

Early-Stage Investigator Lecture

Understanding and Preventing Sport-Related Brain Injury Using a Public Health Prevention Framework

Presented by:

Christine Baugh, Ph.D., M.P.H.
University of Colorado School of Medicine



National Institutes of Health
Office of Disease Prevention

Understanding and Preventing Sport Related Brain Injury Using a Public Health Prevention Framework

Christine Baugh, PhD, MPH

NIH ODP Early-Stage Investigator Lecture

Thank you

Introduction

- Introduction
- Acknowledgements
- Roadmap

Introduction



Acknowledgements



Thank you to my many mentors and colleagues, some of whom are pictured here.

A very special thank you to the clinicians and athletes who have facilitated and/or participated in the research. Without you none of this would be possible.

An additional thanks to my many collaborators, across institutions and disciplines, who have helped advance this work and to the students and trainees who continue to inspire me with their enthusiasm and novel ideas.

Acknowledgements



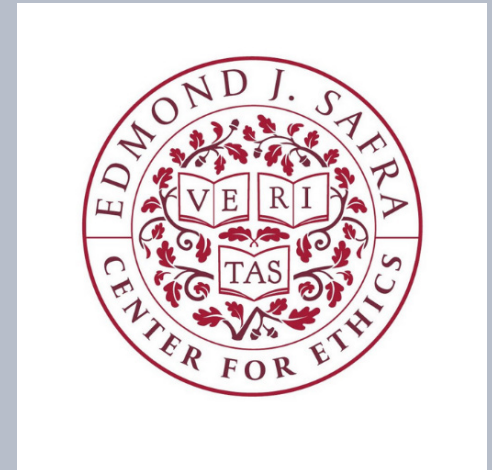
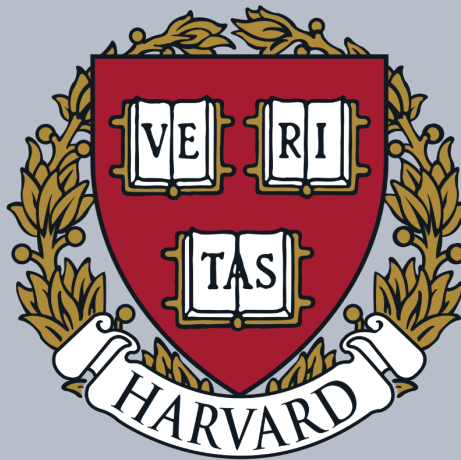
THE FOOTBALL PLAYERS
HEALTH STUDY
AT HARVARD UNIVERSITY



University of Colorado
Anschutz Medical Campus



The
**Greenwall
Foundation**





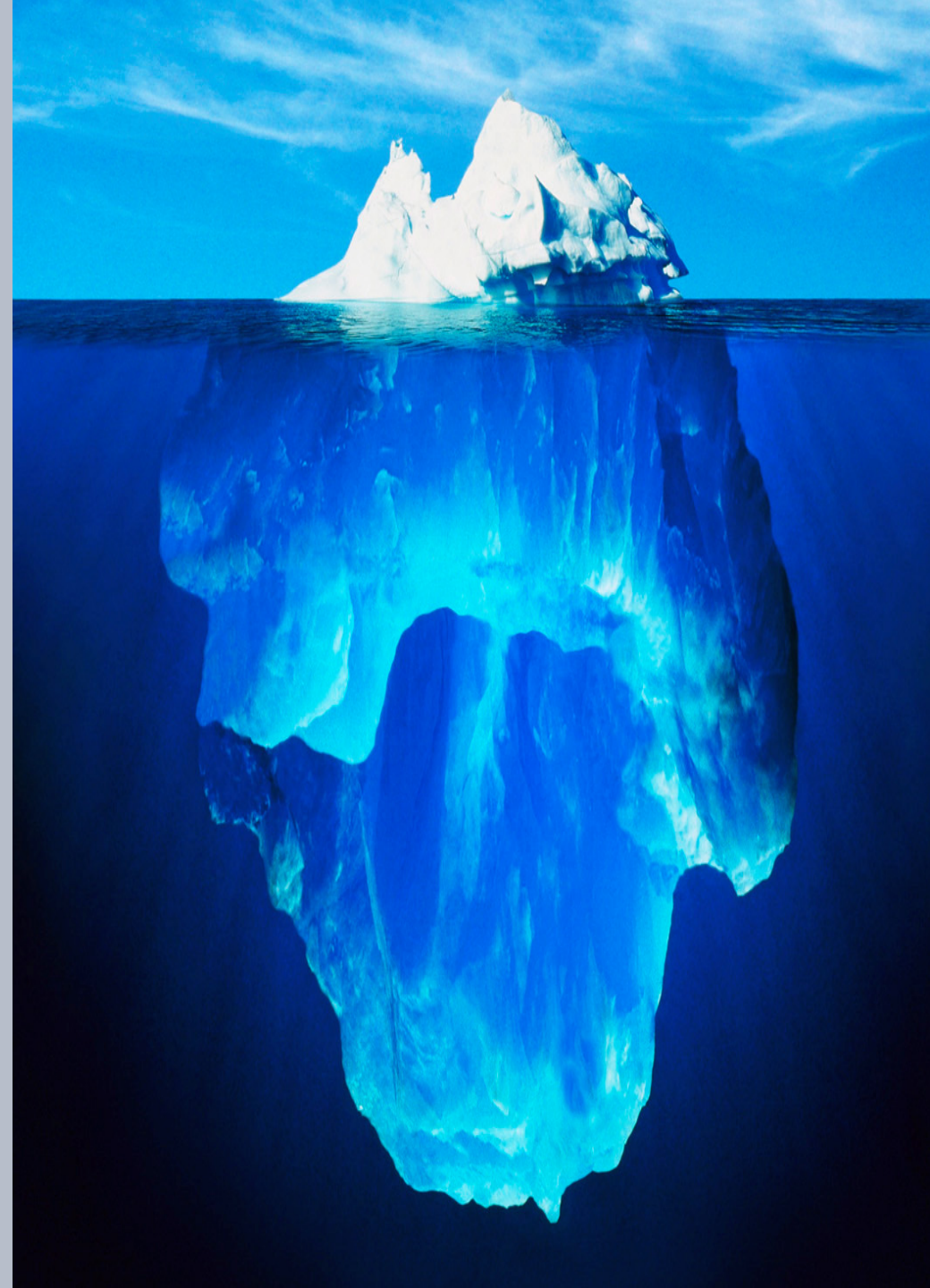
- Define the Problem(s)
- Framing Potential Solutions
- Lessons from Applied Work
- Ethical Considerations & Future Directions

Defining the Problem(s)

- Concussion, Repetitive Head Impacts, Long-term Sequelae
- Epidemiology
- Risk Factors

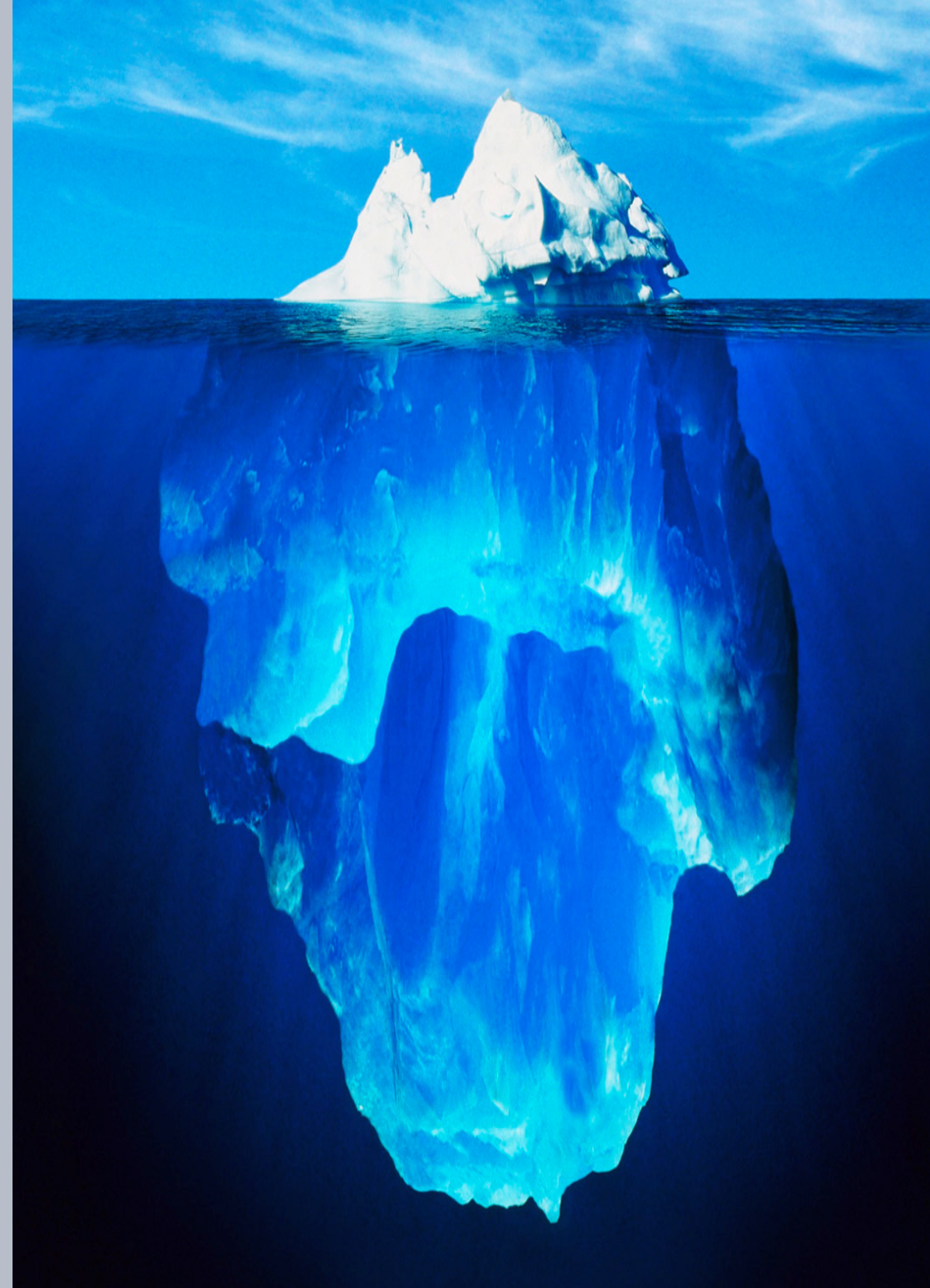
Defining the Problem(s)

- Concussion (mTBI)
 - Acute clinical phenomenon
 - Rapid acceleration/deceleration
 - Diffuse, invisible, microscopic, metabolic
 - Potential symptoms numerous, variable
 - Clinical diagnosis, symptom disclosure
 - Early dx, mgmt. → improved clinical course
 - Most resolve in days/weeks



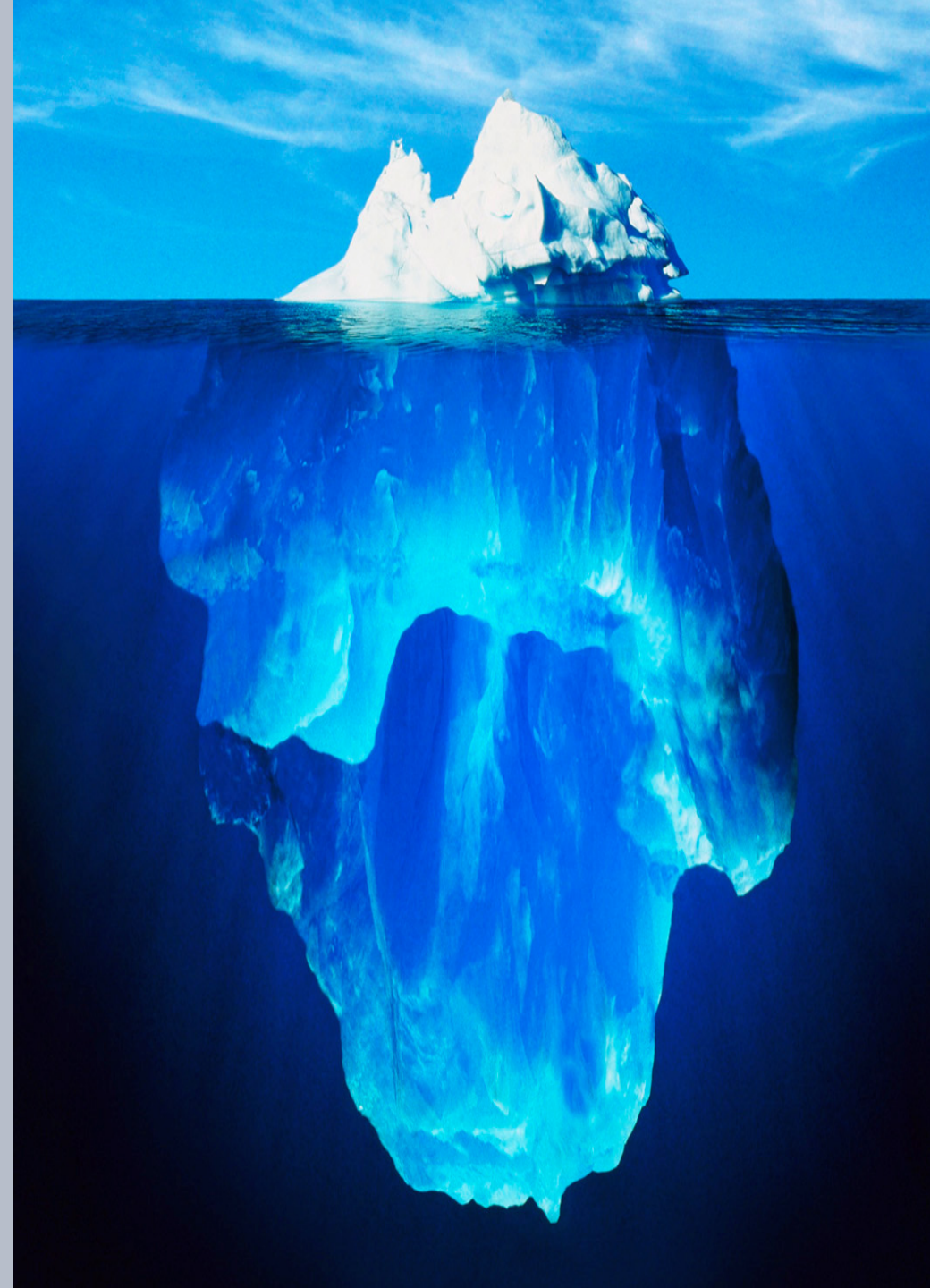
Defining the Problem(s)

- Concussion (mTBI)
 - Acute clinical phenomenon
- Repetitive Head Impacts
 - Helpful for conceptualizing total head/brain trauma exposure burden
 - Includes asymptomatic subconcussive
 - Measurement, averages
 - High levels of cumulative RHI associated with both acute and long-term health deficits



Defining the Problem(s)

- Concussion (mTBI)
 - Acute clinical phenomenon
- Repetitive Head Impacts
 - Helpful for conceptualizing total head/brain trauma exposure burden
- Neurological Sequelae
 - Not a bunch of concussions added together
 - Neurodegenerative: Chronic Traumatic Encephalopathy (CTE), Alzheimer's, ALS
 - Mechanism(s) underlying relationship unclear
 - Apparent in later-life.



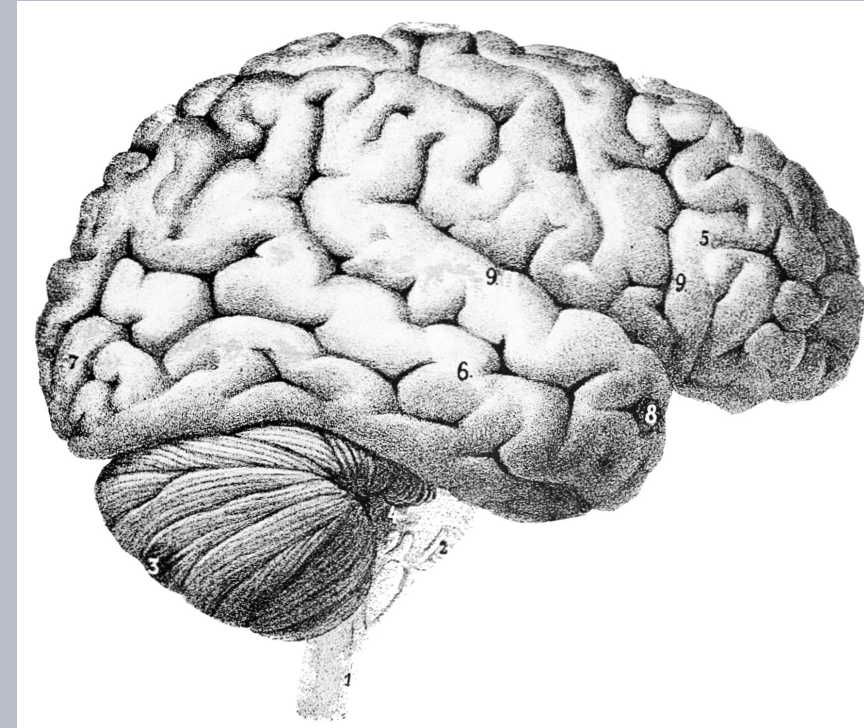
Understanding and Preventing Sport Related Repetitive Head Impacts, Brain Injury, and Related Neurologic Sequelae Using a Public Health Prevention Framework

Christine Baugh, PhD, MPH

NIH ODP Early-Stage Investigator Lecture

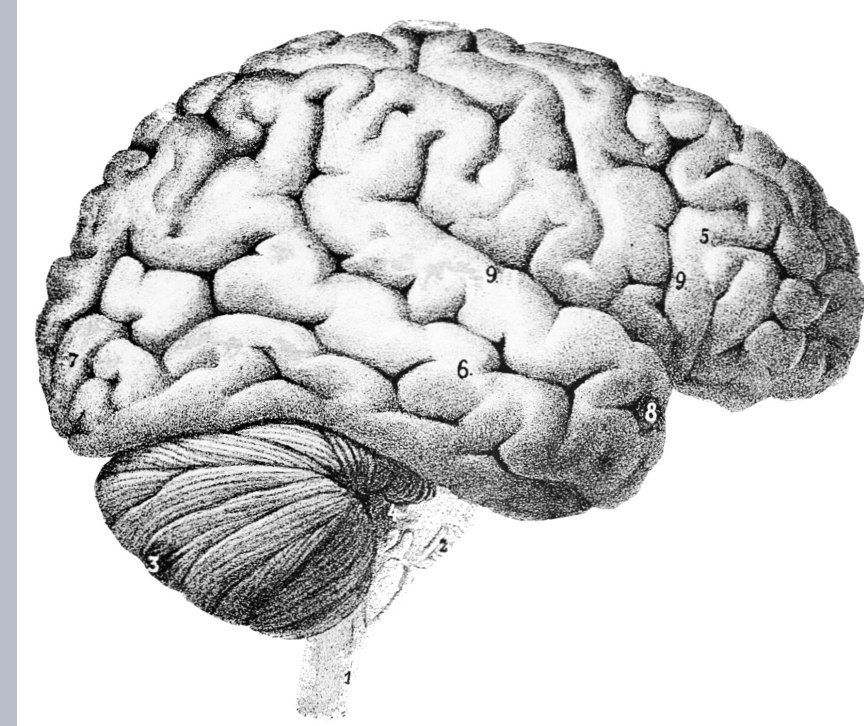
Epidemiology

- Concussion
 - 1.6-3.8 million sports and recreation related concussions occur annually in the United States
 - Increase in diagnosed concussions across time
 - Within comparable sports, women tend to have higher rates of concussion than men
 - Games vs. Practice
- Challenges to Measurement
 - Invisible injury, underreported
 - Some measures use emergency department visits
 - Evolving understanding/awareness of what = concussion over time



Epidemiology

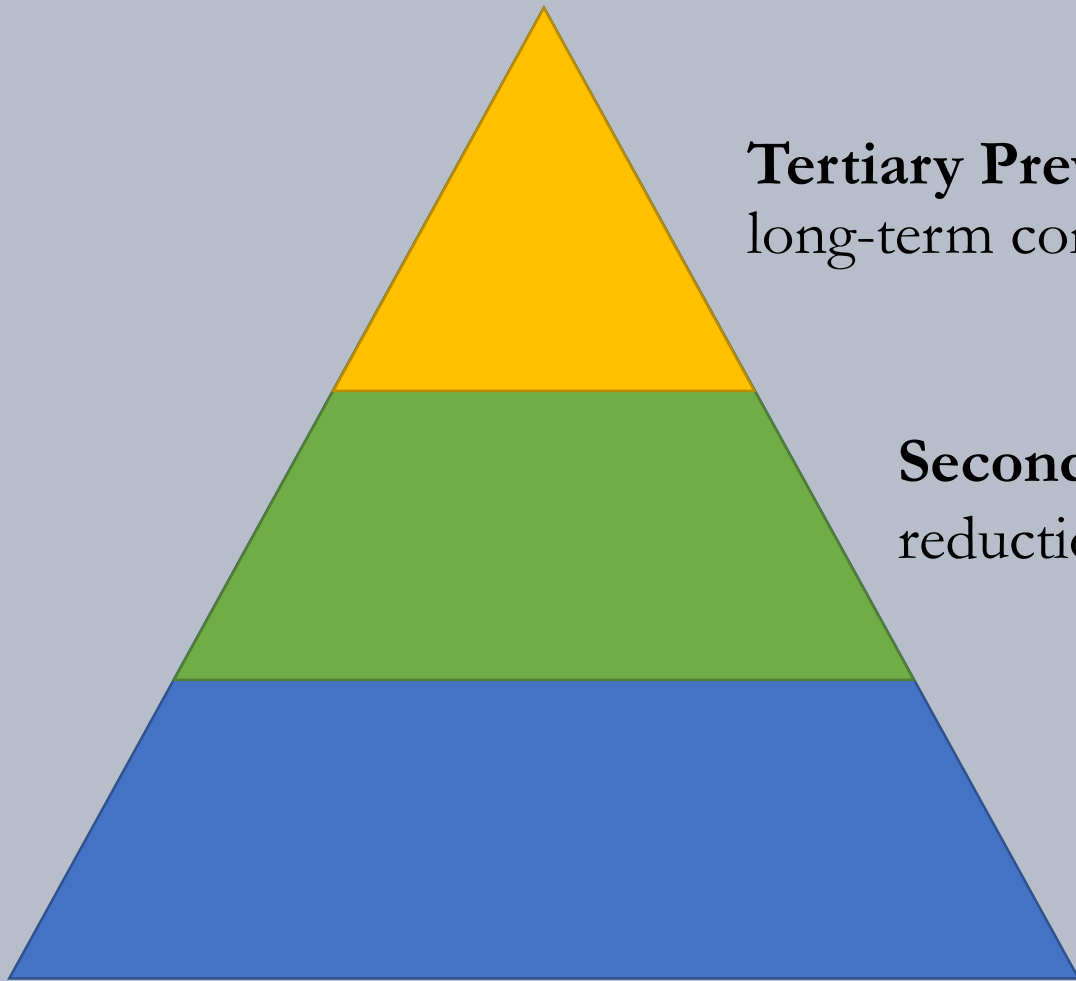
- Head impacts increase risk of neurodegeneration
 - **CTE:** Dose response relationship between football RHI and CTE (Mez, LeClair)
 - **Alzheimer's:** 4x higher rates of death with AD among NFL players (Lehman)
 - **ALS:** Associated with duration of NFL participation (Daneshvar); 4x higher rates of death from ALS among NFL players (Lehman)
- Exact incidence or prevalence of RHI / concussion / TBI induced neurodegeneration unknown



Framing Potential Solutions

- Public Health Prevention Framework
- Socioecological Model
- Challenges and Considerations

Prevention Framework



Tertiary Prevention: Actions that reduce the long-term consequences

Secondary Prevention: Immediate response and reduction of acute and short-term consequences

Primary Prevention: Approaches that take place before the outcome and prevent it from occurring at all

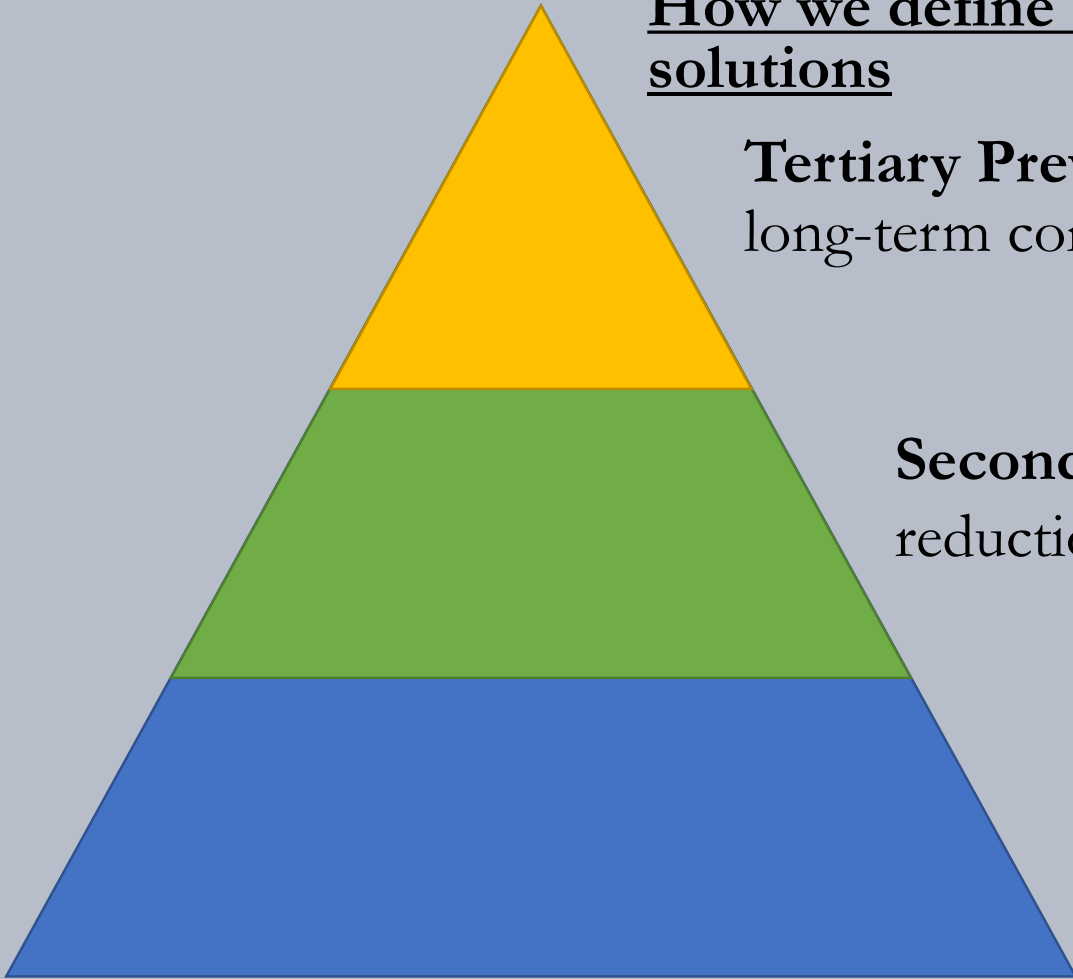
Prevention Framework

How we define the problem guides appropriate potential solutions

Tertiary Prevention: Actions that reduce the long-term consequences

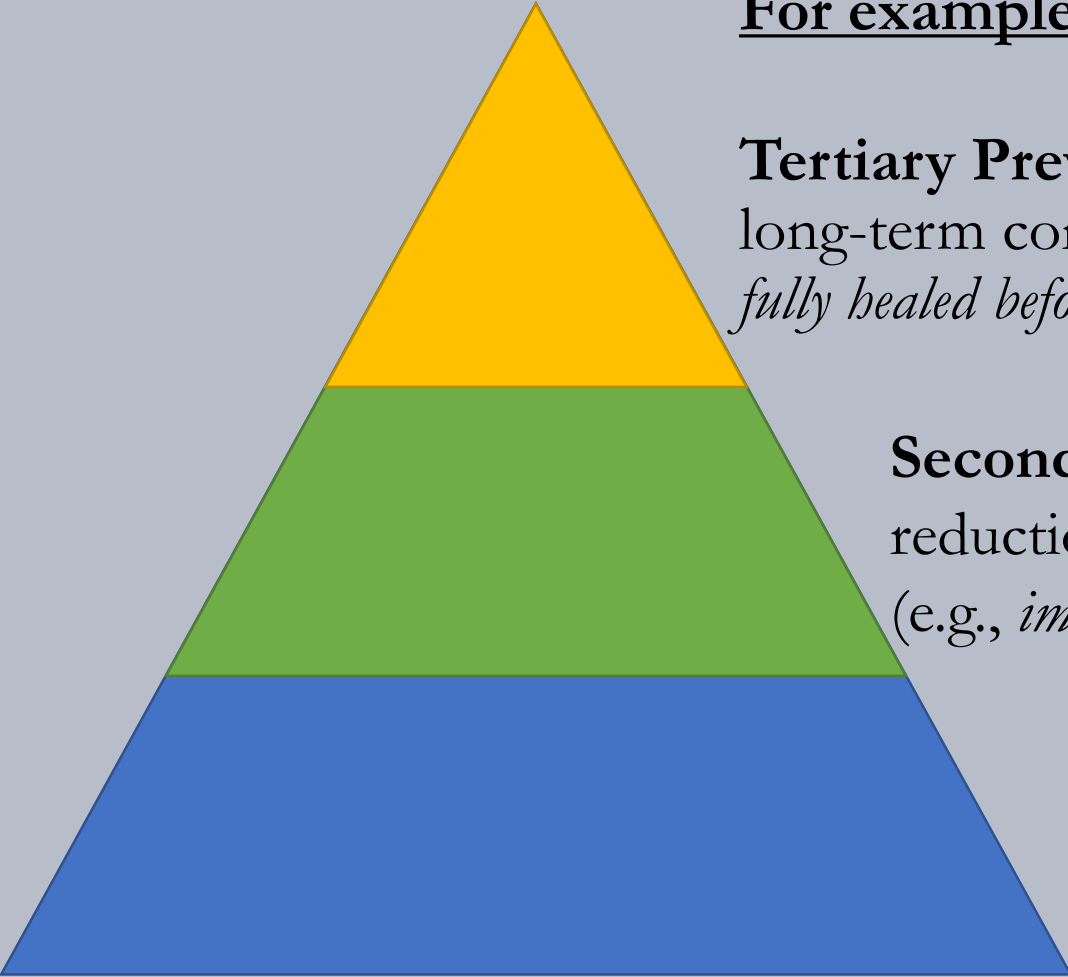
Secondary Prevention: Immediate response and reduction of acute and short-term consequences

Primary Prevention: Approaches that take place before the outcome and prevent it from occurring at all



Prevention Framework

For example, if applied to *Concussion*

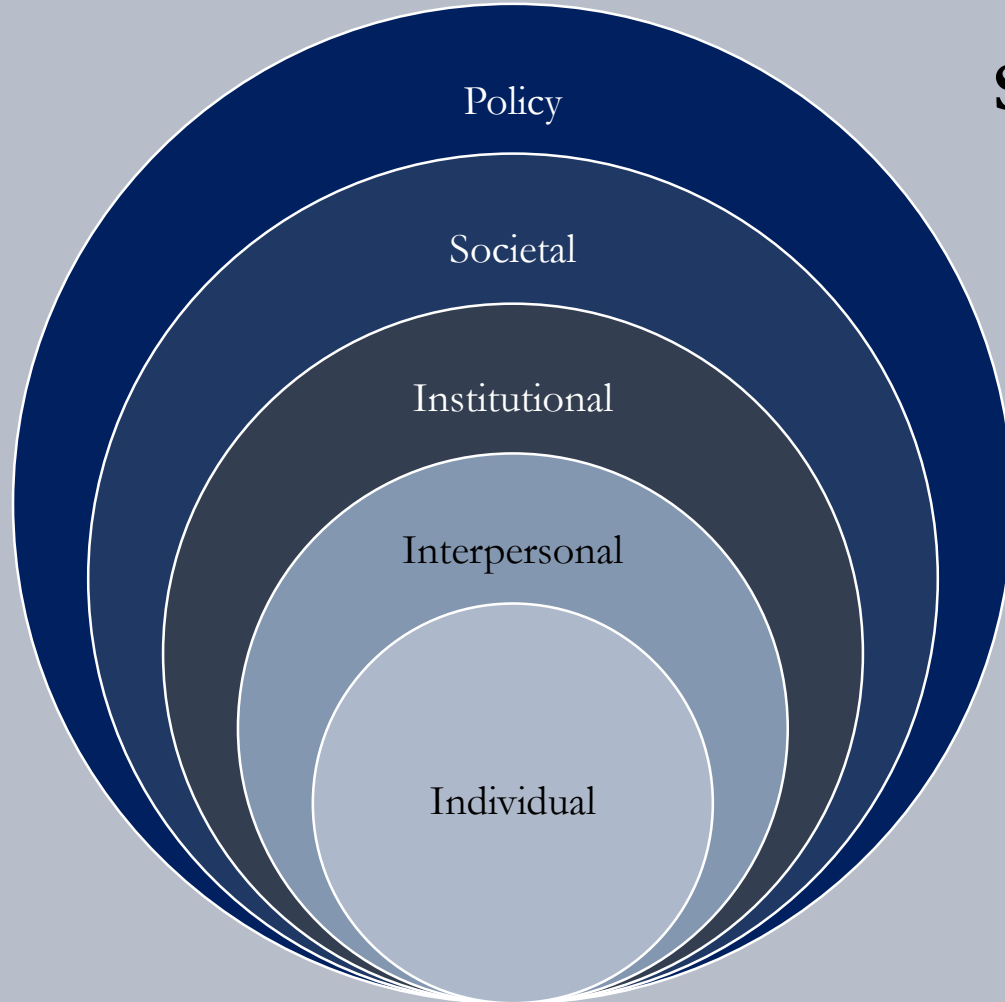


Tertiary Prevention: Actions that reduce the long-term consequences (e.g., *ensure initial injury fully healed before RTP*)

Secondary Prevention: Immediate response and reduction of acute and short-term consequences (e.g., *immediate identification, appropriate dx, management*)

Primary Prevention: Approaches that take place before the outcome and prevent it from occurring at all (e.g., *reduce/eliminate high risk plays*)

Socio-Ecological Model



Solutions can occur at a variety of levels

- Well-defined theory in public health
- Nested levels of influence
- Intervention possible within and across levels
- Useful in understanding health related behaviors and injury prevention (e.g., Register-Mihalik, Kerr, others)
- **How we define the problem matters.**

Challenges and Considerations

- How can we best measure that our interventions achieve their intended outcomes?
Avoid unintended consequences?
- Sport. Positive aspects, lots of feelings
- What are we trying to prevent, exactly?
- **If concussion/RHI → neurodegenerative sequelae, then preventing concussion/RHI prevents (or reduces the likelihood of?) neurodegenerative sequelae**

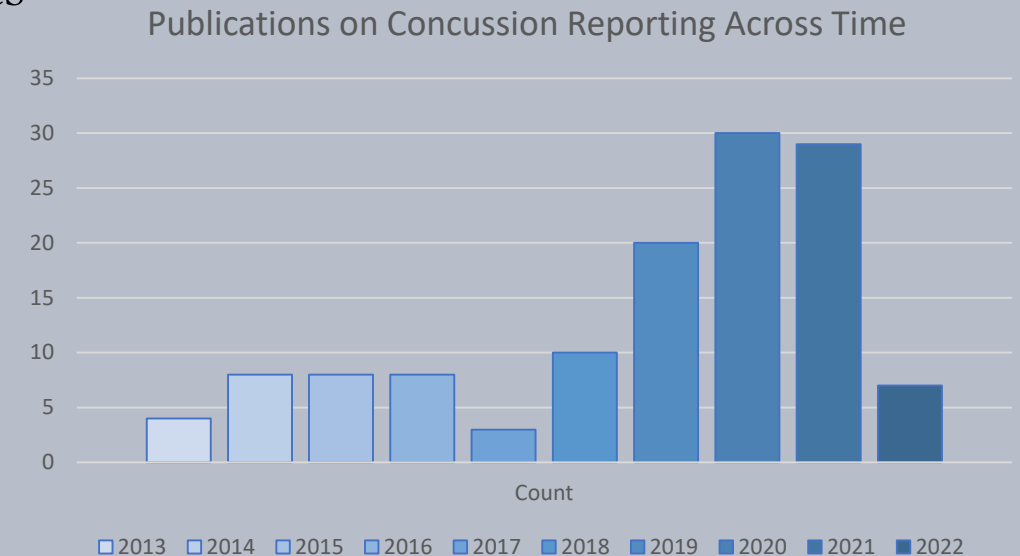


Applied Work & Lessons Learned

- Concussion Disclosure & Cognitive Biases
- Concussion & RHI Prevention Policies
- Back to the Basics: Access to Health Care

Athlete Concussion Disclosure

- Some studies estimate >50% of concussion go undisclosed/undiagnosed
- Numerous factors influence athlete concussion reporting including:
 - (Perceived) Social norms
 - Pressure/Support from stakeholders
 - Incentive structures, perceived costs/benefits
 - History of concussion
 - Educational interventions
 - Access to & trust in medical team
 - Complex, multifactorial
- Secondary/Tertiary Prevention



Athlete Concussion Disclosure

Editorial

Athlete Concussion Reporting: It Is Time to Think Bigger

“Although understanding and improving concussion reporting by athletes are important, we should not forget the broader context in which this occurs, nor should we forgo considering other more global solutions to improving athlete health and well-being...If athletes are faced with limited access to clinicians who face structural conflicts of interest, it is reasonable to suggest that this would decrease their willingness to disclose a concussion even in the case of a strong intention to do so. Shifting our perspective from the reasons why athletes do not report to the ways in which institutions and institutional actors can support athletes in seeking appropriate medical care may lead to improvements in athlete health and well-being including, but also beyond, the realm of concussion.”

Cognitive Biases

- Well described cognitive biases (cog psych, behavioral econ) affect athletes' risk perceptions and medical and care-seeking decisions
- **Underestimation:** Most college football players underestimate their risks of concussion and other injuries
- **Cognitive Reflection:** The ability to switch between fast reactive thinking and slow deliberative thinking is associated with viewing long-term health consequences from football as more likely
- **Pluralistic Ignorance:** Misperceived concussion disclosure social norms may cyclically reinforce underreporting behavior

Original Investigation | Public Health

December 29, 2020

Accuracy of US College Football Players' Estimates of Their Risk of Concussion or Injury

Christine M. Baugh, MPH, PhD^{1,2,3}; Emily Kroshus, ScD^{4,5}; William P. Meehan III, MD⁶; et al

» Author Affiliations | Article Information

JAMA Netw Open. 2020;3(12):e2031509. doi:10.1001/jamanetworkopen.2020.31509

Factors Influencing College Football Players' Beliefs About Incurring Football-Related Dementia

Christine M. Baugh,^{*,††} PhD, MPH, Mason A. Gedlaman,[§] BA, Daniel H. Daneshvar,^{||¶} MD, PhD, and Emily Kroshus,^{###} ScD, MPH

Pluralistic Ignorance as a Contributing Factor to Concussion Underreporting

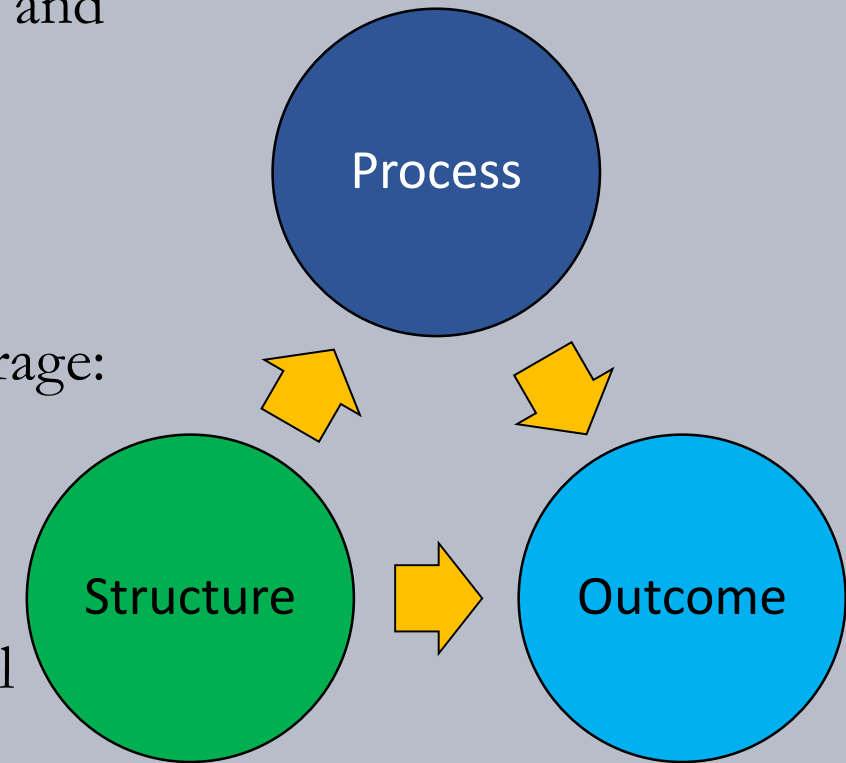
Christine M. Baugh, PhD, MPH¹ , Craig A. Foster, PhD^{2,3}, Brian R. Johnson, PhD⁴, and Christopher D'Lauro, PhD²

Concussion & RHI Related Policy

- **State Laws:** All 50 states have adopted a concussion law; 3 tenets
 - Secondary/Tertiary Prevention
- **Sport and League Policies:** Numerous policies have been put in place by sports sanctioning bodies, leagues, conferences, etc.
 - Primary prevention of concussion & RHI: reduction in contact (e.g., Ivy League)
 - Primary prevention of concussion: change/remove dangerous plays (e.g., kickoff)
 - Secondary/tertiary prevention: required removal, eval, clearance (e.g., NCAA)
- **Very few policies formally evaluated.**
- **Policies often lack data collection and/or enforcement mechanisms.**

Health Care Access and Athlete Health Outcomes

- Series of 3 papers examining staffing, employment model and injury (including concussion) at NCAA schools
- Staffing varies widely (29-575 patients/clinician)
- Injury patterns varied based on proportion of trainees
- Compared to clinician with average # patients, 1SD >average:
 - 9.5% more injuries
 - 2.7% more reinjuries
 - 6.7% more concussions
- Better staffing at schools operating under a medical model
- Access to care affects athlete injury and concussion



Donabedian Model of
Health Care Quality

Ethical Considerations & Future Directions

- Ethical Considerations
- Future Directions
- Q&A

Ethical Considerations

- Individual autonomy vs collective responsibility to prevent injury or disease

“In general, policymakers have the duty to ensure that public health laws are consistent with available evidence and effective in achieving their aims. One way of explaining the origin of this duty is that in creating public health laws, policymakers are generally infringing on individuals’ liberties. Certain infringements are justified if the public health issues involved are important...However, the right of policymakers to constrain personal liberty for the sake of public health relies upon being sufficiently certain that the public health aims are achieved. In this way, policymakers and the public health community that advocated for the intervention bear a duty to ensure that the policy effectively advances the public health ends that justified it.”

- Lowrey, Morain, & Baugh. *J Health Care Law Policy* 2016



Ethical Considerations

- Structural and financial conflicts of interest
- Appropriate access to care
- Representation of women, individuals from historically underrepresented groups
- Parent decision-making/child welfare (e.g., flag vs. tackle)



Future Directions

- LOTS to do.
- Applying health services research tools and technique
- Understanding (equitable) access to care across levels
- Social and structural determinants of health
- Genetic and exposure risk factors for later life neurodegeneration
- Parent decisional processes and empowering informed decision-making
- Disparities in access and outcomes
- Sex and gender differences in concussion, RHI, neurodegenerative

Questions?

- Email: Christine.Baugh@cuanschultz.edu
- Twitter: [@christinebaugh](https://twitter.com/christinebaugh)