Testimony of:

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Chairman Rockefeller, members of the committee, and distinguished guests, it is my distinct honor to join you today and I am extremely grateful to be given this opportunity to provide my testimony.

My name is Jeffrey Kutcher. I am a sports neurologist and team physician at the University of Michigan. Since 2005, I have been the Director of Michigan NeuroSport, the University of Michigan's comprehensive academic program in sports neurology. The NeuroSport program provides clinical care for athletes of all ages and abilities, conducts clinical and basic science research on sports concussion and other issues in sports neurology, and provides education to athletes, parents, coaches, administrators, and health care providers. My experience allows me to speak directly to the complete spectrum of athletes that experience sports-related brain injuries. I care for athletes at the time of their injury, over the course of their season, their career, into their retirement, and beyond.

Since 2009, I have also been the Chair of the Sports Neurology Section of the American Academy of Neurology. The American Academy of Neurology, the world's largest professional association of neurologists, is dedicated to the neurological care of athletes at all levels by optimizing clinical practice, research, and education, and is a leading voice in the arena of sports concussion. I am currently co-leading the American Academy of Neurology's effort to produce a meaningful, evidence-based, clinical practice guideline on sports concussion, an effort that includes the critical review and grading of every academic paper published on sports concussion.

Also pertinent to this topic, I am the Director of the National Basketball Association's Concussion Program and a consultant to the National Hockey League Players' Association.

The Scope of the Problem

Clearly, the issue of sports concussion has been gaining significant public and government interest over the past few years. Fueled by increasing awareness of possible long-term effects from head injuries, the majority of the media coverage has focused on those athletes already in the spotlight, the ones who play our professional contact sports. While these athletes are experiencing the greatest doses of head impact over their lifetimes, they represent only a very small fraction of the population at risk of being injured. That is why I am encouraged that today's hearing is focusing on the protective equipment being used by all athletes, regardless of level of play, age, or gender.

It is a common misconception that concussion is a problem seen only in males. Concussions occur in females as well, with some data suggesting that concussion incidence is higher in females when compared to males playing similar sports. Concussion is an injury that occurs at every age and at every level of play. Up to 3.8 million concussions are estimated to occur in the United States each year from sports and recreational activities, and the majority of these occur in our youth. There is great uncertainty, and with it significant concern, regarding the notion of possible long-term effects from concussion, especially on the pediatric population, which may be at even greater risk given the ongoing development of the pediatric brain.

What is Concussion?

Simply put, concussion is an injury to the brain. It occurs when the brain moves fast enough, and suddenly enough, to disrupt the normal electrical function of its' component cells. Given that the brain is floating in fluid inside of the skull, and that the head can act as a pendulum when the body is struck, movements of the brain significant enough to cause concussion can occur with or without a direct blow to the head. As long as the skull, and thus the brain inside of it, is accelerated or decelerated with enough force, the normal processes of the brain may be compromised. The resulting concussion can take on many different forms, but typically includes transient disorientation, slowed thinking, memory difficulties, or other signs of brain dysfunction. Symptoms, such as headache, nausea, and sensitivity to light are also quite common. I should also note that a loss of consciousness is relatively rare in concussion, occurring in less than 10% of cases. Concussion cannot be diagnosed by any one test. It is a diagnosis that can only be made by a careful clinical evaluation performed by a health care professional, and preferably one with training and experience caring for brain injuries.

It is important to realize that concussion, as defined above, is not the only brain injury that can occur from head trauma. More acutely serious or emergent injuries, such as bleeding in or around the brain or a skull fracture, can occur anytime an athlete or an object is moving quickly in the field of play. On the other side of the spectrum, there is emerging evidence that forces from multiple impacts that are not significant enough to result in a concussion may have potentially negative effects on long-term brain health.

Equipment Limitations

Helmets have an extremely important role to play in head injury prevention. Without them, the potential for bone fracture or intracranial injury would make many of our sports and recreational activities unacceptably risky. In this way, helmets are extremely effective pieces of equipment. With the introduction of hard-shell helmets, for example, skull fractures and resulting deaths from playing football have essentially been eliminated. What helmets do not do well is significantly slow down the contents of the skull when the head is struck or moves suddenly. Since concussions occur not as a result of the forces experienced by the skull, but by those experienced by the brain, it is extremely unlikely that any helmet can be designed that will prevent concussions to the same significant degree that they have been shown to prevent skull fractures.

Currently, there is no data in the published medical literature that shows any particular helmet being better than any other at preventing sports concussions. Such data is hard to collect for two main reasons: First, given the many variables that exist in the athletic population and the varied exposure to impacts, it is extremely difficult to perform a randomized, controlled, clinical trial on similar populations of athletes. Second, given that concussion is a clinical diagnosis, with no available reference standard or diagnostic test, any study of concussion is significantly limited by the ambiguity of the very clinical outcome that is being studied.

For these same reasons, there are no published data supporting the idea that other types of protective equipment, such as mouthguards or soccer headbands, prevent concussion. Moreover, in sports such as soccer, where protective headgear is the exception rather than the rule, I have

seen the use of headgear result in athletes altering their playing style in the wrong direction, as their newfound sense of protection encourages more physically aggressive play.

While clinical data that speaks to concussion prevention is hard to generate, there are many extremely well performed laboratory studies that provide excellent data on the amount of force a helmet allows to get through to a model brain in a mechanical head. This does not mean that these data can be used to construct an estimate of concussion risk. Concussions do not occur at a particular force threshold. They occur across a wide range of forces and are dependent on the complex and variable physiological nature of each individual's brain.

The Potential Harm of Misinformation

With the increased public awareness of an injury that occurs frequently in children and may produce significant negative long-term health outcomes, it is not surprising that the marketplace for products designed to prevent concussions is a busy one. Every week I am asked by patients, parents, and coaches about the claims they hear and what equipment they should buy to prevent concussions. I wish there was such a product on the market. The simple truth is that no current helmet, mouthguard, headband, or other piece of equipment can significantly prevent concussions from occurring. They occur as the result of the nature of sports. Concussion prevention is much more about teaching proper technique, playing by the rules, and limiting the overall dose of impacts. Preventing bad outcomes and long-term damage, meanwhile, is clearly about recognizing the injury when it occurs, removing that athlete from participation, and allowing for appropriate recovery before they return.

The potential harm that I see being caused by products that claim to prevent concussion when they do not is far more than simply the financial harm of paying more for something that isn't likely to work as claimed. It is the harm that comes from having a false sense of security, from not understanding how the injury occurs and what can actually be done to prevent it. This issue is a growing public concern, and rightly so. The public deserves to know that equipment has a significant, but inherently limited, ability to prevent concussions. For the health of all athletes, we must see that each player, parent, and coach becomes educated on concussion, including the use of proper technique, the need for reporting the injury, and the importance of allowing for a full recovery before returning.

There is still a tremendous amount yet to be learned about the nature of concussions and their possible effects on brain health. In the interim, I am deeply encouraged by today's hearing and honored to be included in the efforts of the committee as we work together for the safety of our athletes.