Protecting the Health and Safety of the College Student-Athlete

Brian Hainline, MD
NCAA Chief Medical Officer
Clinical Professor of Neurology
NYU Langone Medical Center and
Indiana University School of Medicine

No Disclosures

NCAA Sport Science Institute

Mission: To promote and develop safety, excellence, and wellness in college student-athletes, and to foster life-long physical and mental development.

NCAA Sport Science Institute

Vision: To be the pre-eminent sport science voice for all student-athletes and NCAA member institutions, and to be the steward of best practices for youth and intercollegiate sports.

The NCAA Approach

- Research
- Education
- Guidelines and Legislation
- Rules

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.

Definitions

Concussion Definitions

AAN	*AMSSM*	*Zurich*	*NCAA*
pathophysiologic disturbance in neurologic function characterized by clinical symptoms induced by biomechanical forces, occurring with or without LOC. Standard structural neuroimaging is normal, and symptoms typically resolve over time.	a traumatically induced transient disturbance of brain function and involves a complex pathophysiological process. Concussion is a subset of mild traumatic brain injury (MTBI) which is generally self-limited and at the less-severe end of the brain injury spectrum.	a brain injury and is defined as a complex pathophysiological process affecting the brain, induced by biomechanical forces.	a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces

Definitions

Mild traumatic brain injury – historically, this has referred to biomechanically induced brain injury with a Glasgow Coma Score of 13–15. Concussions may be included in this categorization.

Subconcussive injury – a theoretical, very mild, biomechanically induced brain injury that may occur in the absence of overt clinical symptoms of concussion. Recent concern has been raised regarding the existence of this entity on the basis of two predominant lines of evidence: very sensitive neuroimaging and electrophysiologic measures showing group differences between individuals exposed to contact sports as compared with non–contact sport controls, and an apparent dose response between contact sport exposure and chronic cumulative neurocognitive impairments.

4th International Conference on Concussion in Sport

"Concussion is a brain injury and is defined as a complex pathophysiological process affecting the brain, induced by biomechanical forces."

"Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilised in defining the nature of a concussive head injury include:"

4th International Conference on Concussion in Sport

- …direct blow to the head, face, neck or …‘‘impulsive’ force transmitted to the head.
- …rapid onset of short-lived impairment of neurological function that resolves spontaneously…In some cases, symptoms and signs may evolve over a number of minutes to hours.
- …functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
- …graded set of clinical symptoms that may or may not involve loss of consciousness.

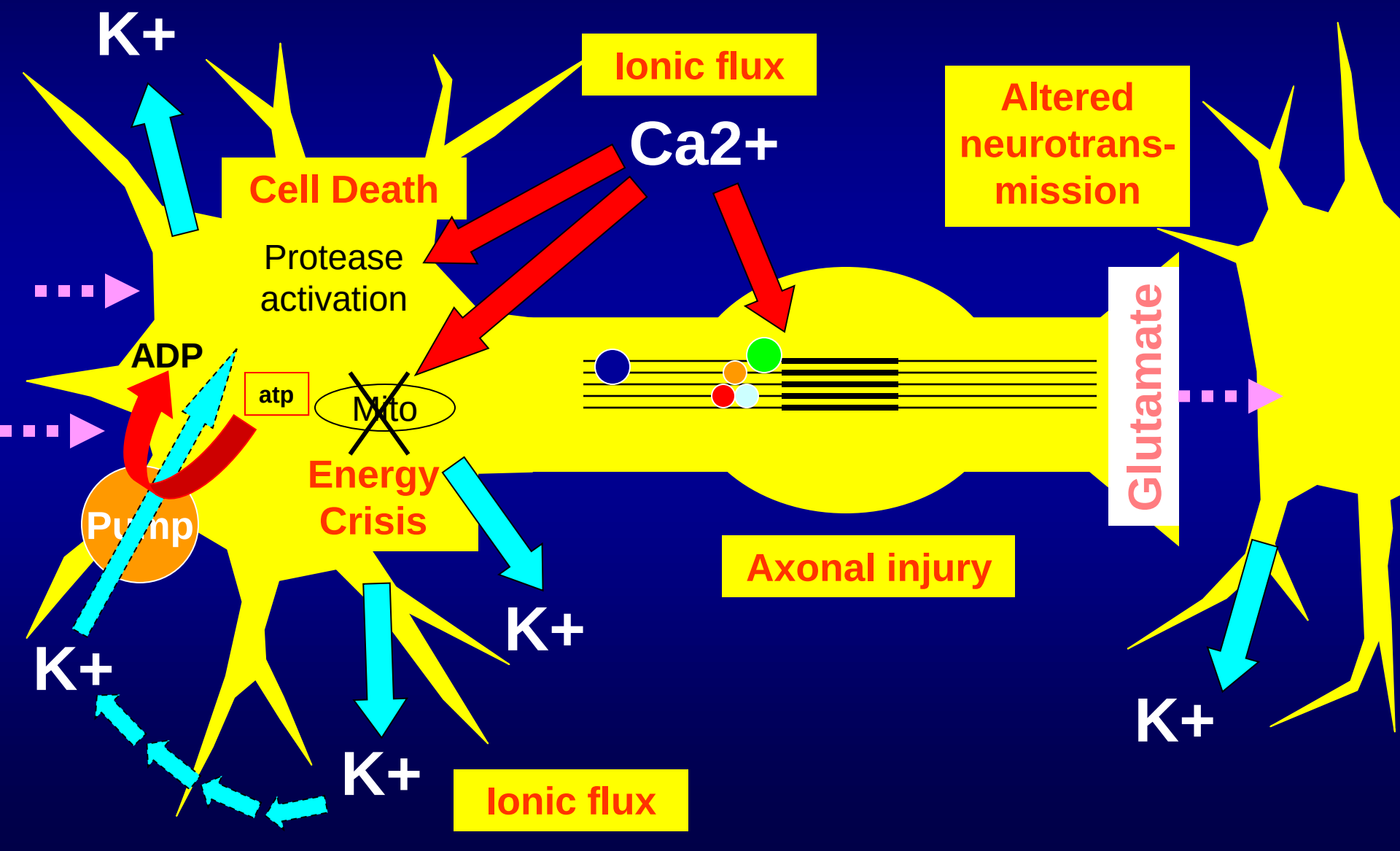
43rd Working Definition of Concussion

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.

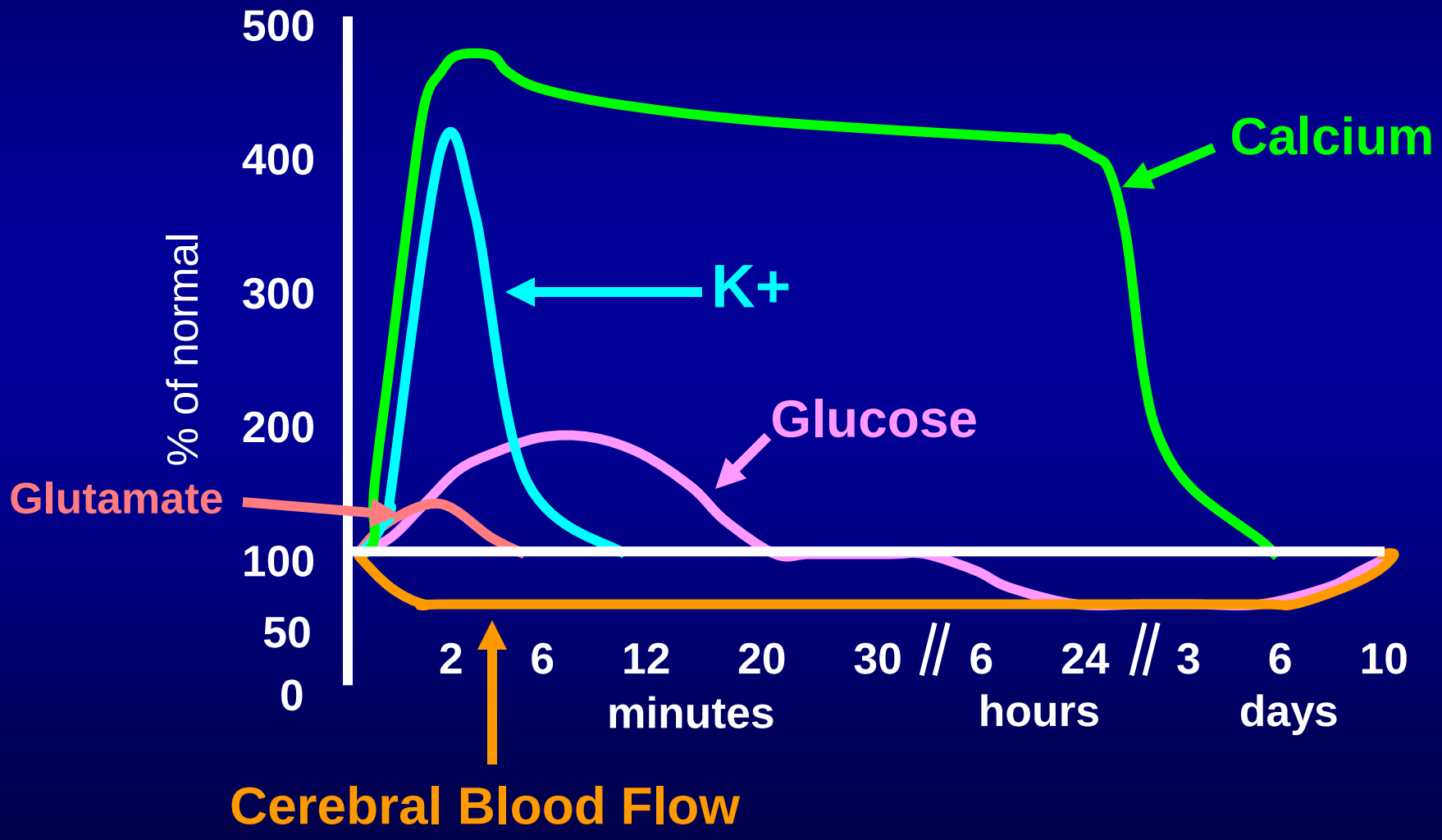
Neurometabolic Cascade of mTBI

(from Chris Giza)

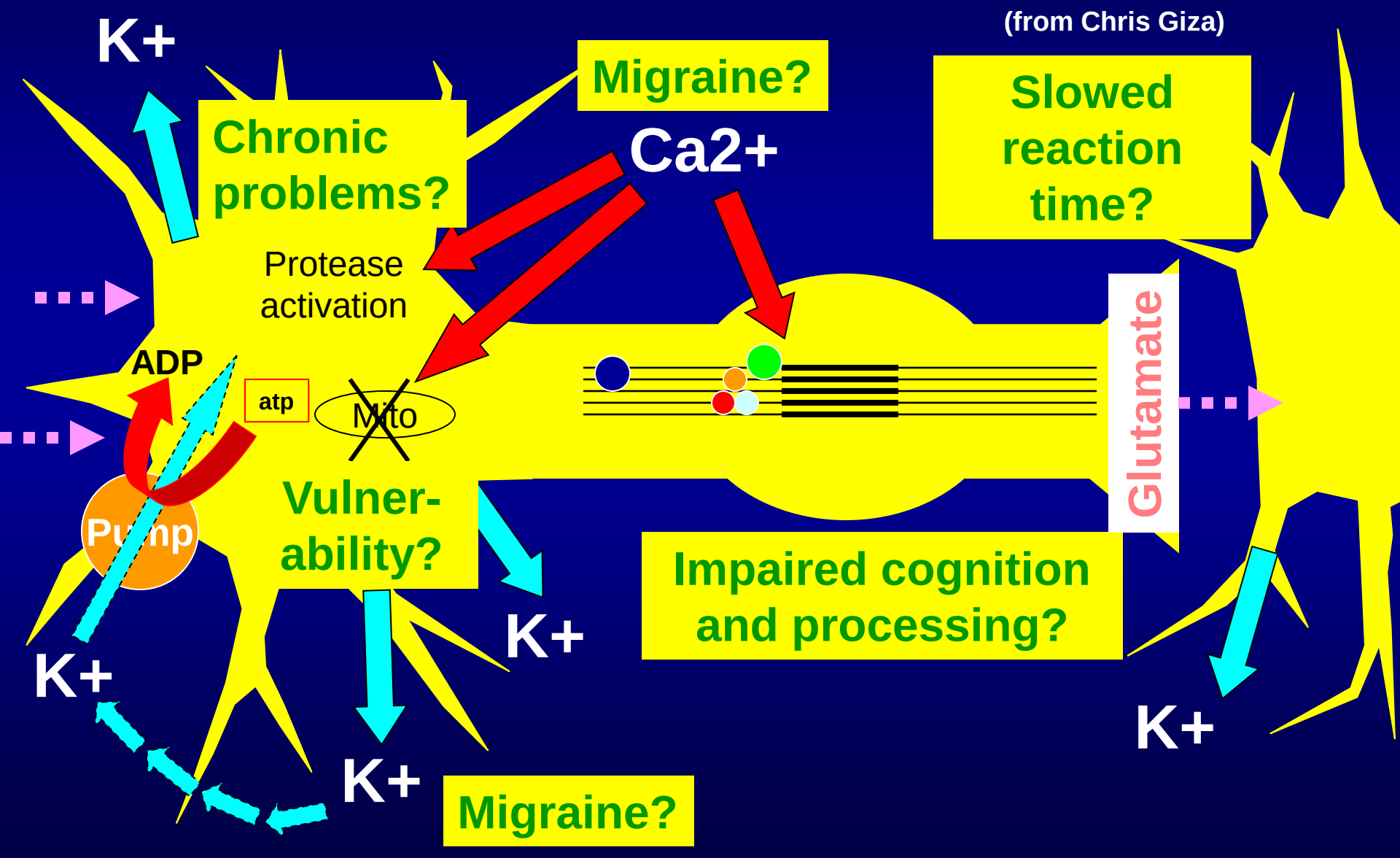


Neurometabolic Cascade Following Traumatic Brain Injury

(from Chris Giza)



Neurometabolic Cascade of mTBI:
Pathophysiology Meets Symptoms



Signs & Symptoms

AMSSM Position Stand '13

- Variety of Signs & Symptoms

Box 1 Signs and symptoms of a concussion

- Physical
  - Headache
  - Nausea
  - Vomiting
  - Balance problems
  - Dizziness
  - Visual problems
  - Fatigue
  - Sensitivity to light
  - Sensitivity to noise
  - Numbness/tingling
  - Dazed
  - Stunned

Box 1 Signs and symptoms of a concussion continued

- Cognitive
  - Feeling mentally 'foggy'
  - Feeling slowed down
  - Difficulty concentrating
  - Difficulty remembering
  - Forgetful of recent information and conversations
  - Confused about recent events
  - Answers questions slowly
  - Repeats questions
- Emotional
  - Irritable
  - Sadness
  - More emotional
  - Nervousness
- Sleep
  - Drowsiness
  - Sleep more than usual
  - Sleep less than usual
  - Difficulty falling asleep

Symptoms

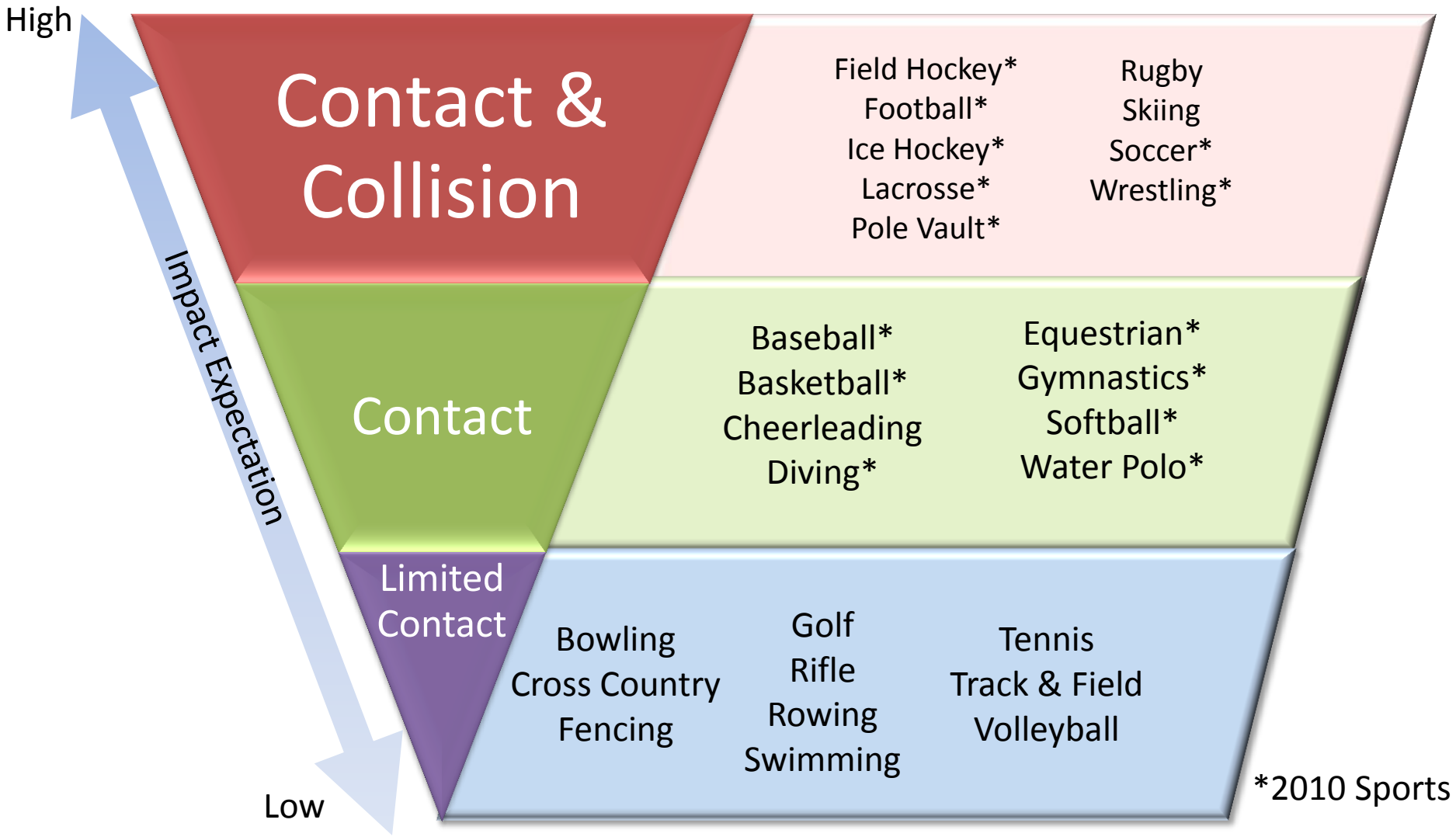
- Internal consistency reliability of 0.88 to 0.94 when part of comprehensive program including baseline vs. post-injury assessment (Lovell ’06)
- HS & College athletes (McCrea ’09)
  - 21% resolution sx w/in 1st day
  - < 3% report sx > one month
- Problem with relying on sx;
  - Subjective
  - Not all specific to concussion

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

Concussion Rates

2009-2014 Academic Years Reported Concussion Rate, by Sport	
Sport	**Number**
Men's Wrestling	1.08
Women's Field Hockey	1.04
Men's Ice Hockey	0.82
Men's Football	0.66
Women's Ice Hockey	0.63
Women's Soccer	0.62
Women's Basketball	0.6
Women's Lacrosse	0.58
Men's Basketball	0.4
Men's Lacrosse	0.38
Men's Soccer	0.34
Women's Softball	0.33


High
Impact Expectation
Low
Contact & Collision
Field Hockey*
Football*
Ice Hockey*
Lacrosse*
Pole Vault*
Rugby
Skiing
Soccer*
Wrestling*
Contact
Baseball*
Basketball*
Cheerleading
Diving*
Equestrian*
Gymnastics*
Softball*
Water Polo*
Limited Contact
Bowling
Cross Country
Fencing
Golf
Rifle
Rowing
Swimming
Tennis
Track & Field
Volleyball
*2010 Sports

Concussion in the 21st Century: Desperately Needed Future Directions

- Concussion definition is inadequate:
  - Comparison of concussion vs. breast cancer

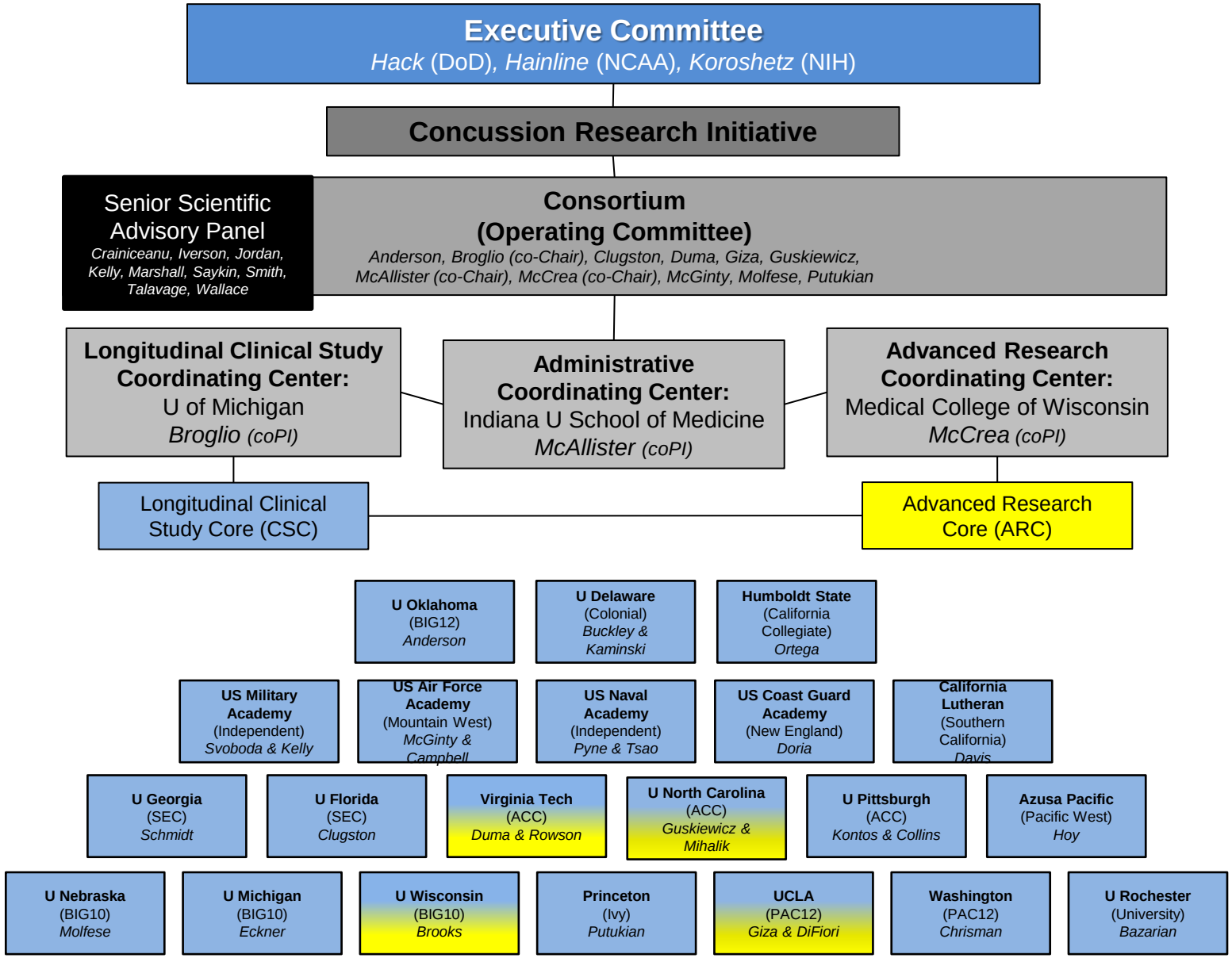
- Concussion localization and pathophysiology is virtually non-existent

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.



NCAA-DOD Grand Alliance CARE Consortium

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*		
• Demographics • Personal and Family History • Neurocognitive Assessment • Neurological Status • Postural Stability • Symptoms	• Neurological Status • Postural Stability • Symptoms	• Neurocognitive Assessment • Neurological Status • Postural Stability • Symptoms
LEVEL B*		
• Advanced Postural Stability • Reaction Time • Oculomotor / Oculovestibular • Smell/Vision • Quality of Life	• Reaction Time • Oculomotor / Oculovestibular • Smell/Vision	• 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.

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
Advanced Research Core (ARC)	Blood Biomarker & DNA Collection	X	X	X	X		X	X
	Multi-modal MRI Studies			X	X		X	X

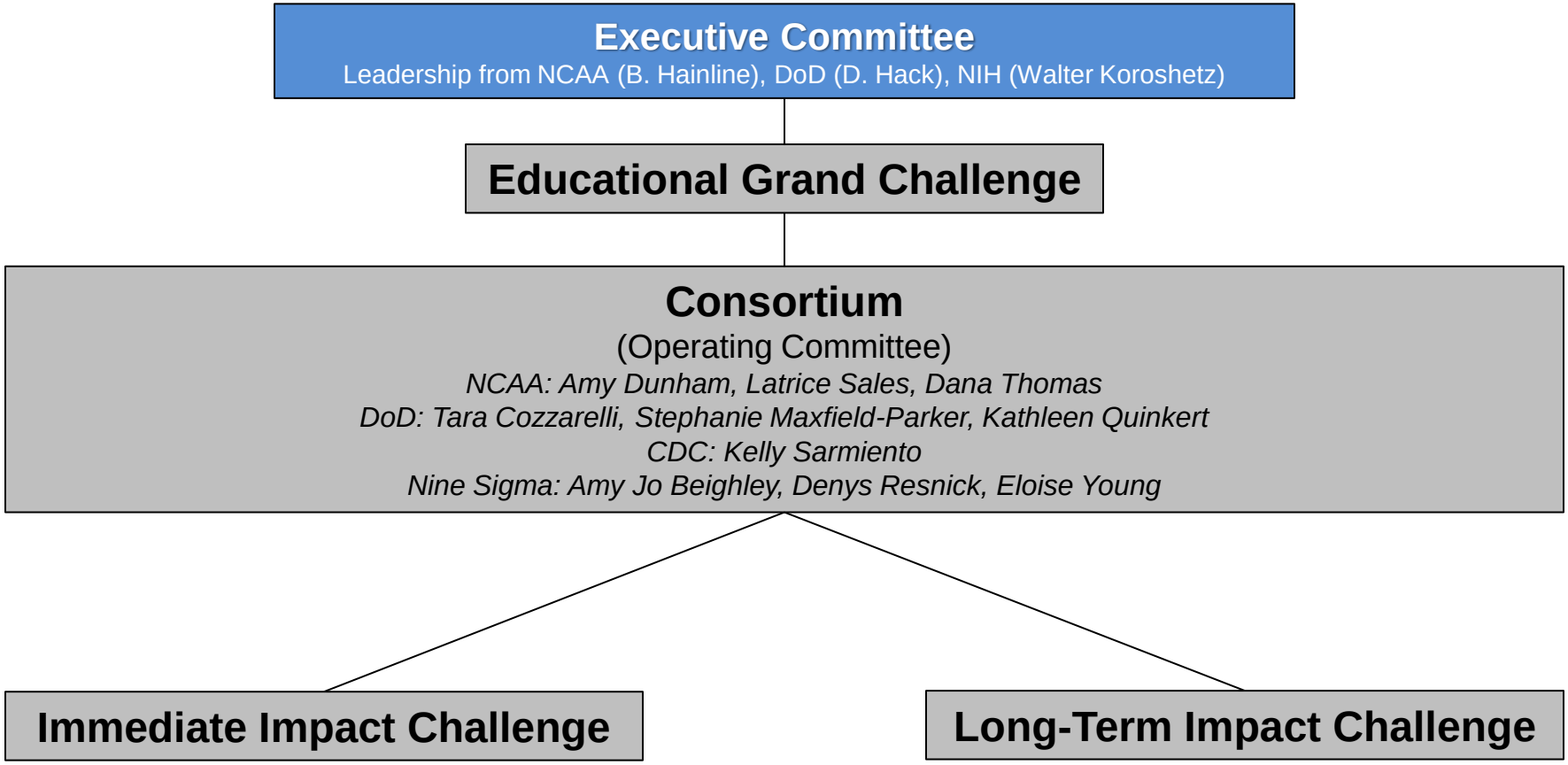
Estimated Enrollment

- 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 ~ 25,000 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

- 3000 baseline studies completed.
- 75 concussions captured.
- 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



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.

Clinical Study: Future Considerations

- Increase public/private funding
- Develop semi-autonomous regional hubs
- Standardize clinical data entry and processing
- Foundation for long-term clinical studies and multiple advance research initiatives

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.

Year-Round Football Practice Contact

Live contact practice: Any practice that involves live tackling to the ground and/or live or full-speed blocking. Live-contact practice may occur in full-pad or half-pad (also known as “shell,” in which the player wears shoulder pads and shorts, with or without thigh pads). Live contact does not include “thud” sessions or drills that involve “wrapping up,” during which players are not taken to the ground and contact is not aggressive in nature. Live contact practices are to be conducted in a manner consistent with existing rules that prohibit targeting to the head or neck area with the helmet, forearm, elbow, or shoulder, or the initiation of contact with the helmet.

Year-Round Football Practice Contact

Full-pad practice: Full-pad practice may or may not involve live contact. Full-pad practices that do not involve live contact are intended to provide preparation for a game that is played in a full uniform, with an emphasis on technique and conditioning versus impact.

Year-Round Football Practice Contact

The guidelines that follow do not represent legislation or rules. As noted in the appendix, the intent of providing consensus guidelines in year one of the inaugural *Safety in College Football Summit* is to provide consensus-based guidance that will be evaluated "real-time" as a "living and breathing" document that will become solidified over time through evidence-based observations and experience.

Year-Round Football Practice Contact

Inseason practice guidelines:

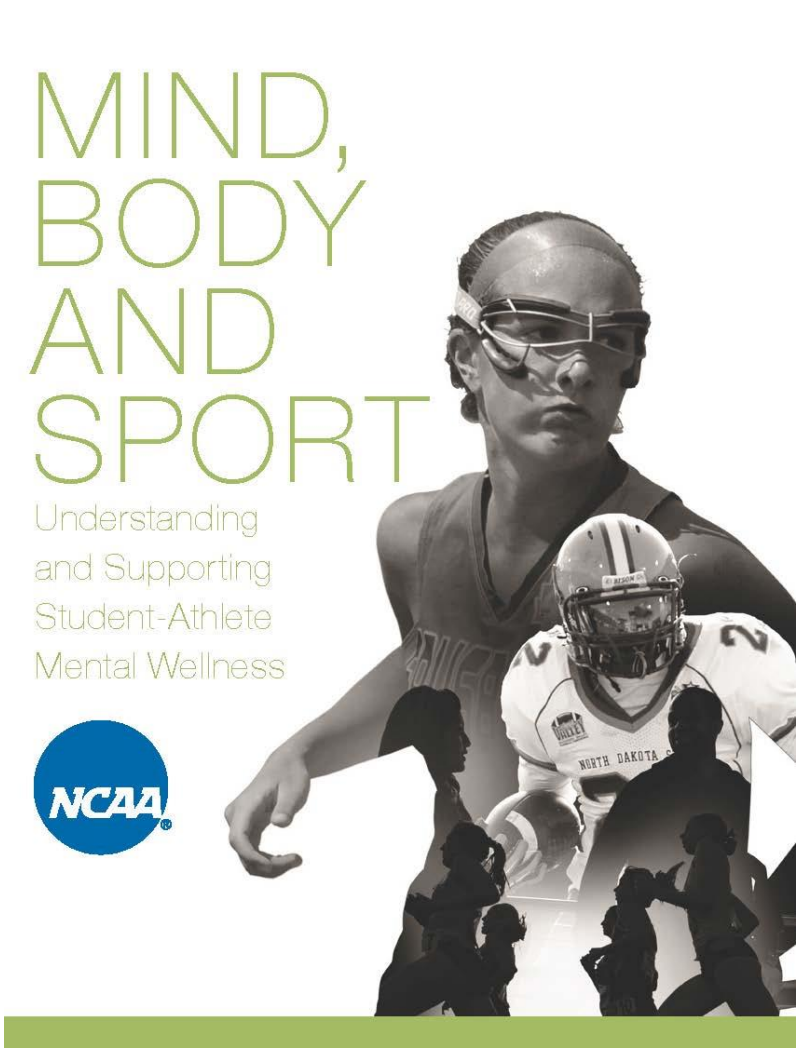
- Inseason is defined as the period between six (6) days prior to the first regular-season game and the final regular-season game or conference championship game (for participating institutions).
- There may be no more than two (2) live contact practices per week.

Independent Medical Care in the Collegiate Setting

- Inter-association consensus statement.
- Allowance for multiple models for collegiate sports medicine.
- Establish a medical director.
- The medical director and primary athletics health care providers should be empowered with unchallengeable autonomous authority to determine medical management and return-to-play decisions of student-athletes.

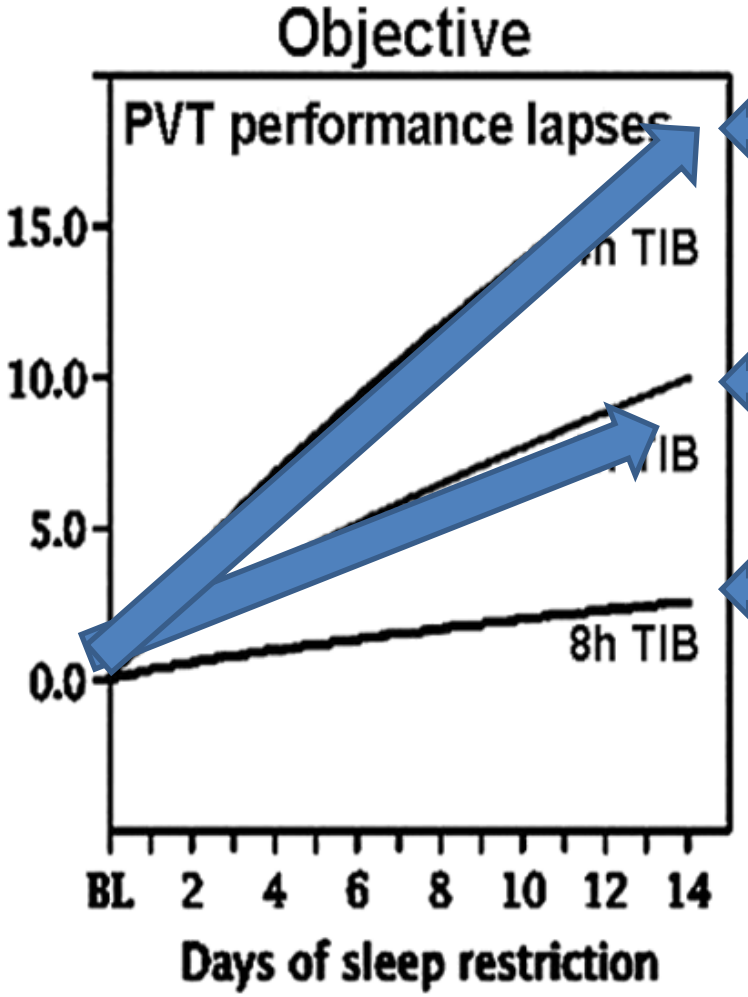
Guidelines Endorsements

- 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



- Personal narratives
- Experts on S-A depression, anxiety, eating disorders, substance abuse, gambling
- Stressors on S-A MH: transitions, performance, injury, academic stress, coach relations
- Sexual assault, hazing, bullying
- Cultural pressures: black, lgbtq athletes
- Role & responsibility of sports medicine
- Coaches' needs and roles
- Models of service
- NCAA resources and policies

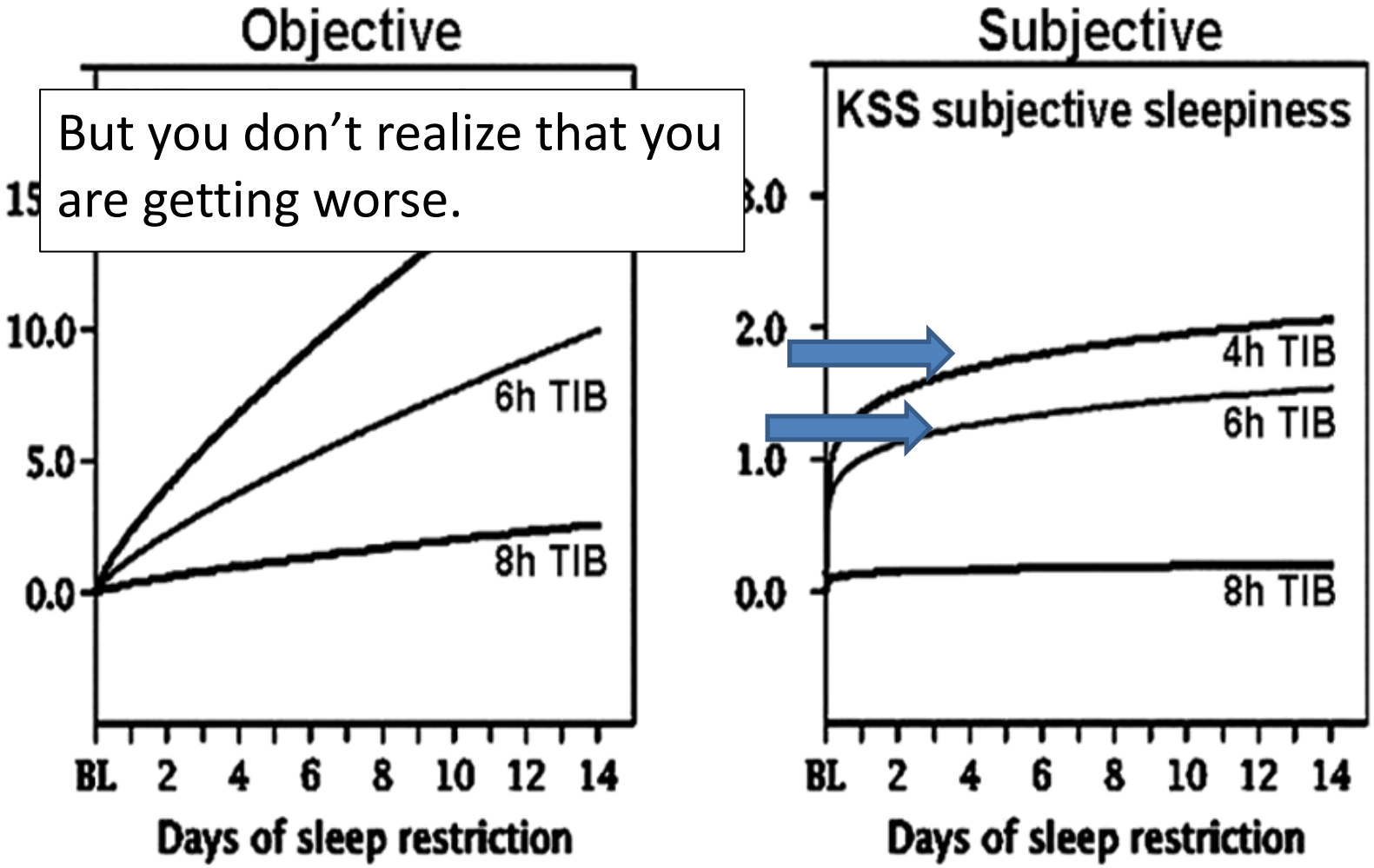
Sleep and performance



- The less sleep you get, the **more impaired** you are
- Deficits due to sleep loss are **cumulative**
- After 2 weeks, you **don't adjust** -- you get worse

Van Dongen et al., 2004

Sleep and performance



Van Dongen et al., 2004

Depression

- Have you ever…..Felt so depressed that is was difficult to function (Yes, in last 12 months)

	STUDENT-ATHLETES	NON-ATHLETES
Male	21% (1,623)	27%
Female	28% (3,303)	33%
White	24%	30%
Black	26%	30%
Other	29%	34%

Anxiety

- Have you ever…..Felt overwhelming anxiety (Yes, in last 12 months)

	STUDENT-ATHLETES	NON-ATHLETES
Male	31% (2,439)	40%
Female	48% (5,747)	56%
White	42%	52%
Black	29%	41%
Other	43%	50%

Mental Health: Next Steps

- www.ncaa.org/mentalhealth
- Progressive rollout of ‘Best Practices’
- Pre-Participation Exam

Cardiac Task Force

- Sudden Cardiac Death
  - Leading cause of death during sport
  - Risk:
    - Overall: 1 in 54,000 s-a
    - Male: 1 in 38,000; Female: 1 in 122,000
    - African-American: 1 in 20,000
    - Men's basketball: 1 in 9,000
      - African-American men's basketball: 1 in 5,000
    - Other high risk: men's soccer, men's football, women's basketball

Developing Cardiac Recommendations

- Bringing together diverse groups
- Expanding research
- Ensuring Emergency Action Plans
- Targeting screening for high-risk populations

Medical Insurance

- All s-a must have insurance that covers:
  - Athletic-related injuries
  - Basic coverage up to $90K

- NCAA Catastrophic Health Insurance
  - For catastrophic injuries
  - Begins after $90K of medical payments
  - Covers $20M for life
  - Monthly payments
  - Continuing education
  - Home modifications

Early Specialization and Overuse Injuries

- Announce rollout of staged task forces in February, 2015 with Project Play
  - Soccer Summit: February 2015
  - Wrestling Summit: Summer 2015
- Buy-in of NGBs and youth sport
- Emphasize athleticism
- Ensure periodization as foundation

Doping, Drug Testing and Drug Education

- CSMAS retreat in December 2014:
  - Deterrence policy for PEDs
  - Biopsychosocial medical model for alcohol and other recreational drugs
- Current pilot at 115 DI schools:
  - myPlaybook drug education
  - 20 schools with additional sexual violence education
- Vision:
  - Conference synergy for PEDs and alcohol/other recreational drugs

The Societal Dialogue

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

Thank You