

Tale of Two TBIs

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Objectives

- Define Social Determinants of Health (SDH)
- List ways that SDH influence health outcomes (generally)
- Define types of traumatic brain injuries
- Recognize potentially serious consequences of head-trauma associated with sports participation
- Describe how SDH can positively or negatively impact traumatic brain injuries, including concussion
- Appreciate the role of SDH on health outcomes related to sports injuries
- Recognize the role of PT in advocacy efforts

Social Determinants of Health (SDH)

Environmental exposures where we live, work, and play, which impact our general wellness and health related outcomes

Social Determinants of Health



Education Access and Quality

- Associated with: employment status, income, and health
- Completion of high school is often viewed as a minimum requirement to attain essential skills for success in adulthood
 - Freudenberg et al., *Prev Chronic Dis*. 2007
- Linked with health through 3 major interrelated pathways:
 - Health knowledge and behaviors → health choices, timely medical care, regular exercise, healthy eating, not smoking or excessively drinking
 - Employment and income → higher paying jobs, insurance, affordability of healthcare expenses, better living conditions
 - Social and psychological factors → sense of control, social standing, and social support
 - Egerter et al., *Education and Health* 2009

Healthcare Access and Quality

- As of 2017, 1 in 10 Americans did not have insurance
 - Berchick et al., 2018 www.census.gov
 - Less likely to have a primary care provider
 - May limit seeking healthcare provider or obtaining medications
 - Lack of preventive screenings for early detection
- Living too far from a healthcare provider's office decreases access
- Telehealth holds promise to increase access
- Communication, provider to provider and provider to patient, is an essential skill for quality
 - <https://www.ahrq.gov/teamstepps/officebasedcare/index.html>

Neighborhood and Built Environment

- To a greater or lesser degree, everywhere has a level of:
 - Crime and violence
 - Pollution/ environmental exposures
 - Access to areas for exercise/ recreation
 - Ability to bike/ walk to necessary locations
 - Access to public or private transportation
 - Availability of internet/ Wi-Fi
 - Proximity to stores with FRESH foods
 - <https://health.gov/healthypeople/objectives-and-data/browse-objectives/neighborhood-and-built-environment>

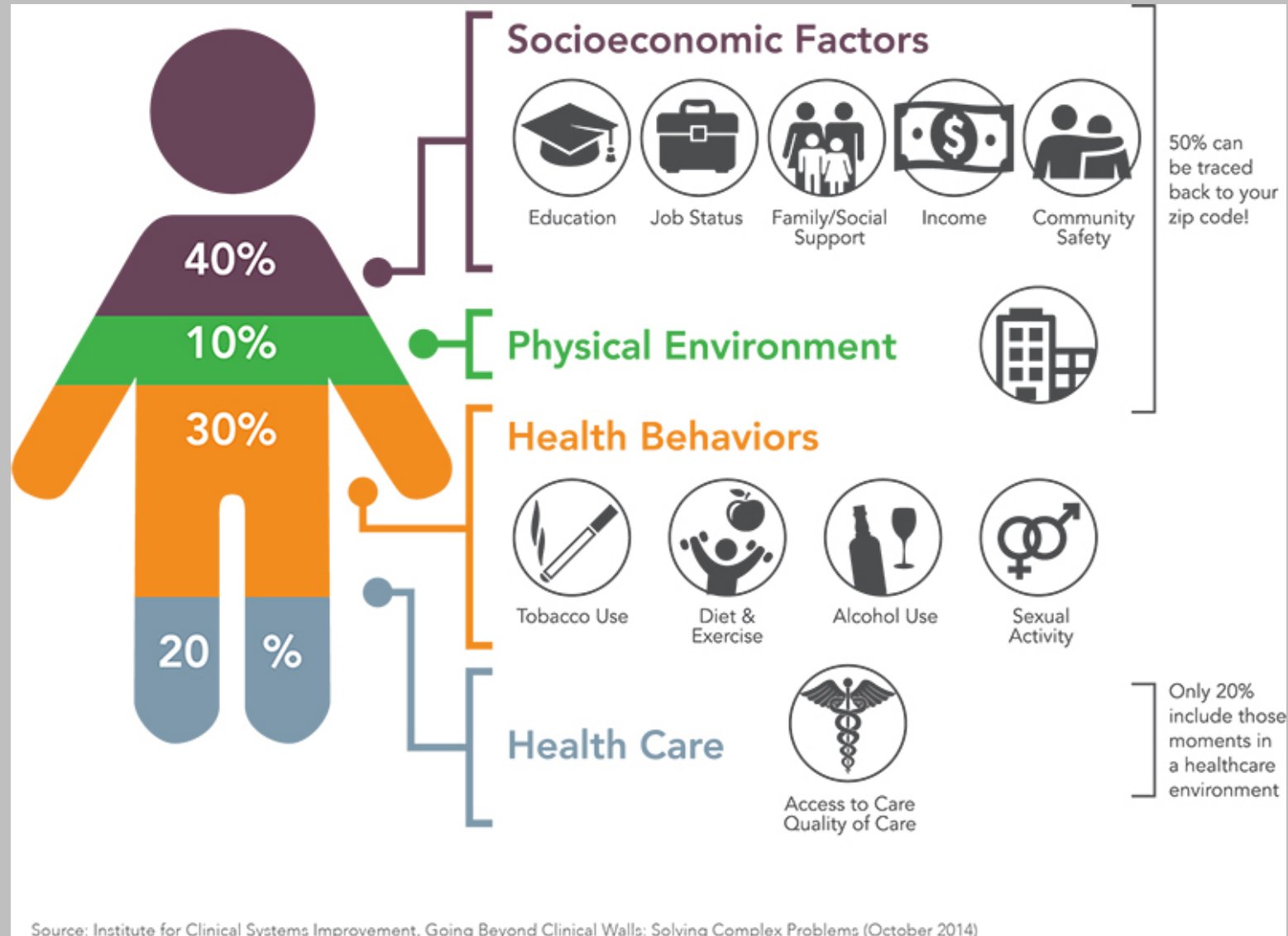
Social and Community Context

- Relationships with family and friends, co-workers, and community members influence:
 - Our sense of belonging and connection to others
 - Value and self-worth
 - Self-efficacy
 - Mental health
 - Support in times of need and for decision making
 - Social standing/ social capital
 - Childhood development
- <https://health.gov/healthypeople/objectives-and-data/browse-objectives/social-and-community-context>

Economic Stability

- Dependability and amount of income influences:
 - What and how often you eat
 - Where you live
 - Choices in the event of an emergency/ inconvenience
 - Decisions about seeking medical care
 - Your perception of self-worth
 - Ability to engage in recreational activities (vacation, sports, etc.)
- <https://health.gov/healthypeople/objectives-and-data/browse-objectives/economic-stability>

Digest this:



Neurotrauma in Sports

Traumatic Brain Injury (TBI)

National Head Injury definition (NHI):

*“Traumatic brain injury is an insult to the brain, not of a degenerative or congenital nature but caused by an **external physical force**, that may produce a diminished or altered state of consciousness, which results in impairment of **cognitive abilities or physical functioning**. It can also result in the disturbance of **behavior or emotional functioning**. These impairments may be either **temporary or permanent** and cause **partial or total functional disability** or **psychosocial maladjustment**.”*

- TBIs range from mild (AKA concussion) to severe:
 - Based on presentation on Glasgow Coma Scale
 - Findings on imaging



Epidemiology of Neurotrauma in Sport, Focus on Concussion



- 1.6 – 3.8 million = total number of traumatic brain injuries, including concussions, occurring in sports annually.
 - Langlois et al., 2006
- 1.1 – 1.9 million = sports- and recreation-related concussions annually in youth (<18 years old)
 - Bryan et. al., 2016
- Highest rate of Sports-Related Concussion (SRC) in American football
 - IOM, 2013; Hendrickson, 2012
 - 2.5 per 1000 exposures in college football
 - IOM, 2013

Concussion is a Neurotrauma

- Functional rather structural – it alters how the brain works does not alter the anatomy
- Most frequently occurs by being kicked or struck in the head or elsewhere on the body

Selassie et al., 2013

- Associated with any contact sport
 - American football has the greatest number of TBI's – it also has the greatest number of participants

Daneshvar, 2011

- May or may not involve a loss of consciousness
 - Loss of consciousness does not necessarily predict longer recovery

Concussion in Sport Group (CISG)

- Composed the international Consensus Statement on Concussion in sport
 - Guidelines developed and published after meetings in 2001, 2004, 2008, 2012, and 2016
 - Most recent statement was published in March 2017 after Berlin meeting
 - McCrory et al., Br J Sport Med 2017; 51:838-847
 - Was accompanied in 2017 with a series of Systematic Reviews after review of 60,000 screened articles
 - Widely recognized as the most comprehensive statement on what is known based on evidence and clinical expertise

Recognizing a Concussion

- Concussion as a diagnosis lacks and specific and validated diagnostic criteria.
 - No gold-standard test to confirm diagnosis
 - Not known if concussion is part of the TBI spectrum with less severe structural injury OR if concussion is a result of purely physiological changes, which are reversible.
- The use of helmet-based sensors to “clinically diagnose or assess concussion cannot be supported at this time”

• McCrory 2017 pg. 839

Sideline Evaluation

- SRC is regarded as one of the most complex injuries to diagnose, assess and manage in sports medicine
 - Most do not have:
 - Loss of consciousness
 - Forthright neurological signs
 - No perfect tool or marker to allow immediate diagnosis
 - Sideline evaluation of attention and memory are practical and effective for rapid screening, not definitive diagnosis (e.g., SCAT5)
 - A&O X 3 – NOT RELIABLE TEST for this population
 - REMOVE: If screening is positive, more diagnostic evaluation needed in distraction free environment

• McCrory et al., 2017

Re-evaluate

- Once a concussion is suspected and a player is removed, medical assessment is required
 - Neurological examination including:
 - Mental status/Cognition
 - Reaction time
 - Visual and verbal processing
 - Sensory processing (e.g. vision and vestibular)
 - Motor functions (e.g. coordination, gait, and balance)
 - Oculomotor function
 - Neuropsychological assessment – further aids clinical decision making related to cognition
 - Advanced neuroimaging, biomarkers, and genetic testing are not yet validated for use in evaluation of SRC



Rest

- Typical management of sports related concussion focuses on physical and cognitive rest until the athlete is symptom free
 - Mental rest from electronics, mental rest with restriction from school, and physical rest
 - Aubry et al., 2002, McCrory et al., 2005, McCrory et al., 2008, McCrory et al., 2012, Guskiewicz et al., 2004, Herring et al., 2011, Meehan et al., 2010
- Rest is the most widely used intervention
- This is based on *belief* that rest will ease symptoms and promote recovery by minimizing brain-energy demands
- No evidence that rest beyond 24-48 hours is needed
- Once past 48 hours, athletes can become generally more active, staying below symptom threshold (cognitive and physical exertion)
 - McCrory et al., 2017



Physical Activity vs. Rest

- Complete restriction from exercise activity after concussion resulted in increased total symptom score and low neurocognitive performance

Majerski et al., 2008

- Strict rest beyond 2 days post-injury does not improve outcome and may contribute to increased symptom reporting.

• Thomas et al., 2015

- Moderate levels of physical activity are safe and provide best outcome for recovery from acute or post-acute concussion

• Majerski et al., 2008; Gagnon et al., 2009; Silverberg et al., 2013; Leddy et al., 2010



Second Impact Syndrome

A rare but potentially fatal risk after a concussion.

Second Impact Syndrome (SIS)

- Additive effect of multiple concussions within a short time frame (before one is healed).
 - Initial concussion may cause cerebral edema, however, the brain's autoregulatory mechanisms protect against massive swelling by limiting cerebral blood flow.
 - Extracellular potassium concentration can increase in the brain after concussion, which makes the brain more vulnerable and susceptible to death after a second even less intense injury.

What is SIS?

- When the athlete sustains a “second impact,” the brain loses its ability to auto regulate intracranial and cerebral perfusion pressures.
 - This may lead to cerebral edema followed by brain herniation
 - This is a very severe TBI with only minutes to act
 - Death has been reported to occur in a matter of two to five minutes, usually without time to stabilize or transport an athlete for medical care
- There is a bit of mystery to what conditions must exist for SIS to occur
- Must approach every person with a concussion as being at risk

The Tale of Cellas and Jamarius

Cellas

- Lives in Madison, Mississippi (MS)
- Attends Madison Central HS
- Plays soccer
- Wants to go to college



The Event

- At a game
 - Hard hit with opponent
- Fell and hit head on ground
 - Lost consciousness briefly

Jamarius

- Lives in Greenwood, MS
- Attends Greenwood HS
- Plays football
- Wants to go to the NFL



The Event

- At a game
 - Hard hit with opponent
- Fell and hit head on ground
- Lost consciousness briefly

Access to Quality Healthcare



Cellas

- ATC on field
- Ambulance on site
- Parents took to Friday night clinic at trauma center
- **Diagnosed with a concussion**
 - Follow up appointment next week
 - Referred to PT

Jamarius

- No ATC
- No ambulance
- No clinic open until Monday, no hospital within 2 hours
- Lifeflight?
- Never saw a medical provider
- **No diagnosis given**

Education



Cellas – Madison HS

- 92% graduation rate
 - 66% proficient in reading
- Multiple healthcare providers at the game (sports fans/parents)
- Parents: aware
- Administrators/teachers: aware/accommodating
- Peers: aware/ supportive

Jamarius – Greenwood HS

- 80 – 84% graduation rate
 - 19% proficient in reading
- No healthcare providers at the game (sports fans/parents)
- Parents: deficient
- Administrators/teachers: unaware/ no accommodations
- Peers: unaware

Economic Stability

Cellas

- Parents Googled concussion information from the game
- Unlimited data on phone
- Co-pay for PT was not a problem
- Rested all weekend

Jamarius

- Lifeflight \$\$\$\$
 - Not an option and since he was walking and talking, did not see expense to seek medical care as necessary
- No Wi-Fi available at home
- Phone with limited data plan
- Had to go to work on Saturday morning, no time to rest



Social Context

Cellas

- Other parents affirmed response
- Teammates clapped him off the field
- Encouraged him to heal

Jamarius

- Other parents encouraged with their stories of survival from “having bell-rung”
- Teammates tried to help him hide so he could play
- Dad encouraged him to, “be tough”



The Next Game

Cellas

- Sat out
- Very disappointed
- Watched his team loose
- Finished PT and was returned to play 30 days after injury

Jamarius

- Started
- Played
- Took a minor hit to the head
- Became unconscious
- Died on the field awaiting an ambulance
 - Autopsy revealed intra-cranial swelling and brain herniation, consistent with Second Impact Syndrome

Hypothetical Stories?

Yes, but not an unreal situation. . .

PLEASE READ!

- <https://www.sbnation.com/2020/2/25/21144866/high-school-football-deaths-risks-race-inequality-mississippi>

Building a Systems Approach for Sport-Related Concussion Prevention in Mississippi

Advocacy as a PT

Mississippi

- Poorest state in the US – While this is often attributed to the Mississippi Delta, the truth is *even without the Delta, MS is still the poorest state in the US*
- Worst health outcomes – look up almost any CDC vital statistic (i.e. birth mortality, obesity, stroke prevalence, heart disease)
- Very visible, national renowned research studies done in MS:
 - Jackson Heart Study
 - Mind Center – Alzheimer's Research
- National Center of Excellence in Telehealth

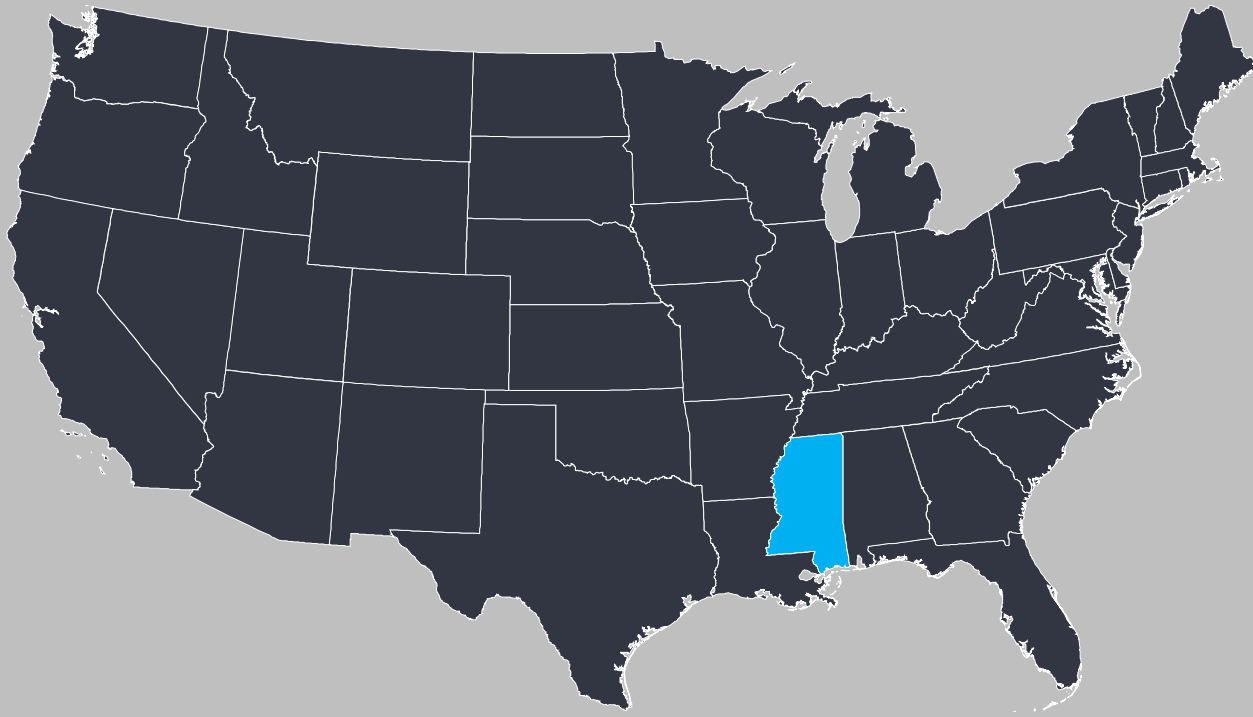
Sports and Concussion in Mississippi

- Mississippians are proud of their sports culture and Mississippi athletes excel to the highest levels of sports participation.
- Within the state, baseline testing (prior to the beginning of the sports season) is not routinely implemented.
- Only 12 school districts employ an athletic trainer in Mississippi.
- No requirement to have a medical professional present at game events.
- UMMC, the state's only level 1 trauma center, does not have an organized concussion management program.
- Concussion is not a covered topic in any of the healthcare professions entry level programs



Sports-Related Concussion

In Mississippi, there is a need for ...



- 01 Preseason Testing
- 02 Prevention & Education
- 03 Continuing Education for Healthcare Professionals
- 04 Standardized Clinical Management

Mississippi was the last state to pass a
Youth Sports Concussion Bill in 2014



GOAL

Develop an equitable statewide
concussion prevention system

1

Across the socioeconomic and
geographic regions of the state

2

Licensed healthcare
providers report positive
attitudes and behaviors
regarding concussion

3

Access to specialty care



Overall Objective:

- Strategically organize concussion practices to provide:
 - Comprehensive, state of the art approaches for primary prevention
 - Point of injury care, and resolution of preinjury function
 - Support innovative and collaborative community-engaged research
 - Encourage an evidence informed shift in the culture of sport in Mississippi

AVERAGE HIGH SCHOOL FOOTBALL PLAYER

HEAD IMPACTS

992

SEASONS

8881

Not all high
scores are good.

HEADS UP MISSISSIPPI

Rules that limit tackling and other contact
can help reduce head impacts by 40%.

Learn more:
www.cdc.gov/HEADSUP

Source: Brackley RB, Williams RR, O'Connor RW, O'Leary JJ. Football players' head impact exposure after limiting of full-contact practice. JAMA. 2013;310(17):1831-1838.



CDC HEADS UP
SAFE BRAIN. IT'S HOW WE LIVE.



Sports-Related concussion



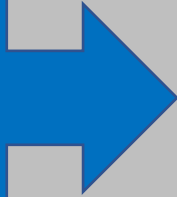
Systemic Approach





Access & Equity

April 17, 2019
Meeting Led
by Chief
Ambulatory
Officer



30 Clinicians and Researchers Attended

4 Clinical Department Chairs Represented

Agreement to appoint a Steering Committee
to develop plan for a Comprehensive
Concussion Program

Housed in the Neuro Institute
Clinical Center (including Tele-Health Capabilities)
Integrated Translational Research
Prevention and Advocacy

Three Phases Across 12-Months

1. Plan for Clinical, Research and Education Aims
2. Community Partnerships and Collaboration
3. Administrative Review, Presentations and Institutes of Higher Learning Approval

Research & Innovation



Funding

4 grants totaling over \$500,000

Research Investigations

- 1st Intervention study completed 12/2018
- 2nd Intervention study began 8/2019
- Diagnostic study 2020-2022

Deliverables

2 Method and system patents pending

- Novel Diagnostic Testing
- Treatment Exercises
- In-person or Remote Use

2 Published Manuscripts

5 National & International Conference Presentations

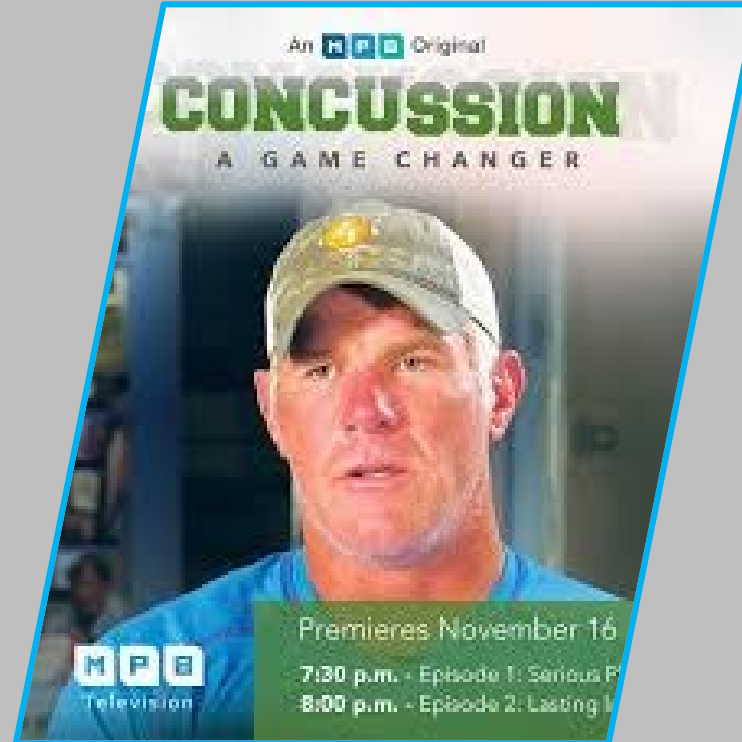
Community Outreach & Education



Community

Community Outreach Events
\$5,000 Educational Content Events
Advocacy Grant (in review)

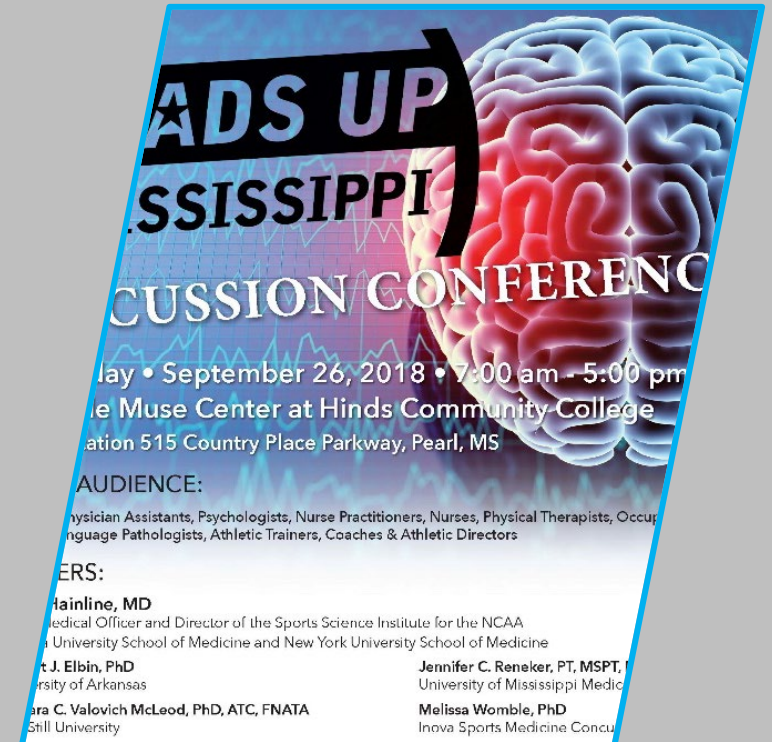
Total attendance of events > 20,000 people
Social Media People Reached = ?



TV Interview

60 minute TV special featuring
Brett Favre and Heads Up
Mississippi Team Members

Total reach is TBA



Education & Training

Concussion Conference with 160
Participants

Participant Survey:
94% report enhancement in knowledge
90% will use content to change clinical practices

Collaborations & Partnerships

