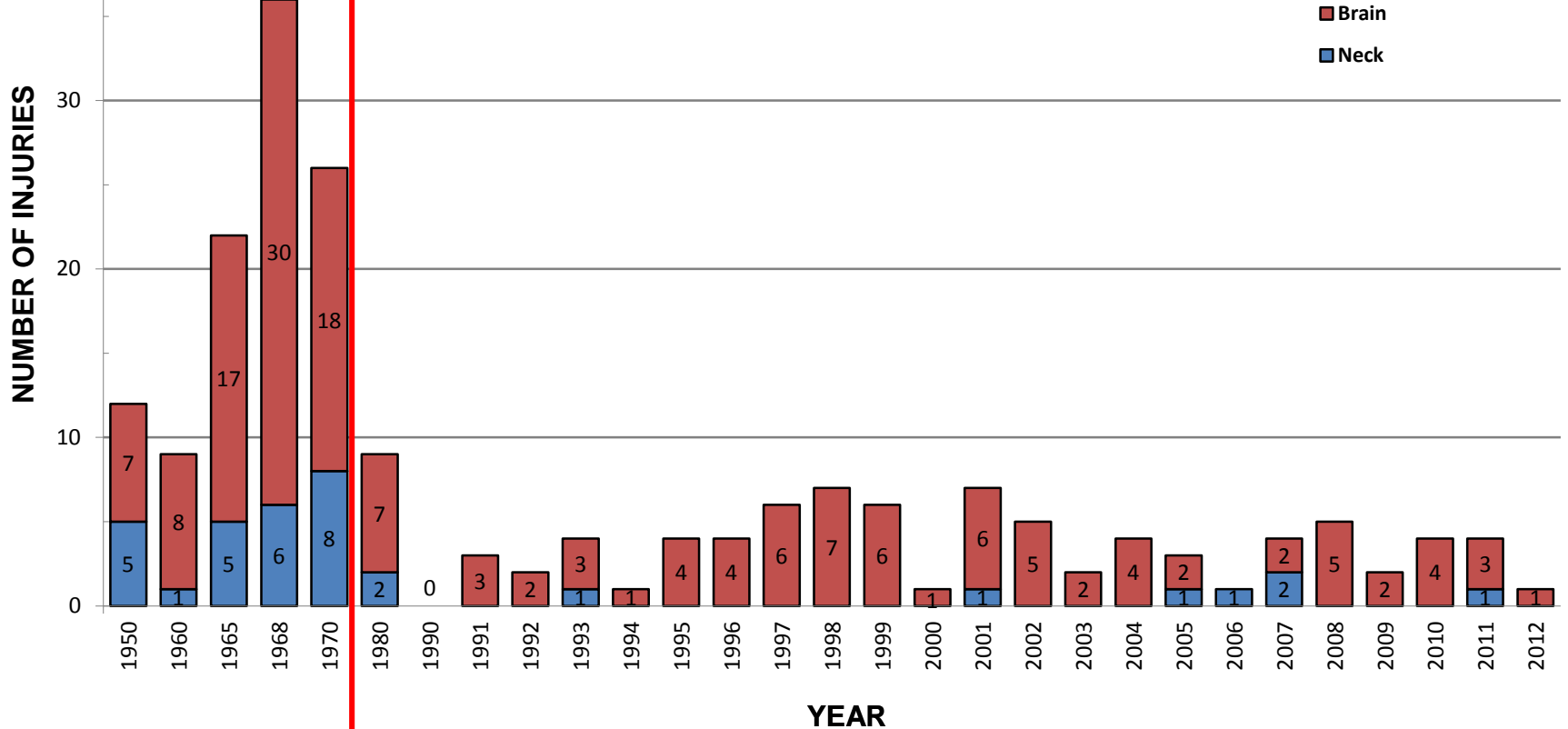
Football Rules

- “Football is an aggressive, rugged contact sport.”
- “There is no place for unfair tactics, unsportsmanlike conduct or maneuvers deliberately designed to inflict injury.”
- “To gain an advantage by circumvention or disregard for the rules brands a coach or player as unfit to be associated with football.”



FOOTBALL FATALITIES (All Levels) BRAIN AND NECK INJURIES

Numbers in the bars represent the number of injuries. If the color is not present, there were not injuries of that type in the given year.



National Center for Catastrophic Sport Injury Research



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Rules of Sport

- Football Kickoff:
 - 300% increase in touchbacks.
 - ~50% decrease in concussion relative to other injuries.
- Targeting
 - Qualitative change in tackling and blocking.
- Cross-functional work with all sports.



The Societal Dialogue

- Why play sport?
- What is the risk/benefit ratio of sport?
- Are all sports a model of wellness for life?



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