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Committee on Aging
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Hearing on State of Play: Brain Injuries and Diseases of Aging

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I. Introduction:

Chairman Nelson, Ranking Member Collins, and Members of the Committee, thank you for inviting me to speak today before the Committee. My name is Chris Nowinski, and I am the founding executive director of the Sports Legacy Institute, known as SLI, which is a non-profit organization dedicated to solving the sports concussion crisis through education, advocacy, policy, and research. I am also a co-founder of the Boston University Chronic Traumatic Encephalopathy (CTE) Center and serve on the executive committee of the Boston University School of Medicine Alzheimer's Disease Center, which houses the CTE Center.

I serve as a volunteer advisor to the National Football League Players Association, Major League Lacrosse, and The Ivy League. I also have a personal relationship with concussion, and tremendous concerns that I have increased my risk of developing a degenerative brain disease in the future. It is my hope that this hearing raises awareness of the urgent need for funding for research on traumatic brain injuries, as well as the tremendous opportunities we have for prevention of their long-term consequences.

I never had a second thought about concussions or brain injuries until one day when my world changed so drastically that I would never go a day without thinking about my brain again. It happened late in my competitive athletic life – I was 24 years old. After playing contact sports in high school and at Harvard University, I had become a professional wrestler, known as a Superstar, with WWE. I got to travel the world playing a bad guy, or “heel,” known as Chris Harvard who creatively insulted the fans’ intelligence and cheated to win. Let me remind you that this was a character than I played; it was a performance to entertain our fans, and it was fun.

In a match at the Hartford Civic Center, I was kicked in the head by my opponent Bubba Ray, and my world immediately changed – my head began throbbing, everything got foggy, and most importantly, I forgot the script. I couldn't remember how we were supposed to finish the match. It was terrifying.

We created a new finish, and on my way back to the locker room I was stopped by our athletic trainer, who asked if I was alright. By that time, my memory had begun to come back, so I answered instinctually with, “I'm fine.” But I wasn't – I went down a hallway and lay down on the ground, holding my head as if I was trying to keep my brain from falling out.

The symptoms, which expanded beyond daily headaches to include depression and sleepwalking, would not go away. I traveled from doctor to doctor until I met Dr. Robert Cantu, my cofounder at SLI. He was the first person to ask me “How many concussions have you had?” I told him, “One.”

Dr. Cantu was the first to then ask, “How many times have you been hit in the head and become confused, dazed, or considered yourself ‘dinged?’” I said “Doc, that happens all the time.” I had been playing contact sports my entire life. I played soccer from age 5 to 13. I played football from age 13 to 21. I wrestled for three years. I probably suffered over 10,000 blows to the head,

and at this point I can remember 9 concussions since the age of 19, but can't remember what happened prior because I never knew the dings were worth remembering.

Dr. Cantu went on to tell me, "The symptoms you are experiencing are likely the result of cumulative trauma. In addition, the fact that you never took a day off for those injuries means that each one was more damaging than it needed to be. Had you chosen to rest, you would have probably recovered by now."

There I was, at 24, learning for the first time how fragile my brain was, and how critical rest is after a concussion. I wish I would have recognized my concussions, reported them to a medical professional, and then rested both physically and cognitively. My ignorance cost me – a career, 5 years of health before the daily symptoms went away, and who knows what else in the future. Dr. Cantu shared with me his concerns about the risk of progressive brain degeneration that may manifest mood disorders, behavioral problems, cognitive impairment and memory deficits, and eventually dementia. All this from a couple of head knocks that seemed perfectly innocent at the time.

II. The Long-Term Effects of Brain Trauma

Scientists have been writing for nearly 100 years that brain trauma can lead to a degenerative process in the brain, but it has only been in the last seven years that we have had a focused national conversation on the problem.

Of concern is the growing evidence that brain degeneration continues after the injury without any additional trauma – the brain essentially continues to rot away. The disease we are most concerned with is Chronic Traumatic Encephalopathy (CTE), which Dr. Ann McKee, Professor of Neurology and Pathology at Boston University School of Medicine and Director of Neuropathology Service for the New England Veterans Administration Medical Centers, has now discovered in over 100 former contact sport athletes and military veterans at our VA-BU-SLI Brain Bank. Studying brains post-mortem is currently the only way to diagnose CTE, which also means we don't know how many people have it. Unfortunately, 58 of the first 62 donated brains of professional football players that we examined ended up having it, and we have found the beginnings of the disease in football players as young as 17.

My colleague Robert Stern, PhD, Professor of Neurology and Neurosurgery at Boston University School of Medicine, has submitted testimony on the science behind CTE and brain degeneration, so I will focus my remaining testimony on the ethical and policy implications of the work.

III. Moving Forward

What the scientific evidence appears to be telling us at this point is that the human brain, while magnificent and resilient, is particularly vulnerable to brain trauma. The working theory is that too much brain trauma, in the form of a severe injury or repetitive mild injury, can spark disease.

What is special about this brain disease is that we think we know the primary cause – concussive or subconcussive brain trauma. In fact, no one has ever been diagnosed with CTE who wasn't exposed to significant brain trauma. Therefore, unlike Alzheimer's disease, Parkinson's, or many other neurodegenerative disorders – we may be able to effectively prevent CTE by limiting or eliminating exposure to brain trauma.

While the majority of CTE cases have been found in professional athletes, it has also been found in many athletes that never played beyond high school, and only played sports as minors. Through participation in sports, we are giving some children a preventable degenerative brain disease.

We must act to recognize and minimize this risk. This is not a war on football, this is not a war on sports, but it is a war on brain injury.

There are a number of meaningful policy solutions that are slowly being implemented across sports, including:

1. Education, so that athletes, parents, coaches, and medical professionals can accurately recognize and respond to concussions.
2. Better tests and return-to-play protocols, so that athletes can recover before being exposed to another injury.
3. Better equipment, so that plastics, rubber, and foam can help absorb impact and draw it away from the brain.

It has been rewarding to watch WWE embrace brain trauma research and implement innovative concussion management, education, and prevention programs. In recent years, WWE has banned certain moves, added full-time doctors to tour with talent, added computerized baseline testing, and annual seminars for all talent, referees, producers and medical personnel on concussions. In fact, I travel to the WWE Performance Center in Orlando where they train new recruits and conduct an educational seminar for all new hires on concussions before they step foot into the ring, emphasizing the urgency of preventing concussions along with the health and career advantages of reporting them. WWE is also one of the largest corporate donors to CTE research.

However, as we implement these changes, they expose the gaps that we may never be able to close, and that call into question how effective our policy changes will be in changing outcomes for athletes, including:

1. **Current education for athletes does not appear to be effective.** While we change their knowledge of concussion signs and symptoms, we still struggle to convince them to report their injuries.¹
2. **We may not be able to educate the youngest athletes,** pre-high school, to even recognize the signs and symptoms of concussion enough to report when they are injured.

3. **We still do not have a biomarker for concussion**, and have imperfect ways of determining when an athlete is injured, or when it is safe to return. Children are more vulnerable: widely used return-to-play tests for adults and teenagers simply do not work for children.
4. **Adding doctors and athletic trainers** to the sideline dramatically improves the odds of recognizing a concussion, yet only about half of high schools have an athletic trainer, and they are rarely available prior to high school. Without them, likely 85%-95% of concussions go undiagnosed.²
5. **Young athletes have biomechanical and developmental differences** that make them more vulnerable to concussions and their negative consequences.

Most of these gaps are not ever going to be closed directly – we will never have a doctor on the sideline of every athletic event, and we will never be able to teach every child how to recognize when they have a concussion and report it to their parent. While we wait for technology to close those gaps, the best solution is prevention, and prevention is far too often missing from this discussion.

The little research we have indicates that people at greater risk for trauma-linked brain disease start younger, play longer, and receive greater cumulative brain trauma (concussions plus subconcussive impacts).

We can reduce cumulative brain trauma, and some sports are working to decrease the frequency of brain trauma. Indeed, SLI has developed the Hit Count® Program which is designed to use sensors to create a Pitch Count for the brain, and eventually provide guidelines and limits.

However, the one option we have the most control over is when athletes start receiving repetitive, voluntary brain trauma. This does not refer to accidental, rare brain trauma, the kind that can occur when someone trips and falls. It refers to regular, unavoidable brain trauma, the kind that occurs when a football player makes a tackle or block, or purposeful, repetitive brain trauma, like heading a soccer ball.

The curious thing about repetitive brain trauma in sports is that most people don't think it is a good idea to hit a child in the head. In our culture and in our legal system, outside of the context of sports, it is considered abuse. Deep down, we know there is something inherently disconcerting about children being hit in the head, and the science is now finally catching up and putting numbers where before there was only intuition.

I don't believe we should continue to tolerate repetitive brain trauma in sports for children.

Children should play games for fun, exercise, and life lessons. They should not just be playing the sports that professionals play, which we watch on television for entertainment and that are organized for profit.

Some governing bodies of youth sports have taken notice of the long-term risks of brain trauma and made logical changes. USA Hockey raised the age of the introduction of checking from 11 to 13, in part to reduce the number of concussions, and US Lacrosse continues to change its rules and penalties to eliminate all purposeful hits to the head for youth.

But not every sport is reacting quickly. Current guidelines in soccer which are not well enforced, recommend introducing headers at age 10. This week, SLI is teaming up with the Santa Clara Institute of Sports Law and Ethics (ISLE) on a campaign to educate parents and coaches on the risks of headers in soccer prior to the high school level.

Former US Women's National Team player and ISLE board member Brandi Chastain and former teammates Cindy Parlow Cone and Joy Fawcett are leading the campaign along with SLI medical director and concussion expert Dr. Robert Cantu, to educate parents and coaches that the risks of introducing heading prior to high school have to be weighed against the rewards of more skilled heading among children.

Chastain, Parlow Cone, and Fawcett, former professionals who are now parents and coaches, don't allow their children or players they coach to head the ball before high school, as they don't believe the risk is worth it. I hope the rest of the world follows their lead.

In many ways, the risks involved with brain trauma mimics smoking cigarettes. The more cigarettes one smokes, the greater the risk of lung disease. As a society, we determined that no child should smoke before age 18, when they have the capacity to understand the long-term risks involved, and we have immense campaigns to discourage children from smoking.

We should view purposeful brain trauma in children in a similar fashion, as both lung disease and brain disease are expensive problems to care for down the road, and will negatively impact our health care system and our economy.

IV. Conclusion

We must not underestimate the long-term impact of brain injuries. With one in four boys and one in sixteen girls in America playing contact sports, we are putting a lot of children at risk for CTE. We owe them, as well as our military veterans, greater investment into finding ways to effectively minimize the negative consequences of inevitable brain trauma.

We must also take what we have learned about brain injury and take advantage of opportunities we have to prevent brain trauma and prevent CTE, and it begins with changing the culture of sports. I look forward to working with you to protect those at risk.

¹ Kroshus E, Daneshvar DH, Baugh CM, Nowinski CJ, Cantu RC. NCAA concussion education in ice hockey: an ineffective mandate. *BJSM*. 2013 Aug 20.

² Echlin PS, Johnson AM, Riverin S, et al. A prospective study of concussion education in 2 junior ice hockey teams: implications for sports concussion education. *Neurosurg Focus* 2010;29:E6.