

ONE HUNDRED FOURTEENTH CONGRESS
Congress of the United States
House of Representatives
COMMITTEE ON ENERGY AND COMMERCE
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MEMORANDUM

March 10, 2015

To: Subcommittee on Oversight and Investigations Democratic Members and Staff

Fr: Committee on Energy and Commerce Democratic Staff

Re: Forum on “Evaluating the State of Concussion Research and Implications for Public Health”

On Monday, March 14, 2016 at 2:00 p.m. in room 2123 of the Rayburn House Office Building, the Committee on Energy and Commerce will be holding a roundtable discussion on concussions. The roundtable will bring together experts from government agencies and the medical, military, athletic, and research communities to review the causes, effects, and treatments of concussions and other head trauma. Entitled, “Evaluating the State of Concussion Research and Implications for Public Health,” the roundtable will cover what is known about brain injury, what gaps exist in the scientific literature, and what is being done to address those gaps.

I. BACKGROUND

Many Americans – including children, youth, and adults at the amateur and professional levels – participate in sports. Sports participation comes with an inherent risk of injuries, however, along with its many benefits. Although sports injuries take many forms, the impact of head injuries can be severe and can have long-term consequences that experts are only beginning to understand. A series of highly publicized incidents involving professional and college athletes have provoked widespread discussion of the consequences of sports-related head injuries. More recently, the release of the major motion picture “Concussion,” featuring the work of Dr. Bennet Omalu and his discovery of chronic traumatic encephalopathy (CTE), has sparked a flood of attention to the possible effects of repetitive brain injury on long-term brain health.

As recognized by President Obama in launching a federal brain research initiative, the underlying causes of neurological conditions remain a major challenge for scientists.¹ Despite recent advances in diagnostic brain imaging and our understanding of the physics of concussion, both the short-term and long-term consequences of traumatic brain injury are poorly understood.² However, there is emerging evidence that brain injuries, even those once considered minor, are linked to long-term, sometimes debilitating consequences, such as psychological and sleep disorders, amyotrophic lateral sclerosis (ALS), CTE, and Alzheimer's disease.³ The problem is of special concern in youth sports because children and teens may be more vulnerable to brain injuries than adults, and take longer to recover.⁴

II. THE SCIENCE OF SPORTS-RELATED BRAIN INJURY

The leading cause of death from sports-related injuries is traumatic brain injury (TBI), which includes concussions, as well as more severe brain injuries.⁵ More than 70 percent of emergency room (ER) visits for sports and recreation-related TBI were youths from 10 to 19 years old, and ER visits for children and teens increased nearly 60 percent over the last decade.⁶

Concussions, or mild traumatic brain injuries (mTBI), occur when a blow to the head or body causes the head to move rapidly back and forth, resulting in temporary neurological impairment, such as disorientation, loss of memory for events immediately before or after the injury, or brief loss of consciousness.⁷ Based on available data, the Centers for Disease Control

¹ The White House, *Remarks by the President on the BRAIN Initiative and American Innovation* (Apr. 2, 2013) (press release).

² *Expert Consensus Document: Mind The Gaps—Advancing Research Into Short-Term and Long-Term Neuropsychological Outcomes of Youth Sports-Related Concussions*, *Nature* (Apr. 2015).

³ See, e.g., *Link Found Between Concussions and Lou Gehrig's Disease*, *Los Angeles Times* (Aug. 17, 2010); Christine M. Baugh et al., *Chronic Traumatic Encephalopathy: Neurodegeneration Following Repetitive Concussive and Subconcussive Brain Trauma*, *Brain Imaging & Behavior: mTBI Special Issue* (2012); *Concussion Could Be Linked to Alzheimer's Risk, Study Says*, *US News* (Dec. 27, 2013).

⁴ Centers for Disease Control and Prevention, *Get a Heads Up on Concussion in Sports Policies* (accessed Jan. 19, 2016) (online at www.cdc.gov/headsup/pdfs/policy/headsuponconcussioninsportspolicies-a.pdf).

⁵ American Association of Neurological Surgeons, *Sports-Related Head Injury* (Aug. 2014) (online at www.aans.org/patient%20information/conditions%20and%20treatments/sports-related%20head%20injury.aspx).

⁶ Centers for Disease Control and Prevention, *Nonfatal Traumatic Brain Injuries Related to Sports and Recreation Activities Among Persons Aged ≤19 Years --- United States, 2001—2009* (Oct. 7, 2011).

⁷ Centers for Disease Control and Prevention, *Heads Up: What is a Concussion?* (Feb. 16, 2015).

and Prevention (CDC) estimates that between 1.6 million to 3.8 million sports- and recreation-related concussions occur each year.⁸

There continues to be uncertainty in how TBI is diagnosed. Concussion has multiple, non-harmonized definitions across the medical literature. Furthermore, in the absence of objective diagnostic measures, concussion remains a clinical diagnosis subject to great variability across specialties and is likely underreported.⁹ One major initiative currently funded by the National Institutes of Health (NIH) and the Department of Defense (DoD), the TRACK-TBI study, seeks to refine and improve diagnosis and treatment of TBI.¹⁰

Recent research suggests that athletes can sustain significant brain damage caused solely by repeated head impacts, even if those collisions do not result in concussions.¹¹ These “sub-concussive” events occupy an increasingly large role in the discourse surrounding sports-related brain injuries.

Repetitive brain trauma, including concussive and sub-concussive injuries, may increase an individual’s risk of developing CTE, a neurodegenerative disease associated with serious mental impairments and psychological effects, such as memory loss, confusion, impulse control, aggression, depression, suicidal ideation, and eventually progressive dementia.¹² Studies have found that athletes who had no observable symptoms of concussion but who nevertheless sustained repeated impacts to the head performed worse than their non-athlete peers on tasks involving memory and displayed altered brain function on fMRI scans.¹³ This research provides

⁸ Data showing the occurrence of TBI, especially in youth sports, is limited due to the absence of a comprehensive reporting and collection system. Centers for Disease Control and Prevention, *Report to Congress: Traumatic Brain Injury In the United States: Epidemiology and Rehabilitation* (Mar. 27, 2015); Sports Concussion Institute, *Concussion Facts* (online at www.concussiontreatment.com/concussionfacts.html#sfaq9) (accessed on Jan. 19, 2016).

⁹ *Expert Consensus Document: Mind the Gaps—Advancing Research Into Short-Term and Long-Term Neuropsychological Outcomes of Youth Sports-Related Concussions*, Nature (Apr. 2015).

¹⁰ *Traumatic Brain Injury Research Advances with \$18.8M NIH Award*, University of California San Francisco News Center (Oct. 22, 2013).

¹¹ *Study Indicates Brain Injuries Among College Football Players*, USA Today (March 7, 2013) (online at www.usatoday.com/story/gameon/2013/03/07/study-links-brain-injuries-to-ncaa-football-players-hits-that-do-not-cause-concussions/1970177/).

¹² Christine M. Baugh et al., *Chronic Traumatic Encephalopathy: Neurodegeneration Following Repetitive Concussive and Subconcussive Brain Trauma*, Brain Imaging & Behavior: mTBI Special Issue (2012).

¹³ Talavage et al., *Functionally-Detected Cognitive Impairment in High School Football Players Without Clinically-Diagnosed Concussion*, Journal of Neurotrauma (2013).

additional evidence that repetitive hits to the head—even in the absence of the clinical signs of concussion—have cumulative, long-term effects on brain function and physiology.¹⁴

Repetitive brain trauma triggers progressive degeneration of the brain tissue, including the build-up of an abnormal protein called tau.¹⁵ Although currently diagnosable only post-mortem, and without any known pharmacological treatments, researchers are working to develop tests to identify CTE in living individuals, which may eventually lead to earlier diagnosis and treatment.¹⁶

CTE has been diagnosed post-mortem in 87 former NFL players. Although CTE is primarily considered a neurodegenerative disease that results from a career of either collegiate or professional contact sports, cases of CTE have been reported in high school athletes. The Boston University Brain Bank has found CTE in the brain tissue of 131 out of 165 individuals who played football either professionally, semi-professionally, in college, or in high school.¹⁷ This suggests that long athletic careers are not required for CTE development, and that young athletes represent an at-risk population.¹⁸ However, the prevalence of CTE and the risk factors for developing CTE and other neurodegenerative diseases are currently unknown.¹⁹

III. CONCUSSION PREVENTION AND TREATMENT INITIATIVES

A. Sports Leagues

Many sports organizations at all levels have sought to increase knowledge of concussions among players, coaches, and officials. The major U.S. professional sports leagues have all implemented some form of concussion plan, with some requiring baseline mental testing and

¹⁴ *Expert Consensus Document: Mind The Gaps—Advancing Research Into Short-Term and Long-Term Neuropsychological Outcomes of Youth Sports-Related Concussions*, Nature (Apr. 2015).

¹⁵ Ann C. McKee et al, *The First NINDS/NIBIB Consensus Meeting to Define Neuropathological Criteria for the Diagnosis of Chronic Traumatic Encephalopathy*, Acta Neuropathologica (2015).

¹⁶ *New Tests for Brain Trauma Create Hope, and Skepticism*, New York Times (Dec. 25, 2013) (online at www.nytimes.com/2013/12/26/sports/football/new-tests-for-brain-trauma-create-hope-and-skepticism.html).

¹⁷ *New: 87 Deceased NFL Players Test Positive for Brain Disease*, Frontline (Sept. 18, 2015) (online at www.pbs.org/wgbh/frontline/article/new-87-deceased-nfl-players-test-positive-for-brain-disease).

¹⁸ *Expert Consensus Document: Mind the Gaps—Advancing Research Into Short-Term and Long-Term Neuropsychological Outcomes of Youth Sports-Related Concussions*, Nature (Apr. 2015).

¹⁹ *Id.*

immediate removal from play.²⁰ The NCAA requires schools to have concussion management plans, but it does not enforce adherence to the plans.²¹ Some national youth sports associations, including Pop Warner and USA Hockey, have also implemented concussion management policies. Further, USA Football, the NFL's youth development arm and the national governing body for amateur football, has created and implemented an education program known as "Heads Up Football" to educate players on tackling techniques to avoid head impact and reduce the incidence of concussions.²²

Some organizations have also changed gameplay rules and equipment regulations to prevent concussions. The National Hockey League (NHL), for example, added rules prohibiting blind-side hits as well as all hits to the head.²³ The NFL created a rule that penalizes players for striking opponents with the crown of their helmets.²⁴ Beginning in 2013, the NFL also began installing neurotrauma specialists at every game to spot possible signs of concussion and remove players from the game if necessary.²⁵

In response to concerns raised regarding concussive and sub-concussive impacts, organizations including the National Collegiate Athletic Association (NCAA) and Pop Warner Youth Football have taken steps to limit contact at practice, thereby reducing the number of total hits sustained by players.²⁶ A 2012 study found that the average second-grade football player

²⁰ *Official Concussion Protocol Is Still A New Venture For Major U.S. Sports*, Al Jazeera America (Oct. 29, 2013) (online at america.aljazeera.com/watch/shows/techknow/blog/2013/10/29/official-concussion-protocols-is-still-a-new-venture-for-major-us-sports.html).

²¹ *Why the NCAA won't adopt concussion penalties – at least not yet*, CBS Sports (Feb. 18, 2015) (online at www.cbssports.com/collegefootball/writer/jon-solomon/25073014/why-the-ncaa-wont-adopt-concussion-penalties---at-least-not-yet).

²² *Questions about Heads Up Tackling*, ESPN (Jan. 13, 2014) (online at espn.go.com/espn/otl/story/_/id/10276129/popular-nfl-backed-heads-tackling-method-questioned-former-players).

²³ *Hockey Still Plagued by Concussions, Despite Rule Changes*, Los Angeles Times (July 17, 2013) (online at www.latimes.com/news/science/sciencenow/la-sci-sn-hockey-concussions-20130717,0,6800845.story#axzz2vIGjx1DI).

²⁴ *With Eye on Concussions, NFL Adopts New Rule on Helmet Hits*, Frontline (Mar. 22, 2013) (online at www.pbs.org/wgbh/pages/frontline/sports/concussion-watch/with-eye-on-concussions-nfl-adopts-new-rule-on-helmet-hits).

²⁵ *Sideline Doctors: How the NFL's Concussion-Spotting System Is (and Isn't) Working*, Stat News (December 22, 2015) (online at www.statnews.com/2015/12/22/nfl-concussion-spotting-system).

²⁶ *Head Injuries on the Football Field*, New York Times (Sept. 8, 2011) (online at well.blogs.nytimes.com/2011/09/08/head-blows-on-the-football-field); *Trying to Reduce Head Injuries, Youth Football Limits Practices*, New York Times (June 13, 2012) (online at www.nytimes.com/2012/06/14/sports/pop-warner-football-limits-contact-in-practices.html).

sustained more than 100 head impacts during the course of ten practices and five games, with some of those hits exceeding the force exerted during a college football game.²⁷

Some players argue that leagues have not done enough to protect their safety. In 2011, more than 4,500 former players sued the NFL, alleging that the League concealed the link between repetitive TBI and degenerative neurological disorders.²⁸ The suit settled in April 2015 for over \$900 million.²⁹ In November 2013, former professional hockey players filed a similar suit against the NHL.³⁰ A number of lawsuits against the NCAA have also been filed alleging a failure to adequately protect collegiate athletes.³¹

B. Military

The Department of Defense (DoD) has renewed its focus on TBI in the wake of the conflicts in Afghanistan and Iraq. The DoD estimates that more than 313,816 service members have sustained a TBI in training or combat, with 18,564 recorded injuries during the first three quarters of 2014 alone.³² In response to this new research, DoD has launched a series of initiatives aimed at increasing awareness among service personnel and entered into research partnerships designed to improve diagnosis and treatment.

In 2010, DoD established the Recovering Warrior Task Force (RWTF) to examine the effectiveness of extant military policies with regard to posttraumatic stress disorder (PTSD) and TBI.³³ Over the course of four years, the RWTF presented annual reports and recommendations

²⁷ Ray W. Daniel, et al., *Head Impact Exposure in Youth Football*, Annals of Biomedical Engineering (2012).

²⁸ Plaintiffs' Amended Master Administrative Long-Form Complaint, *In Re National Football League Players' Concussion Injury Litigation*, Case no. 2:12-md-02323-AB (E.D. Pa. July 17, 2012).

²⁹ *Judge approves settlement – at least \$900M – to NFL concussion lawsuits*, USA Today (Apr. 22, 2015) (online at www.usatoday.com/story/sports/nfl/2015/04/22/concussion-related-lawsuits-judge-settlement-nfl/26199011/).

³⁰ Complaint, *Leeman, et al. v. NHL*, Case no. 1:13-cv-01856 (D.D.C. Nov. 25, 2013).

³¹ *Plaintiff list in NCAA concussion lawsuit growing, schools bracing*, CBS Sports (Sept. 13, 2013) (online at www.cbssports.com/collegefootball/writer/jeremy-fowler/23630356/ncaa-concussion-lawsuit-growing-plaintiff-list-schools-brace-for-scope-of-issue); *Who's Suing the NCAA? AL.Com Database of Concussion Lawsuits by Ex-Players*, AL.com (Feb. 6, 2014) (online at al.com/sports/index.ssf/2014/02/whos_suing_the_ncaa_alcom_data.html).

³² Department of Defense, *Traumatic Brain Injury: Department of Defense Special Report* (accessed Jan. 19, 2016) (online at archive.defense.gov/home/features/2015/0315_tbi/).

³³ Department of Defense, *Recovering Warrior Task Force 2013-2014 Annual Report* (Sept. 2, 2014) (online at rwtf.defense.gov/Portals/22/Documents/Reports/fy2014report.pdf).

to DoD, including a 2013 recommendation to ensure TBI treatments met the needs of injured troops, and to standardize, document, and track the efficacy of those treatments.³⁴

The Department of Veterans Affairs (VA) and the DoD have collaborated on several mTBI related projects and studies. The VA and DoD jointly fund the Chronic Effects of Neurotrauma Consortium (CENC), to examine the long-term effects of mTBI in military service personnel and veterans, identify service members most susceptible to neurodegeneration, and identify effective treatment strategies.³⁵

In addition, the DoD has committed \$30 million to a joint project with the NCAA focused on concussion risks, treatment, and management.³⁶ The NCAA-DoD CARE Consortium will fund a comprehensive study of concussion and head impact exposure, as well as finance educational efforts aimed at changing concussion safety behaviors and the culture of concussion reporting and management.³⁷ The study will track the effects of concussion using data from up to 37,000 student athletes, including participants from each of the service academies.³⁸

³⁴ *Id.*

³⁵ Chronic Effects of Neurotrauma Consortium (online at cenc.rti.org/Goals-and-Mission) (accessed Jan. 20, 2016).

³⁶ *Short on Concussion Data, NCAA Sets Out to Get Some*, Wall Street Journal (Apr. 17, 2015) (online at www.wsj.com/articles/short-on-concussion-data-ncaa-sets-out-to-get-some-1429264981).

³⁷ National Collegiate Athletic Association, *NCAA, DOD Launch Concussion Study* (May 29, 2014) (online at www.ncaa.org/about/resources/media-center/news/ncaa-dod-launch-concussion-study).

³⁸ *Id.*