

CONCUSSIONS IN YOUTH SPORTS: EVALUATING PREVENTION AND RESEARCH

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BEFORE THE
SUBCOMMITTEE ON OVERSIGHT AND
INVESTIGATIONS
OF THE
COMMITTEE ON ENERGY AND
COMMERCE
HOUSE OF REPRESENTATIVES
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¹The information has been retained in committee files and also is available at <http://docs.house.gov/meetings/IF/IF02/20160513/104914/HHRG-114-IF02-20160513-SD099.pdf>.

CONCUSSIONS IN YOUTH SPORTS: EVALUATING PREVENTION AND RESEARCH

FRIDAY, MAY 13, 2016

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC.

The subcommittee met, pursuant to call, at 9:33 a.m., in room 2123, Rayburn House Office Building, Hon. Tim Murphy (chairman of the subcommittee) presiding.

Members present: Representatives Murphy, McKinley, Burgess, Griffith, Bucshon, Hudson, Collins, Cramer, DeGette, Schakowsky, Castor, Tonko, Yarmuth, Clarke, Green, Welch, and Pallone (ex officio).

Staff present: Leighton Brown, Deputy Press Secretary; Rebecca Card, Assistant Press Secretary; Jay Gulshen, Staff Assistant; Kelsey Guyselman, Counsel, Communications and Technology; Brittany Havens, Legislative Associate, Oversight; Charles Ingebretson, Chief Counsel, Oversight and Investigations; John Ohly, Professional Staff Member, Oversight and Investigations; Chris Santini, Policy Coordinator, Oversight and Investigations; Gregory Watson, Legislative Clerk; Jeff Carroll, Democratic Staff Director; Ryan Gottschall, Democratic GAO Detailee; Tiffany Guarascio, Democratic Deputy Staff Director and Chief Health Advisor; Christopher Knauer, Democratic Oversight Staff Director; Ukna Lee, Democratic Chief Oversight Counsel; Elizabeth Letter, Democratic Professional Staff Member; Matt Schumacher, Democratic Press Assistant; and Andrew Souvall, Democratic Director of Communications, Outreach, and Member Services.

OPENING STATEMENT OF HON. TIM MURPHY, A REPRESENTATIVE IN CONGRESS FROM THE COMMONWEALTH OF PENNSYLVANIA

Mr. MURPHY. Good morning, and welcome to the Oversight and Investigations hearing. We are here today to continue the committee's ongoing examination of concussions. This hearing follows an initial roundtable we had in March where we had a constructive dialogue with leading experts in the field about how to address the challenge of concussions.

Today's hearing will focus on youth sports, specifically the areas of prevention and research.

While there's always some risk of injury participating in sports, particularly at a young age, it is shown to have many benefits. The benefit of youth sports participation include better health through

increased activity, improved academic achievement, physical skill building and social development, to name a few.

I might add that the number one health risk of youth is increasing rate epidemic proportion of child obesity. We know that that leads to increased adult risk for diabetes, cardiovascular disease, and all sorts of other problems. So we want children to pay careful attention to their nutrition and be active.

While the estimates suggest that more than 30 million children, ages 5 to 18, participate in organized sports each year, and that despite this being the largest population of athletes, this group is one of the most underserved populations when it comes to the level of awareness, prevention, and research related to head injuries, which brings us to our task for today.

We want to examine what is being done today to reduce the instance of head injuries to young athletes, what policies and guidelines are currently in place to limit their risk of injury? How are these policies developed? And do they go far enough, what educational and training policies exist for athletes, coaches, and parents? How does the large number of disparate leagues, teams, clubs, and recreational opportunities available to young athletes complicate efforts to improve injury prevention?

While youth sports are not nearly as far along as many professional leagues, progress has made in recent years. All 50 States and the District of Columbia have enacted concussion laws and some youth sports, organizations, and leagues, such as Pop Warner Football, USA Hockey, U.S. Soccer, to name a few, have implemented policies to reduce the amount of head contact in practice and games. Others, such as USA Football, provide education and guidance to enhance training and awareness for coaches, parents, and athletes. A number of these groups are represented here today, and I look forward to hearing how their efforts are affecting their sports.

Based on their experience thus far, are we doing enough, and what does the science tell us? The last question is particularly interesting and important. There's a lot we do not know about concussions generally, but pediatric populations, including youth sports, are severely underrepresented in assisting research, and therein lays the challenge.

The public wants answers that science is not ready to provide. We have much to learn how concussions and repetitive head injuries affect younger individuals, both immediately as well as later in life. Therefore, I'm interested to learn how youth sports, organizations develop, review, and update their policies, guidance or educational efforts in light of the limited but rapidly evolving research about concussions.

We don't know how traumatic brain injury affects our youth, and it makes that much more challenging to protect them. Adding to the challenge, we currently lack any form of protective injury surveillance, including concussions for athletes younger than high school age. Given the large number of athletes, teams, leagues, and other recreational opportunities, this is a daunting task. But if we do not understand the magnitude of the challenge, how different factors such as age, gender, sports, socioeconomic status, et cetera,

influence outcomes, how can we be sure we are making the best decision for our kids?

This morning on our first panel, we are joined by two mothers; Ms. Kelly Jantz and Ms. Karen Zegal, both of whom tragically lost their son as a result of injuries sustained while playing youth sports. Ms. Jantz' son, Jake, was a promising freshman athlete at Grandview High School in Aurora, Colorado, and is the namesake of Colorado's Jake Snakenberg Youth Concussion Act. While Ms. Zegal's son, Patrick Risha, was a star running back at Elizabeth Forward High School in my district and played football from the moment he could pick up a ball. We greatly appreciate your willingness to share your stories as it reminds us why it is so vital that we continue to examine this issue.

Later on our second panel, we will have Dartmouth's head football coach, Buddy Teevens, and representatives from some of the sports organizations, USA Football, USA Hockey, and U.S. Lacrosse that oversee or provide guidance to U.S. sports leagues. We will also hear from practice life pros to learn more about additional options to keeping athletes safe.

Additionally, we have prominent researchers in the field. They will be able to speak to how we can approve research and surveillance, better monitor injuries, and minimize the risk of injury based upon science.

I appreciate all of our panels for joining us this morning. This is an important issue, and your perspectives are important to advance the public dialogue on these complex injuries.

I also want to thank Ranking Member DeGette for her support in this initiative and look forward to continuing our efforts together in this endeavor.

[The prepared statement of Mr. Murphy follows:]

PREPARED STATEMENT OF HON. TIM MURPHY

We are here today to continue the committee's ongoing examination of concussions. This hearing follows an initial roundtable that we had in March, where we had a constructive dialogue with leading experts in the field about how to address the challenge of concussions. Today's hearing will focus on youth sports, specifically areas of prevention and research.

While there is always some risk of injury, participating in sports, particularly at a young age, has shown to have many benefits. The benefits of youth sports participation include better health through increased activity, improved academic achievement, physical skill-building, and social development, to name a few.

Estimates suggest that more than 30 million children, ages 5 to 18, participate in organized sports each year. Despite this being the largest population of athletes, this group is one of the most underserved populations when it comes to the level of awareness, prevention and research related to head injuries.

This brings us to our task for today. We want to examine what is being done today to reduce the incidence of head injuries in young athletes. What policies and guidelines are currently in place to limit the risk of injury? How are these policies developed and do they go far enough? What educational and training policies exist for athletes, coaches, and parents? How does the large number of disparate leagues, teams, clubs and recreational opportunities available to young athletes complicate efforts to improve injury prevention?

While youth sports are not nearly as far along as many professional leagues, progress has been made in recent years. All 50 States and the District of Columbia have enacted concussion laws and some youth sports organizations and leagues—such as Pop Warner Football, USA Hockey, US Soccer, to name a few—have implemented policies to reduce the amount of head contact in practices and games. Others—such as USA Football—provide education and guidance to enhance training and awareness for coaches, parents, and athletes. A number of these groups are rep-

resented here today and I look forward to hearing how their efforts are affecting the safety of their respective sports. Based on their experience, thus far, are we doing enough? What does the science tell us?

This last question is particularly interesting and important. There is a lot we do not know about concussions, generally, but pediatric populations, including youth sports, are severely underrepresented in existing research. And therein lays the challenge—the public wants answers that the science is not ready to provide. We have much to learn about how concussions and repetitive head injuries affect younger individuals, both immediately as well as later in life. Therefore, I am interested to learn more how youth sports organizations develop, review, and update their policies, guidance, or educational efforts in light of the limited, but rapidly evolving, research on concussions. If we don't know how traumatic brain injury affects our youth, it makes it that much more challenging to protect them.

Adding to the challenge, we currently lack any form of effective injury surveillance, including concussions, for athletes younger than high school age. Given the large number of athletes, teams, leagues, and other recreational opportunities, this is a daunting task. But if we do not understand the magnitude of the challenge, how different factors—such as age, gender, sport, socioeconomic status, etc.—influence outcomes, how can we ensure we are making the best decisions for our kids?

This morning on our first panel, we are joined by two mothers—Ms. Kelli Jantz and Ms. Karen Zegel—both of whom tragically lost their sons as a result of injuries sustained while playing youth sports. Ms. Jantz's son, Jake, was a promising freshman athlete at Grandview High School in Aurora, Colorado and is the namesake of Colorado's "Jake Snakenberg Youth Concussion Act." While Ms. Zegel's son, Patrick Risha, was a star running back at Elizabeth Forward High School, in my district, and played football from the moment he could pick up a ball. We greatly appreciate their willingness to share their stories, as it reminds us why it is so vital that we continue to examine this issue.

Later, on our second panel we will have Dartmouth's Head Football Coach, Buddy Teevens, and representatives from some of the sports organizations—USA Football, USA Hockey, and US Lacrosse—that oversee or provide guidance to youth sports leagues. We will also hear from Practice Like Pros to learn more about additional options for keeping athletes safe. Additionally we have prominent researchers in this field that will be able to speak to how we can improve research and surveillance, better monitor injuries, and minimize the risk of injury based on the science.

I appreciate all of our panelists for joining us this morning. This is an important issue and your perspectives are important to advancing the public dialogue on these complex injuries.

I also would like to thank Ranking Member DeGette for her support on this initiative and look forward to continuing our efforts on this endeavor. I now recognize the Ranking Member for 5 minutes to deliver her own remarks.

Mr. MURPHY. So I now recognize the ranking member for 5 minutes to deliver her own remarks.

OPENING STATEMENT OF HON. DIANA DEGETTE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF COLORADO

Ms. DEGETTE. Thank you so much, Mr. Chairman, for having this follow-up hearing on our roundtable that we held on concussions and brain trauma earlier this year. I am very pleased that we are looking, first, at youth sports through official hearings, because studies have shown that children and teens are more likely than adults to get a concussion, and they take longer to recover.

Athletes at the professional college levels, they can make their own decisions about undertaking the risks associated with certain sports, but we need to ensure that children and their parents have enough data to make informed decisions about participation in youth contact sports. Part of that discussion needs to be the recognition of how valuable these sports are, both for physical fitness and team building, as you so well stated, Mr. Chairman. But I

think we also need to have an open discussion about how to make them safer.

I approach this issue, both as a policymaker and a parent. And as I said in the roundtable, I support evidenced-based policy making and am very encouraged that we are having ongoing research to better understand brain trauma. But at our roundtable, the experts said that they are going to have answers about what the protocol should be in 7 to 10 years. And what I said at that hearing is, as a mom, when I'm deciding if my kid is going to play Pee Wee sports, I can't afford to wait 7 to 10 years. By then, they will be in high school, and so we need to take whatever evidence that we have right now, and we need to figure out for now what we should tell the parents and what we should tell leagues that they should be doing as the best practices as far as we know right now.

For example, at what age should children start playing tackle football? How many times a week should children be engaging in full contact practices? And when they do begin to play, how do we teach them to tackle safely and to protect their heads and the heads of other players? And how do we ensure that coaches are educated in teaching these skills to young players? I'm sure that we can ask other questions in all youth sports, not just football.

I agree that most, if not all parents, would agree that it is better to err on the side of caution. The worst-case scenario would be that we discover later, that some of these safety measures may have been unnecessary. But as a mom, I always want to have more safety rather than less safety, especially when you're talking about our children's brains.

Now, as we implement changes in sports now, this is not a reason to stop researching our gaps in knowledge. We need to understand the long-term effects of concussive and subconcussive injuries; we need to analyze whether the rule changes being implemented are having the desired effects; we need to study how to prevent brain injury in the first place.

I also am interested from hearing in our witnesses on the second panel about the differences they are seeing in girls and boys sports and how the rates of concussion differ. I know that there have been studies suggesting that women and girls report concussions at higher rates than men and boys in similar sports. I want to know about that disparity, and also if there's any disparity about the actual effects on brains.

Both of our panels contain excellent witnesses, and it's so important to have them today. I'm really proud to welcome two witnesses from Colorado. Kelly Jantz, as you heard, tragically lost her son Jake to second impact syndrome in 2004.

And, Kelly, I'm so proud of you, because what you did is you were instrumental in ensuring that concussions are taken seriously in youth sports, and that parents and coaches have the information they need. As the chairman mentioned, in 2012, Governor Hickenlooper signed the Jake Snakenberg Youth Sports Concussion Act into law in Colorado, and we're really proud that you've taken his legacy to that. We really are.

Dr. Dawn Comstock is on our second panel. She's from the Colorado School of Public Health. And like me, a Colorado native. She's one of the leading experts in sports injury epidemiology. Her data-

base gathers information on injury exposure and incidents among high school athletes. She looks at injury patterns like examining the correlation between neck strength and concussion risk to inform prevention and mitigation strategies. And so I want to thank you, also, Dr. Comstock, for making youth sports safer.

I want to thank everybody who is here today to help us figure this out. And I also really want to say, we want to see sports succeed. I can't let this hearing go by without congratulating the world champion Denver Broncos, for example, which I have season tickets. And I also want to say, as I said before, one of my great sadnesses is that I was unable to persuade either of my daughters to play ice hockey, and they took up dance instead.

But the point is, all—every child in this country should be safe. We love sports. We want to see sports succeed, but that means that we have to do our utmost to improve player safety and guarantee that participation in sports doesn't mean that you have long-term health consequences.

So I know, Mr. Chairman, you intend to have more hearings. I think this is the perfect place to start. I want to thank you again, and yield back.

Mr. MURPHY. Thank you. Go Steelers.

Of course, right now the Penguins are in the playoffs. We wish them the best, too, and all athletes.

I now am going to recognize—first of all, I want to say the opening statement of Mr. Upton will be included in the record. He could not be with us this morning.

[The prepared statement of Mr. Upton appears at the conclusion of the hearing.]

Mr. MURPHY. But we're going to recognize Mr. Hudson for an opening statement.

OPENING STATEMENT OF HON. RICHARD HUDSON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NORTH CAROLINA

Mr. HUDSON. Thank you, Mr. Chairman. I thank you, Chairman Murphy and Ranking Member DeGette, for your focus on this issue. Even as painful as it is to hear Representative DeGette talk about the Broncos, so I want to represent Charlotte, North Carolina, home of the Carolina Panthers. There's always next year.

I would like to thank the panelists for your important testimony today. Your experiences and expertise help the committee better understand the gravity of concussions in youth sports and what we need to do to prevent concussions and the long-lasting effects for future generations.

Unfortunately, pediatric trauma, which concussions and traumatic brain injury is a part of, is the number-one killer of kids. Pediatric trauma has become a particular focus of mine. I've been fortunate to have the Childress Institute for Pediatric Trauma partner with me in examining what we can do to help our children live long, fulfilling lives. Childress Institute was started by my dear friend, Richard Childress' wife Judy, with the goal of discovering and sharing in the best ways to prevent and treat severe injuries in children. The Childress Institute supports a number of pediatric research programs, including the Concussive Care Fund, which

funds initiatives prevent and treat injuries in youth and recreational sports. The promising research being done to prevent and treat trauma not only broadly, but also on specific issues like concussions, takes on particular importance to me as a father of a 7-month-old baby boy. I'm thankful so much awareness is being brought to this issue by discussions like today.

As one trauma surgeon said to me, it's not a life saved; it's a lifetime saved. And I want to also note that my fellow North Carolina Representative, G.K. Butterfield and I are hosting a pediatric trauma briefing with the Energy and Commerce Committee on Tuesday, May 24th. I would encourage anyone who is interested to please attend, and I look forward to today's discussion.

With that, Mr. Chairman, I yield back.

Mr. MURPHY. Is there anybody else on our side who have anything they want to add at this point?

Then I now recognize the ranking member, Mr. Pallone, for 5 minutes.

OPENING STATEMENT OF HON. FRANK PALLONE, JR., A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

Mr. PALLONE. Thank you, Mr. Chairman.

And I want to thank all of our participants for joining us today. Additionally, I would like to thank the chairman for his commitment to this committee's examination of concussions and brain trauma. Earlier this year, we had an initial roundtable on this issue, and at the time I requested to Chairman Upton that we hold a series of hearings on concussions and sports-related head trauma. I propose that we start with an examination of head impacts in youth sports, and I'm gratified that we are here today to discuss this very topic and look forward to the additional hearings on this important issue.

Parents across the country are concerned about the risk of concussions, and with good reason. I have my own experience as a parent in dealing with my daughter's concussion and deciphering the medical advice provided. It's challenging as a parent to balance the news stories and the results of the latest research against the value of our children's participation in sports, and I can certainly relate to parents' concerns and their confusion about how to make the right decisions for their children.

And there is compelling research to suggest that the effects of repeated head trauma, even those received during one's youth, can accumulate and cause serious consequences, and these consequences can stem from injuries once considered minor known as subconcussive hits, or repetitive hits to the head. Purdue University Research is led by one of our witnesses today, Dr. Tom Talavage, found significant structural changes to the brains of high school football players, even among those who were not diagnosed with a single concussion. And what is particularly troubling is that these changes persist at even 12 months later, suggesting lasting damage. Many other studies have documented an association between subconcussive hits and changes in brain chemistry, decreased brain functioning, and behavioral changes. A recent study by a group of researchers at Boston University found that exposure

to hits, regardless of whether a concussion occurred, is Associated with a higher likelihood of mood disorders, like depression. Researchers have also repeatedly found evidence of the linkage between head impacts and CTE, a devastating degenerative brain disease.

CTE has been found in former athletes as young as 25 years old and in adults who never played football beyond the high school level. And there remain a number of unanswered questions about what risk factors make individuals more susceptible to these debilitating conditions. We also need to understand what happens in the brain when it's hit, and how many hits trigger these neurological effects. And while there is still research that needs to be done, that should not be an excuse for inaction. What is not in dispute is the association between head trauma from contact sports, such as football, and lasting brain damage in degenerative diseases, such as CTE. Even the NFL publicly acknowledged this link at this committee's roundtable back in March.

Some researchers in this field suggest that we should, quote, "wait on the science before making changes to the rules of youth sports." And I respectfully disagree. We cannot ask children and their parents to wait 10, 15, or 20 years for the science to catch up before we take measures to make sports safer. We need to be asking questions right now and implementing the appropriate rule changes.

The science has raised enough red flags about the dangers of repetitive head trauma that I think it is incumbent upon those who organize and promote youth contact sports to take every effort to make the games as safe as possible. And earlier this month, the subcommittee ranking member, Ms. DeGette, Mr. Green, and Ms. Schakowsky joined me in sending letters to collegiate and youth football leaders. We asked them to explain what rule or policy changes they are considering to address the risks associated with both concussive and subconcussive hits. And I expect that we will have a response by May 25th. And I commend Pop Warner for announcing yesterday that it would ban kickoffs in games starting this fall.

I also look forward to hearing today from other youth sports organizations about what they are doing for their individual sports, and whether additional measures need to be considered.

And last, Mr. Chairman, I want to express my deep thanks to both Kelly Jantz and Karen Zegel for joining us today. I can't even imagine the losses you and your families have experienced.

Thank you for your willingness to share your experiences with this committee. We can learn from you as we pave a path forward to better protect our kids. And thank you, again, to all our witnesses for their contribution and for helping us with our comprehensive review of concussions and head trauma.

I hope we can all continue to work together to find the best ways to address this significant public health issue to protect our children. I yield back.

[The prepared statement of Mr. Pallone follows:]

PREPARED STATEMENT OF HON. FRANK PALLONE

I want to thank all of our participants for joining us today. Additionally, I'd like to thank the chairman for his commitment to this committee's examination of concussions and brain trauma.

Earlier this year, we had an initial roundtable on this issue, and at the time, I requested to Chairman Upton that we hold a series of hearings on concussions and sports-related head trauma. I proposed that we start with an examination of head impacts in youth sports. I am gratified that we are here today to discuss this very topic, and I look forward to additional hearings on this important issue.

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There is compelling research to suggest that the effects of repeated head trauma—even those received during one's youth—can accumulate and cause serious consequences. And these consequences can stem from injuries once considered minor, known as subconcussive hits, or repetitive hits to the head.

Purdue University researchers, led by one of our witnesses today, Dr. Tom Talavage, found significant structural changes to the brains of high school football players, even among those who were not diagnosed with a single concussion. What is particularly troubling is that these changes persisted even 12 months later, suggesting lasting damage.

Many other studies have documented an association between subconcussive hits and changes in brain chemistry, decreased brain functioning, and behavioral changes. A recent study by a group of researchers at Boston University found that exposure to hits, regardless of whether a concussion occurred, is associated with a higher likelihood of mood disorders like depression.

Researchers have also repeatedly found evidence of a linkage between head impacts and CTE, a devastating degenerative brain disease. CTE has been found in former athletes as young as 25 years old and in adults who never played football beyond the high school level.

There remain a number of unanswered questions about what risk factors make individuals more susceptible to these debilitating conditions. We also need to understand what happens in the brain when it's hit, and how many hits trigger these neurological effects.

While there is still research that needs to be done, that should not be an excuse for inaction. What is not in dispute is the association between head trauma from contact sports, such as football, and lasting brain damage and degenerative diseases, such as CTE. Even the NFL publicly acknowledged this link at this committee's roundtable back in March.

Some researchers in this field suggest that we should "wait on the science" before making changes to the rules of youth sports. I respectfully disagree. We cannot ask children and their parents to wait 10, 15, or 20 years for the science to catch up before we take measures to make sports safer.

We need to be asking questions right now and implementing the appropriate rule changes.

The science has raised enough red flags about the dangers of repetitive head trauma that I think it is incumbent upon those who organize and promote youth contact sports to take every effort to make the games as safe as possible.

Earlier this month, subcommittee Ranking Members DeGette, Green, and Schawsky joined me in sending letters to collegiate and youth football leaders. We asked them to explain what rule or policy changes they are considering to address the risks associated with both concussive and subconcussive hits. I expect that they will respond to us by May 25th. And I commend Pop Warner for announcing yesterday that it would ban kickoffs in games starting this fall. I also look forward to hearing today from the other youth sports organizations about what they are each doing for their individual sports, and whether additional measures need to be considered.

Last, I want to express my deep thanks to both Kelli Jantz and Karen Zegel for joining us today. I cannot even imagine the losses you and your families have experienced. Thank you for your willingness to share your experiences with this committee. We can learn from you as we pave a path forward to better protect our kids.

Thank you again to all of our witnesses for your contributions and for helping us with our comprehensive review of concussions and head trauma. I hope we can all

continue to work together to find the best ways to address this significant public health issue to protect our children.

Mr. MURPHY. The gentleman yields back. I ask unanimous consent that Members' opening statements be introduced in the record.

And, without objection, the documents will be entered into the record.

Now, I would like to introduce the witnesses for our first panel for today's hearing. We are going to try to get through their testimony before votes.

The first witness on today's panel is Ms. Kelly Jantz. Ms. Jantz, the mother of Jake Snakenberg. Jake passed away after suffering from second impact syndrome. Following her son's death, Ms. Jantz has become a dedicated activist, committed to raising awareness of concussions in youth sports. We thank Ms. Jantz for preparing her testimony and look forward to her insights on these matters.

I also want to welcome Ms. Karen Zegel. Ms. Zegel is the president of the Patrick Risha CTE Awareness Foundation. The Foundation was created in memory of her son, Patrick Risha, who I enjoyed reading about during his football career. He passed away after suffering from CTE.

Thank you, Ms. Zegel, for your testimony today. We look forward to your comments.

So you two are aware that this committee is holding the investigative hearing and when doing so has the practice of taking testimony under oath.

Do either of you object to testifying under oath? Seeing no objections, the Chair then advises you that under the rules of the House and rules of the committee, you are entitled to be advised by counsel.

Do either of you desire to be advised by counsel during your testimony today?

Neither one does. In that case, would you mind, please, rising and raise your right hand, and I'll swear you in.

[Witnesses sworn.]

Both answered affirmatively, and you are now under oath and subject to the penalties set forth in Title 18, section 1001 of the United States Code.

I will ask you each to give a 5-minute summary of your written statement. There will be light in front of you which will be red when that time is up.

You can begin, Ms. Jantz. Turn the microphone on and bring it very close to you if you don't mind. Thank you.

**STATEMENTS OF KELLI JANTZ, MOTHER OF JAKE
SNAKENBERG AND CONCUSSION AWARENESS ADVOCATE;
AND KAREN KINZLE ZEGEL, MOTHER OF PATRICK RISHA
AND CHRONIC TRAUMATIC ENCEPHALOPATHY (CTE)
AWARENESS ADVOCATE**

STATEMENT OF KELLI JANTZ

Ms. JANTZ. Chairman Murphy, and Ranking Member DeGette, and members of the subcommittee, good morning and thank you for this opportunity to provide testimony on the important issue regarding youth and youth-related sports concussions.

I commend you and your colleagues on the work of this committee to shed light on this critical issue. My name is Kelli Jantz, and I'm the mom to Jake Snakenberg. My son was your typical all-American boy, devoted to sports, his friends, and our family. Jake was often referred to as our social butterfly in our family. He had a big heart and genuinely cared for those in his life. He had a joy about him that others could not resist. His big brother summed it up best when he said Jake drank up life like it was pouring from a fire hose. He gave 110 percent in everything, especially sports.

On September 18th, in 2004, Jake got up at 6:15 in the morning in anticipation of his freshman football game. He loved football and all it offered; the physical challenge, the spirit of competition, and probably most of all, the friendships that were involved. He was particularly excited about playing in this game, because he had been held out of a few practices because the week prior, he had suffered an injury where his arms and hands went numb and tingly. What he described to us sounded like maybe he had tweaked his neck or strained his neck. He hadn't lost consciousness; he didn't see stars. You wouldn't have associated it with a major type of injury. He didn't report to his dad or me and any headaches during the week, though his friends had said that after that injury, he had complained of some headaches. Regardless of that, he was able to return to practices and meet the required number of practices to play on the game day.

In warmups on the 18th, Jake took a really hard hit that really appeared to shake him. He noticed me looking on and waved me off to let me know he was oK. When the game began and he lined up for a play, right before the snap, Jake stumbled forward. A whistle was blown, and they called a penalty, and flag was thrown. And Jake got up and started to come to the sideline, and then stumbled and went down again, and he never got back up again. He was unconscious, and 911 was called immediately, and a life flight was dispatched to the football field. Jake was airlifted to Swedish Medical Center where a neurosurgeon advised us that Jake had could suffered a head injury, and steps were being taken to decrease the swelling in his brain. He told us that Jake may never play football again, and would likely have a long recovery. But he followed that statement with, if Jake survives this injury. Tragically, Jake didn't survive. It was determined that Jake had suffered second-impact syndrome, a condition leading to rapid swelling of the brain from more than one concussion. It's a phenomenon unique to young brains.

It was likely that Jake had suffered a concussion the previous week. Subsequent hits during practice and warmups, though not associated with the concussion, had a compounding effect and continued to further injury his already compromised brain.

Since Jake's death, I have made it my mission to continue to raise awareness of the consequences of concussion in youth sports. Following Jake's death, Dr. Karen McAvoy developed the REAP Project, which was adopted by a Rocky Mountain hospital for children and is made available to the Colorado Department of Education. This program deals with all youth concussions, regardless of the cause, meaning not just sports-related concussions, as any concussion can directly impact a student's learning ability.

I've had the opportunity to support REAP Concussion Management Program, which is being adopted by other States through helping distribute the REAP manuals funded by the Jake Snakenberg Memorial Fund.

Looking at the wealth of research on the consequences of youth concussion and the rapidly evolving advances in concussion management, we would be remiss and, actually, it would be irresponsible not to take every possible opportunity to develop measures to protect our youth from the devastating disabilities and potential death resulting from these types of injuries.

To help—excuse me. I think, actually, in closing, these children are our future, and it's our responsibility as parents and coaches, teachers, medical professionals, policymakers, and the community as a whole to make sure we do all we can to support the necessary culture change to make youth sports as safe as possible, and protect our children as well as to provide appropriate treatment and assistance should a concussion occur.

I want to thank you, again, for addressing this critical issue and allowing me to participate in the hearing today.

Mr. MURPHY. Thank you.

[The prepared statement of Ms. Jantz follows:]

TESTIMONY
Before the
Subcommittee on Oversight and Investigations
House Committee on Energy and Commerce
Hearing:
Concussions in Youth Sports: Evaluating Prevention and Research
Friday, May 13, 2016

Chairman Murphy, Ranking Member DeGette, and Members of the Subcommittee:

Good morning and thank you for this opportunity to provide testimony on the important issue regarding youth and sports-related concussions. I commend you and your colleagues on the work of this committee to shed light on this critical issue. My name is Kelli Jantz, and I am the mom to Jake Snakenburg. My son Jake was your typical all American boy. Devoted to sports, his friends, and our family Jake, was often referred to as our "social butterfly". He had a big heart, and genuinely cared for those in his life. He had a joy about him, that others could not resist. His big brother summed it up best when he said "Jake drank up life like it was pouring from a fire hose". He gave 110% in everything, especially sports.

On September 18, 2004 our 14 year old son Jake Snakenburg got up at 6:15AM in anticipation of his football game. Jake loved football and all that it offered, the spirit of competition, the physical challenge and probably most of all the friendships. He was particularly excited about playing in this game as he had been held out of a few practices due to an injury from a prior game. Jake had suffered a hit which left his arms numb and tingly for a few minutes. From what he described we figured he had "tweaked" or strained his neck. He had not lost consciousness, or seen stars, no telltale signs of a major injury. He was monitored the following week and the range of motion in his neck improved. Jake did not inform his father or I of any headaches, but a few friends said Jake had complained of headaches during the week. Regardless, he was able to return to practice and meet the required number of practices to be eligible to play game day.

In warm – ups on the 18th, Jake took a hard hit that appeared to shake him. He noticed me looking on and waved me off to let me know he was ok. As the game began, Jake lined up with his team, but before the snap stumbled forward. The whistle was blown and penalty flag thrown. Slowly Jake got up and headed to the sideline, but collapsed on the field. He did not get up. Jake was unconscious. 911 was called immediately and life flight dispatched to the football field. Jake was airlifted to Swedish Medical. The neurosurgeon advised us that Jake had suffered a head injury and steps were being taken to decrease the swelling in his brain. He told us that Jake may never play his beloved football again, and will have a long recovery. The surgeon followed this statement with “if he survives this injury”. Tragically Jake did not survive. It was determined that Jake had suffered what is called Second Impact Syndrome, a condition leading to rapid swelling from more than one concussion, a phenomenon unique to young brains. It is likely Jake suffered a concussion the previous week. The subsequent hits during warm ups, though not associated with a concussion had a compounding effect and continued to further injure his already compromised brain.

Since Jake’s death, I have made it my mission to continue to raise awareness of the consequences of concussion in youth sports. Following Jake’s death, Karen McAvoy, Psy.D., developed the REAP Project which was adopted by the Rocky Mountain Hospital for Children and is made available to the Colorado Department of Education. The REAP Project is a community-based model for Concussion Management. REAP stands for Remove/Reduce physical and cognitive, or mental demands; Educate the student athlete, families, educators, coaches and medical professionals; Adjust/Accommodate for the student athlete academically; and Pace the student athlete back to learning, activity and play. However, the program addresses

all youth with concussions, regardless of cause, meaning not just sports-related concussions, as any concussion can directly impact a student's learning ability. Educators, therefore, should understand the impact of concussions, as well as moderate to severe brain injury, will have with regard to academics.

At least three states have passed legislation to begin addressing academic needs after a concussion, generally referred to as "return to learn", to bring these issues to the attention of educators. And, several states have developed training, resources and consultative teams to assist educators with screening, assessment, educational planning and support for children with brain injury regardless of severity.

I have had the opportunity to support the REAP concussion management program which is now being adopted in other states. The REAP manuals have been funded for free distribution by the Jake Snakenburg Memorial Fund. I have also had the opportunity to testify in hearings leading to the passing of the Jake Snakenburg Youth Concussion Act in 2011, which requires Colorado middle school, junior high and high school coaches, as well as volunteer coaches with regard to recreational sports, to be educated on how to recognize a concussion; to remove players from play, if a concussion is suspected; and to require the student athlete to be signed off by a medical professional before returning to play. All 50 states and the District of Columbia have passed similar legislation.

Looking at the wealth of research on the consequences of youth concussion and the rapidly evolving advances in concussion management, we would be remiss, actually it would be irresponsible, not to take every possible opportunity to develop measures to protect our youth from the devastating disabilities and potential death resulting from these types of injuries. To help determine the extent and resulting problems, the Institute of Medicine and the National

Research Council issued a report in October 2013 that called for the Centers for Disease Control and Prevention to establish and oversee a national surveillance system.

Therefore, I support funding in the President's budget (\$5 million) to implement the National Concussion Surveillance Survey. Without comprehensive data, we will never know how many of our youth have been affected by concussions nor the short-term and long-term consequences. I ask Congress to please include \$5 million in the FY2017 budget to allow the CDC to collect data on incidence and prevalence of concussions in youth population. I also support the passage of the Youth Sports Concussion Act, sponsored by the Congressional Brain Injury Task Force Co-chairs, Representative Bill Pascrell and Representative Tom Rooney, to ensure that sports equipment is safe.

In addition, I urge the U.S. Department of Education to provide assistance and support to state departments of education and public schools with regard to training educators to better address the academic needs of students with brain injury resulting in cognitive and behavioral problems. Schools should be encouraged to work with state and local agencies that provide services to individuals with brain injury in order to coordinate community resources and supports to families in order for children who are injured to have a successful recovery and outcome after brain injury. The National Association of State Head Injury Administrators (NASHIA) is one organization which can help identify state resources.

In closing, these children are our future. It is our responsibility as parents, coaches, teacher, medical professionals, policy makers and the community as a whole to make sure we do all we can to support the necessary culture change to make youth sports as safe as possible and protect our children, as well as to provide appropriate treatment and assistance once a concussion occurs. Thank you for addressing this critical issue and allowing me to participate in the hearing today.

Subcommittee on Oversight and Investigations
Hearing:
Concussions in Youth Sports: Evaluating Prevention and Research
Summary
Kelli Jantz, Colorado

- The Centers for Disease Control and Prevention estimates 1.6 million to 3.8 million concussions occur each year.
- 5-10% of athletes will experience a concussion in any given sport season.
 - Football is the most common sport with concussion risk for males (75% chance for concussion).
 - Soccer is the most common sport with concussion risk for females (50% chance for concussion).
- Headache (85%) and dizziness (70-80%) are most commonly reported symptoms immediately following concussions for injured athletes.
- All states have enacted youth sports concussion laws, referred to as “return to play”.
 - Colorado is one of thirteen states to extend concussion law requirements to private entities, such as private schools or youth athletic leagues, in addition to public schools.
 - Texas prohibits districts from using football helmets that are 16 years old or older. Helmets 10 years old or older must be reconditioned at least every two years.
- At least 3 states have enacted “return to learn” laws in recognition of the impact of concussions on learning and academics. All states should implement similar programs to assess the learning abilities or difficulties following a concussion.
- Colorado has developed a concussion management program, called REAP, which is similar to other concussion management programs. However, not all states have the availability of such programs, or have them statewide.
- Educators need training to understand identification, assessment and educational strategies for students with brain injury, regardless of severity.
- Request Congress to include \$5 million in the FY 2017 budget to allow the Centers for Disease Control and Prevention to implement the National Concussion Surveillance Survey in order to obtain data to determine the extent and impact of concussions.
- Request Congress to pass the Youth Sports Concussion Act, sponsored by Representative Pascrell and Representative Rooney, to ensure that sports equipment is safe.
- The U.S. Department of Education should provide opportunities for training and other assistance to assist educators in identification, assessment, and educational strategies for individuals with brain injury.

Mr. MURPHY. Ms. Zegel, you can go for 5 minutes. Thank you.

STATEMENT OF KAREN KINZLE ZEGEL

Ms. ZEGEL. Chairman Murphy, Ranking Member DeGette, and members of the committee, thank you so much for inviting me to speak today. My son, Patrick Risha, was a hometown hero in high school football. I'm going to cry.

He grew up in an area that measured the worth of a man by his prowess and heart on the football field. He started just south of Pittsburgh, and with the Elizabeth Forward Youth Leagues when he was 10 years old. He was not gifted with size or speed, but nonetheless, worked hard to become a great player and through that, achieved his dream to go to an Ivy League school. It is that work ethic and perseverance in a collision sport that ultimately killed him.

Patrick took his own life at the age of 32, but actually, we have come to know CTE took his life. Patrick never played in the NFL. Patrick was like millions of children before and after him that just played for fun and success in life. But throughout high school, prep school, and Dartmouth College, our sweet, tough, young running back received enough subconcussive blows to his head to essentially seal his fate. When he died, a newscaster friend of the family suggested he might have CTE. I had never heard of CTE before. I've had heard about NFL players having brain injuries and concussions, but I never dreamed it could affect a player at the college level.

When Patrick's autopsy revealed he had widespread CTE, I was in shock and horror. How many other players like Patrick are there out there? How many other families are dealing with a loved one gradually becoming unwired, with no clue what is happening? Not every grieving family has a newscaster friend saying the words CTE.

For the sake of American families, this has to change. And we are grateful this committee is conducting this hearing to learn more about the disease, and the impact on families and on our society.

Personally, I worried about Patrick becoming paralyzed, but I thought the chances were extremely small, and I thought he had so much to gain from playing.

If I had known the repeated tackles my son endured were slowly killing him, I would have stopped it. No family wants their child to suffer a disease that causes him to lose his mind slowly, and with such anxiety and loneliness. Yet, every day, parents are signing their kids up for youth collision sports. These parents don't understand the horror they may face with their child. Parents need to be told the truth.

The human brain is much more fragile than we ever imagined. The brain doesn't heal the way skin and bones do. Traumas could be very well permanent. For thousands of years, men have fought in arenas for sports and entertainment. Somehow we seem to have evolved to a point where we're now willing to put children into arenas to tackle each other for sport. We put them in the equivalent of cheap Halloween costumes to emulate their NFL heroes. We ask

them to be tough little warriors. That's what our family did, and we were so proud when Patrick carried his team to victory.

Sadly, we lost an amazing young man before he ever had the chance to live his life, and gifted and promising young children like Patrick all over this land are winning battles on the sports field, but sadly losing their chances for a happy, healthy, productive future.

Patrick's tragic end was not an isolated incident. Parents need to know that one in three players may develop CTE. Soldiers coming home and ex-amateur collision athletes are being diagnosed with PTSD, ADHD, anxiety, depression, drug addictions, anger issues, et cetera, when, in fact, they may have CTE.

When I see a guy on TV hitting his wife, shooting his friend, or going on a high-speed car chase, I wonder if maybe he played one too many football games. People need to know that this invisible disease is more common than we know, that it can develop in youth, high school, and college levels of collision sports. Families need to know what the causes and symptoms are, and how to address the disease.

This has been hidden in plain sight for much too long. It was this realization that prompted us to form the Patrick Risha CTE Awareness Foundation and the Web site, stopCTE.org. We also created a brochure, *Flag Until 14* to help parents understand the key issues of CTE.

Heading the ball has recently been eliminated from youth soccer. Checking in hockey has been eliminated in youth leagues. Yet, over 2 million children are still putting their precious brains at risk in tackle football. The urgency of this problem is beyond measure. I wish we would have known the truth 25 years ago.

There are those out there who would prefer parents didn't know about CTE. They will obfuscate the issue with unreasoned arguments. We've heard a few, like you can get a concussion riding a bike, or you're turning our warriors into pansies, or do you want them to sit and play video games for the rest of their lives? When you have lost your son to CTE and you understand how it is caused and how prevalent it is, these arguments are hurtful and, in my opinion, keep children at risk.

We see CTE as a human tragedy of immense proportions, and we need the help of everyone in this room and beyond. We all now have the duty to save children and families. CTE is 100 percent preventable. We need to remove repetitive head trauma from youth sports. To do anything else is to be complicit to the problem, knowing more families will suffer the pain we personally endure every day.

Thank you very much.

[The prepared statement of Ms. Zegel follows:]

Testimony for Public Hearing
"Concussions in Youth Sports: Evaluating Prevention and Research"
Energy and Commerce Committee
Oversight and Investigations Subcommittee
May 13, 2016

Karen Kinzle Zegel
31 Doyle St.
Doylestown, PA 18901

Thank you Energy and Commerce Committee members and particularly Representative Murphy for allowing me to speak to this hearing today. I consider it an honor and a privilege to represent the millions of children that are in harms way as we debate their future health and wellbeing.

I am not a doctor or scientist. But I have experience. I have lived with and loved a person struggling with the disease Chronic Traumatic Encephalopathy, CTE. I have seen close-up the transformation of a beautiful, bright, energetic, loving young man into a reclusive, paranoid, depressed and angry person. It is heartbreaking.

My son Patrick Risha was a hometown hero in high school football. He grew up in an area that measured the worth of a man by his prowess and heart on the football field. He started just south of Pittsburgh with the Elizabeth Forward youth leagues when he was ten years old. He was not gifted with size or speed but nonetheless worked hard to become a great player, and through that achieved his dream to go to an Ivy League school. It is that work ethic and perseverance in a collision sport that ultimately killed him. Patrick took his own life at the age of 32.... But actually we have come to learn CTE took his life.

Patrick never played in the NFL. Patrick was like millions of children before and after him that just played for success in life. But throughout high school, prep school and Dartmouth College, our sweet, tough, young running back received enough sub-concussive blows to his head to essentially seal his fate. When he died, a newscaster friend of the family suggested he might have CTE. I had never heard of CTE before. I had heard about NFL players having brain issues but never dreamed it could have an effect at the level of a college player. When Patrick's autopsy revealed he had widespread CTE I was in shock and horror. How many other players like Patrick are there out there? How many other families are dealing with a loved one gradually coming unwired and have no clue what is happening? Not every grieving family has a newscaster friend saying the words CTE. For the sake of American families this has to change.....and we are grateful this committee is conducting this hearing to learn more about the disease and the impact on families and on our society.

People need to know that this disease is out there. That it can occur in youth and high school and college levels of collision sports. Families need to know what the symptoms are and how to address the disease. This has been hidden in plain sight for much too long. It was this realization that prompted our family and friends and the support of my husband, to form the Patrick Risha CTE Awareness Foundation and the website StopCTE.org. Sadly, I am not the only grieving loved one on this crusade. In March for Brain Injury Awareness Day here in the House twelve families were represented that lost loved ones to brain trauma and disease. Paul Bright, Eric

Pelly, Daniel Brett and Joseph Chernach only played football up to the high school level. Their moms and other families of CTE victims formed the Save Your Brain Campaign to bring attention to the need for protecting children in sports. Together with many other families (as the numbers grow), we will be returning to DC until we are sure that children are protected and safe.

No family wants their child to suffer with a disease that causes them to lose their mind slowly and with such anxiety and loneliness. Yet everyday parents are signing their kids up for youth collision sports. Our "Steelers Country" area in Pennsylvania supports a television show called "Friday Night Tykes" with young children bashing heads on national television. These parents don't understand the horror that may face their child or they would not participate.

Since Roman times MEN have fought in arenas for sport and entertainment. Yet somehow we seem to have evolved to the point where we are now willing to put children into arenas and tackle each other for sport. We put them in the equivalent of cheap Halloween costumes and we ask them to be tough little warriors. We did it. And we were so proud when Patrick carried his team to victory. Sadly we lost a gifted young man before he ever had a chance to live his life. And gifted children all over this land are winning battles on the sports fields but sadly losing their chances for a happy, healthy, productive life.

If I had known the collisions my son endured were slowly killing him, I would have

stopped it. Any parent would who knows the truth would stop it. Parents need to be told the truth. Parents need to know:

- That 32% of amateur athletes in collision sports were found to have had CTE post mortem.
- Parents need to know that helmets and sports equipment are unregulated and may even add to the likelihood of brain trauma in children.
- Parents need to know that athletes that receive repetitive brain trauma before the age of 12 have significant changes in physiology, operations, and structure of the brain. So even if a child never gets CTE, he/she may still have done irreparable damage to the brain. Human brains are still developing until the age of 18 and sub-concussive blows to the head cause white matter changes, axon changes, and blood vessel changes, and these changes can be permanent.
- Parents need to know that recognizing a concussion in a child is often very challenging. Kids won't even tell you when they are tired, let alone tell you if they have vision problems, sensitivity to noise, trouble concentrating, or feel emotionally changed.
- Parents need to know that their child can develop CTE without ever receiving a concussion.
- Parents need to know that less than half of youth football coaches are well trained in concussion management. Coaches do know that the team plays better when the best players are on the field. So where is the incentive in the heat of competition to do the right thing at the right time?

Our Foundation created a brochure, "Flag Until 14" to help parents understand the key issues of CTE. We intend to place these brochures in every pediatrician office in the country. We have reached 62 practices so far. We have much more work to do. Heading the ball has recently been eliminated from youth soccer. Checking in hockey has been eliminated in youth leagues. Football needs to institute "Flag until 14", at the very least. (We would prefer Flag Until 50) Now the information is out there. Now we need to pay attention to it. At the very least, we need to protect those precious little brains. Right now children need us to help protect them.

There are those out there who would prefer parents didn't know about CTE. They will obfuscate the issue with unreasoned arguments. We've heard a few like "you can get a concussion riding a bike" or "you're turning our warriors into pansies" or "do you want them to sit and play video games for the rest of their lives?" When you've lost your son to CTE, and you understand how it is caused, these arguments are insulting, and almost evil. So for now, please let's just help protect the kids.

And what about the men and women who already have CTE? We believe that this silent epidemic may be playing out in millions of homes across this land. Families are burying loved ones all over this country thinking they died from suicide, drug addictions, PTSD, depression, ADHD, and irrational behaviors. Thinking that somehow something happened to change the person they loved, and feeling somehow that they failed them. Very few are linking these deaths to CTE.....

Maybe they don't know to ask. Maybe a doctor misdiagnosed the patient. Maybe the coroner is rushing to judgment. Maybe the behaviors in their loved ones changed so slowly that no one is linking it to previous military or sports history from so many years ago. Whatever the reasons, the silent epidemic continues. And we believe the magnitude of this horrific disease has yet to be discovered. Gunplay and murders are in the news every evening, and we always wonder how many of the perpetrators played collision sports or served in the military. Just as many suicides are NOT reported every evening because of the stigma attached to suicide. We muffle the fact that a reported 22 veterans a day commit suicide, and that suicides exceed homicides every year.

What also continues? Beautiful children are being placed in harms way through collision sports everyday. Families and loved ones are in turmoil. People are losing their lives. Mental health practices, drug addiction facilities, and suicide centers are on overload. Lawyers are filing lawsuits all over the place. Insurances are going up.

We also have some suggestions for better insight, research and ultimately help for victims and their families:

- The CDC death certificate needs to have a box to check if the victim played a collision sport, and in turn the possibility for death from CTE should be noted on the death certificate.
- The jails nation wide should do a study on how many inmates played a collision sport or were in the military. Rehab facilities should do the same.

- Mental health providers need trained to recognize and treat CTE
- No school or organization should field a collision sports team without a certified medical specialist on the field.

In my sons memory, we set our mission to increase awareness of the insidious disease, CTE, and to help parents make informed decisions about the safety and welfare of our children, and to provide a resource to promote greater understanding of the challenge we face dealing with this silent epidemic. This is a human tragedy of immense proportions, but we are small and need the help of everyone in the room and in the halls of Congress.

After we are done hearing everyone's testimony today we will know that children are in danger and need our help and that families are in crisis. Parents are receiving conflicting data and just don't know. We can't be the only doomsday placard holder in the street. Every person in this room now has the duty to save these children and families. CTE is 100% preventable. To do anything else is to be complicit to the problem and more families will suffer the pain we personally endure every day.

Thank you so much for the opportunity to be a voice for children.

Mr. MURPHY. I thank both for that moving testimony. I think I'm just going to ask you one question. And that is, you mentioned that Patrick began playing football at age 10 and continued on. Do you know if his coaches, anybody working with the teams, had any specialized training to recognize, or be aware of concussions and injuries and discussed with his teammates? Do you know if there's any of that training?

Ms. ZEGEL. At that time, I knew most of the coaches personally, and I would have to guess no. I mean, we're going back a ways before people starting talk about concussion.

Mr. MURPHY. Even on the collegiate level, too? Even on the college level, too?

Ms. ZEGEL. At the college level, as a parent, I was never informed of anything like that.

Mr. MURPHY. OK.

Ms. ZEGEL. I mean, that would have been nice to know then, but, no.

Mr. MURPHY. Ms. Jantz, can you answer that, too? Any training you thought the youth coaches had to recognize, be aware of anything with concussions or head injuries?

Ms. JANTZ. Not back in 2004 when Jake experienced this. Even—I mean, Jake's stepfather and myself were both medical professionals, and while we understand, you know, obviously, hitting your head is a bad thing, we certainly didn't have the background that we have now where you would have the opportunity to truly, you know, step back and look at it. Perhaps he would have been pulled and not played the next week. So I think that in those times, we did not have that, and now we have an opportunity to make sure that coaches and the people who are involved with our kids have all that information.

Mr. MURPHY. Thank you.

Ms. DeGette.

Ms. DEGETTE. Thank you. Just following up on the chairman's questioning.

Ms. Jantz, I've been given this brochure. I think probably your Foundation was involved in helping put this together. Is that right? And it's called, REAP, Remove/Reduce, Educate, Adjust/Accommodate Pace by the Center for Concussion at the Rocky Mountain Hospital for Children. And it really goes through a lot of information for educators and parents.

Ms. JANTZ. Yes.

Ms. DEGETTE. It's a wonderful piece. I'm wondering, is this distributed? What do folks do with this?

Ms. JANTZ. Well, we have a used that. It is distributed and available. We've made it available to school districts, to various groups, actually, I like to say anybody who I can get to listen, I will be happy to give that to. And it's a comprehensive way of managing concussions, and it's community-based. And it's got a section for parents; and it's got a section for medical professionals, and it has a section for the students and teachers. So everybody has a different piece in this.

We're not with our kids 24 hours a day.

Ms. DEGETTE. Right. And, Ms. Zegel, you also have formed a foundation, an advocacy foundation. And I'm assuming that you've

also been working to get information like this out to parents, educators, coaches?

Ms. ZEGEL. Right. Our current goal is—we're working with medical examiners and coroners on one end, trying to get them to recognize the disease if they are presented with a drug overdose, or suicide, or something like that. Then on the other end, we're trying to get—push for parents to have informed decisions that flag football is fun and—and it could be a lot of very famous football players never played until high school.

Ms. DEGETTE. And you've got your brochure right next to you?

Ms. ZEGEL. Yes, my daughter made that up.

Ms. DEGETTE. Your daughter made that? That's wonderful. Mr. Chairman, thank you so much.

Ms. ZEGEL. Thank you.

Ms. DEGETTE. And I would ask unanimous consent to put both of these brochures in.

Mr. MURPHY. Without objection, that's a great idea. Thank you. [The information appears at the conclusion of the hearing.]

Ms. ZEGEL. Thank you.

Ms. DEGETTE. Thank you for coming.

Mr. MURPHY. Without objection. We want to thank our first panel. They have just called votes, so what we are going to do, we are going to take a break. Vote. I think we have three votes. We will do that as quickly as congressionally possible. We will come back. This will give the panel and opportunity to sit down and be ready. As soon as that last vote, I ask members to be back here immediately. We'll get going, because our goal is to finish this hearing before the second set of votes. So we will work on that.

Thank you, we will be recessed until votes are ended. Thank you. [Recess.]

Mr. MURPHY. Could our witnesses please take their seats?

All right. Thank you. We're going to get moving right away because we know we've got another vote series, and we'd like to all give you the opportunity to testify. So I'd like to introduce the witnesses of our second panel for today's hearing.

We have Mr. Eugene Buddy Teevens to lead up our second panel. He has been head football coach at Dartmouth College since 2004, where he has implemented a policy of noncontact practices. I believe, Coach, you also were a teammate of the famous coach from Harvard University named Tim Murphy. He's my twin.

Next, we'd like to welcome Dr. Andrew Gregory. Dr. Gregory is here as a member of the Medical Advisory Committee for USA Football.

Mr. Kevin Margarucci—did I say that correctly?—of USA Hockey. Mr. Margarucci has 20 years of experience as a certified athletic trainer and now serves as the manager of player safety at USA Hockey.

Next, we welcome Mr. Steve Stenersen. Mr. Stenersen has served as executive director and now president and CEO of USA Lacrosse since 1998.

Next, we welcome Mr. Terry O'Neil. Mr. O'Neil is the founder and CEO of Practice Like Pros, whose mission is to educate high school coaches on alternative practice regiments.

Next, Dr. Dawn Comstock, who is an associate professor at Colorado School of Public Health and one of the Nation's leading experts on high school injury surveillance.

And finally, I'd like to introduce Dr. Thomas Talavage.

Dr. TALAVAGE. Close enough.

Mr. MURPHY. Is that close enough? What is the correct? Say it.

Dr. TALAVAGE. Talavage.

Mr. MURPHY. Talavage. I'll get it right.

Professor at the Weldon School of Biomedical Engineering at Purdue University. Dr. Talavage is also the founding codirector of Purdue's MRI facility and a part of the Purdue Neurotrauma Group.

Thank you to all the witnesses for being here today. I look forward to having a productive discussion.

You're all aware that the committee is holding an investigative hearing and when doing so has the practice of taking testimony under oath. Do you have any objections to testifying under oath?

Seeing no objections, the Chair then advises you that under the rules of the House and rules of the committee, you're entitled to be advised by counsel. Do any of you desire to be advised by counsel during your testimony today?

And seeing no comments on that, then in that case, would you all please rise, raise your right hand, and I'll swear you in.

[Witnesses sworn.]

Mr. MURPHY. Thank you. All witnesses have answered in the affirmative. And so now you're all under oath and subject to the penalties set forth in Title 18, Section 1001 of the United States Code.

I'm going to ask you all to give a 5-minute summary of your written statement. Please pay attention to the lights in front of you because we are on tight time for that.

Mr. Teevens, you're now recognized for 5 minutes. Coach, go ahead. Make sure your microphone is turned on and you pull that mike as close to you as possible, almost touching it. Thank you.

STATEMENTS OF EUGENE F. (BUDDY) TEEVENS, III, HEAD FOOTBALL COACH, DARTMOUTH COLLEGE; ANDREW GREGORY, M.D., MEDICAL ADVISORY COMMITTEE MEMBER, USA FOOTBALL, AND ASSOCIATE PROFESSOR OF ORTHOPEDICS, NEUROSURGERY AND PEDIATRICS, VANDERBILT UNIVERSITY MEDICAL CENTER; KEVIN MARGARUCCI, MANAGER, PLAYER SAFETY, USA HOCKEY; STEVE STENERSEN, CEO, US LACROSSE; TERRY O'NEIL, FOUNDER/CEO, PRACTICE LIKE PROS; R. DAWN COMSTOCK, PH.D., ASSOCIATE PROFESSOR, DEPARTMENT OF EPIDEMIOLOGY, COLORADO SCHOOL OF PUBLIC HEALTH; AND THOMAS M. TALAVAGE, PH.D., PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING, WELDON SCHOOL OF BIOMEDICAL ENGINEERING, PURDUE UNIVERSITY

STATEMENT OF EUGENE F. (BUDDY) TEEVENS, III

Mr. TEEVENS. Thank you, Mr. Chairman. I'd like to thank Kelli and Karen for their testimony as well. I think it underscores the importance of the committee.

VOICE. Can you bring the mike closer?

Mr. TEEVENS. Closer?

As I mentioned, I'd like to thank Karen and Kelli for their stories, and I think it underscores the importance of the committee and your task.

My name is Buddy Teevens. I've been a college football coach for 35 years. I've coached in the Ivy League, the SEC, the PAC-10, the Big Ten, Conference USA, and the Yankee Conference. During the course of summers, I work with all age groups, peewees right through high school-age kids.

And football is a very special game. The life lessons with all the team sports, things people learn, the friendships they make, the experiences they have. I love the game of football, but I love my players more.

And looking at concussive head injury through the course of time, I was—5 years ago, I made the decision that we were going to eliminate tackling from our practices, in-season practices, spring practices, pre-season practices. And the guarantee I make to parents is their son comes to Dartmouth, they will never tackle or be tackled by another Dartmouth football player for their 4 years.

Now, making that decision, I wasn't 100 percent sure I was doing the right thing. I worried about my players. Was I putting them at a competitive disadvantage? Was I preparing them fully for games? It was not a popular decision amongst my staff. It went from complete ridicule, to disbelief, to condemnation in some parties.

I was convinced, however, I did a lot of research on it, that the way that we teach tackling was not the way that we tackle in games. And what I looked at, at length, was our defensive tape and how we actually tackled. And then we tried to replicate that tackling practice that we saw in games against pads, fitting them against other players without going to live concept, tackling sleds. We developed at Dartmouth, with the Thayer School of Engineering, a mobile tackling device, which has been quite beneficial in terms of actually replicating a moving target.

With that, we actually tackle, I would say, more than anybody else in the country. Each of my players annually, 500 to 800 tackles per year, but never one against another human being. The only time our guys tackle are 10 games per year during the course of the season.

What's happened is our injury reduction has been phenomenal. Missed tackles, which we chart aggressively, dropped 50 percent the first year that we went to this nontackling process. And people ask me why, and it's, quite simply, the skill of tackling, we practice more than we did when we were tackling live. It's a shame, but in our sport, the most injurious act, tackling, is the one that's practiced the least because of the fear of the risk of injury.

So by putting our guys in a position to tackle with regularity, and this was unanticipated, we've become much more proficient at executing the act of tackling. You hear an awful lot about rugby tackling. I think football is a different sport. Shoulder tackling is a thing that we do preach. We don't talk about the head other than say take it completely out of contact points. And it's like riding a bike. You don't just throw someone on a bike and let them start

to figure it out. There's a process, training wheels and so on, support from parents. I do the same thing with our football players.

A lot of folks ask me, well, can you do that at different levels? Without question. People look at the NFL, and I use them as a model. They hit less than anybody in the world and their concussive results in practice are probably some of the best. We've gone from a football team that struggled at times to we're a championship team. We've won 17 games in the last 2 years, Ivy championship this year, and we had zero defensive concussive head injuries this season. And it's all a process of how you present to your players. The buy-in has been appreciable. It's been wonderful from a recruiting standpoint.

Can other people use it? And I speak nationally with this. Prep school, Pop Warner school, youth football, they'll say, well, how do you teach someone that's never tackled a human being? Well, it's a crawl, walk, run. Start with pads and progress forward. And I fully believe at any level that the approach we take—and I'd like to kick on a video right now, if I could. I think I've got time. And this will demonstrate more accurately than I could with words how we actually practice tackling.

[video shown.]

Mr. TEEVENS. We tackle literally every day that we practice and we put people in a position to execute the things that they would do on game day. A tackle's different from position to position. A defensive lineman will not execute the same skill set that a defensive back will. And we've actually broken it down to levels of tackling, planes of tackling, and then repetitions that we have. The end result is we play at a very high level. We've been very, very successful and we've been very, very safe.

[The prepared statement of Mr. Teevens follows:]

Eugene F. Teevens Testimony before

Congress of United States

House of Representatives

Committee of Energy and Commerce

May 13, 2016

Thank you committee members for allowing me to address the issue of concussions in youth sports.

As a member of the football coaching profession for over 35 years I have worked at a number of colleges and universities and have instructed young men on campuses and in high school and youth football camps every year.

Football is a physical sport and the risk of injury is well known and documented. There has been an increased focus on the safety of the game particularly in the area of concussive head trauma. With concern for the health of my players at Dartmouth, I opted to eliminate all full contact live tackling of a teammate in all spring practice, pre-season and in season drills five years ago.

At that time, my decision was questioned heavily and not well received by my peers. The decision was not made lightly however. I weighed the possibility of putting our players at a competitive disadvantage and having them poorly prepared for full contact on game day; but believed that we could simulate game situations, without compromising performance, while reducing injury risk.

With the help of the Dartmouth Football staff, we developed a practice plan that emphasized tackling technique and situations that our players would find themselves in. We did this with greater

specificity and repetition than we ever could in live tackling sessions. We use partners, pads, dummies, sleds and a mobile tackling device "MVP" developed with Dartmouth College's Thayer School of Engineering to teach, develop and practice proper form and execution.

There has been some misunderstanding in the general public about our lack of tackling. We may, tackle more of than any other team in the country, we just never tackle each other. Our sole opportunity for full live tackling occurs on game day. I tell each of our recruited student athletes that they will never tackle or be tackled by a Dartmouth Football player during their career.

The resulting injury reduction from contact related practices has been significant, even at a time when concussive injury awareness, reporting, self-reporting by student athletes and their teammates is as extensive as it has ever been. Peripheral injuries and missed practice time due to injury have all dropped and has allowed our most talented players to be on the practice field and in game situations more regularly than before we switched to a non-live tackling operation.

The past two seasons our record has been 17-3 and we earned a share of the Ivy League title this past fall. The practice protocol we follow has not hampered our development, quite the opposite. Dartmouth is a nationally ranked football program with a Division 1 leading defense. Our missed tackles per game is at an all-time low and we have had zero defensive concussive head injuries for the 2015 season and through the recently concluded spring practice session.

The Ivy League, under the leadership of Robin Harris, and by the unanimous vote of all Ivy League Head Football Coaches recently eliminated all live tackling practices during the football season. I believe every college conference in the country could adopt this same policy without any negative impact on their athletes or the caliber of play. It is however, extremely difficult for individual coaches to take such a step.

For the past three years I have worked with "Practice like Pros," a group advocating reduction of contact in high school and youth football. I have spoken with hundreds of high school and youth football coaches about our practice approach. Questions that are frequently asked pertain to developing toughness, tackling skills, player evaluation and how to convince other coaches to try a different method of practicing. My response is simply the skills that we teach are the same ones first-time players need to learn, practice and master. It is a "crawl, walk, run" progression. Those who want to "try" football are demonstrating the "toughness" many feel is needed to play. As coaches we can develop the confidence and skills needed to block and tackle gradually and not overwhelm "first timers" by putting them in extreme situations before they are comfortable and prepared to engage in them.

As a profession, we are conservative and at times hesitant to change. We all care deeply about our sport, our players and the wonderful lessons and life experiences it can provide. This is an important time in the long history of the game. As coaches, we need to decide whether we will wait for change, or become agents of change that must be made.

What many are referring to as the "Dartmouth Way" is a viable means of reducing the amount of contact that players of any levels are exposed to. Understanding, teaching and practicing the most injurious aspects of the game, in a controlled environment, will eliminate countless "hits" to young men at all levels during the course of their careers and will create a safer environment for those who choose to play the game.

Again, thank you for affording me this opportunity and best wishes as you carry out your important work.

Mr. MURPHY. Thank you very much.
I now recognize Dr. Gregory for 5 minutes.

STATEMENT OF ANDREW GREGORY

Dr. GREGORY. Chairman Murphy and members of the subcommittee, my name is Dr. Andrew Gregory. I'm a pediatric sports medicine specialist at Vanderbilt University Medical Center. I'm a fellow of both the American Academy of Pediatrics and the American College of Sports Medicine, as well as a member of USA Football's Medical Advisory Committee. I am not a USA Football employee, nor do I receive any compensation for being on the committee. I'm also a parent of an 18-year-old daughter who's a soccer player. Thank you for the invitation to testify on USA Football's behalf.

In short, USA Football is the sport's national governing body and a member of the U.S. Olympic Committee. It is an independent nonprofit organization. We create resources and direct programs establishing standards using the best available science, educating coaches, parents, and athletes. Our programs are endorsed by more than 40 organizations spanning medicine and sport, including the American College of Sports Medicine, the National Athletic Trainers' Association, and the American Medical Society for Sports Medicine.

I'd like to highlight three elements of how USA Football addresses player safety. The first of that is education. We train more youth and high school football coaches combined than any other organization in the U.S. Education is the core of our Heads Up Football program, which we're going to highlight. This is delivered through online courses and in-person clinics. There are six educational components of this program, which you can see listed on the slide: Concussion recognition/response, heat preparedness and hydration, sudden cardiac arrest, proper equipment fitting, and then tackling and blocking techniques.

More than 6,300 youth leagues and 1,100 high schools nationwide representing about a million young athletes enrolled in Heads Up Football in 2015.

The second element is research. USA Football advances player safety by commissioning independent research. According to a 2014 youth football study encompassing more than 2,000 players, leagues that participated in the Heads Up Football program showed a 76 percent reduction in all injuries during practice, 38 percent reduction in all injuries during games, 34 percent fewer concussions during practice, and 29 percent decline in concussions during games.

A subset of this group showed that players and leagues enrolled in Heads Up Football had two to three fewer head impacts of 10 Gs or greater during practice, which may equate to more than 100 fewer impacts in a season.

On the high school level, Fairfax County Public Schools has reported a 43 percent decline in football-related concussions since 2013 for 3,000 players since implementing Heads Up Football, and a 24 percent decline in overall football injuries.

And, finally, we'll highlight innovation. USA Football provides practice guidelines, practice planning tools, and defined levels of

contact. You can see the levels of contact listed there on the slide, including air; bag; control, which is a noncontact or nontaking down to the ground drill; thud, which is a controlled drill where you are not taken down to the ground, but there is contact; and then, finally, live action, where you are taken down to the ground.

More young footballers than ever are learning the fundamentals of gradually and appropriately tackling before advancing to full contact. Where USA Football's programs are in place, today's youth and high school football is not the same as what it used to be for your children or what you may have watched.

We'll conclude with a video showing the difference that USA Football and Heads Up Football are making.

[Video shown.]

[The prepared statement of Dr. Gregory follows:]

Testimony of

ANDREW GREGORY, M.D., F.A.A.P., F.A.C.S.M.

Medical Advisory Committee Member

USA Football

Associate Professor of Orthopedics, Neurosurgery &

Pediatrics

Vanderbilt University Medical Center

Before the House Subcommittee on Oversight and
Investigation

“Concussions in Youth Sports: Evaluating Prevention and
Research”

May 13, 2016

Chairman Murphy and Members of the Committee:

My name is Dr. Andrew Gregory. I am a pediatric sports medicine specialist at Vanderbilt University Medical Center. I am a fellow of both the American Academy of Pediatrics and the American College of Sports Medicine as well as a member of USA Football's Medical Advisory Committee. I have served USA Football in this capacity since 2013. I am not a USA Football employee nor do I receive compensation for being on the committee.

USA Football is the sport's national governing body and a member of the U.S. Olympic Committee. We do not operate youth football leagues nor lead high school teams. We create resources and direct programs that establish important standards using the best available science, educating coaches, parents and young athletes who play football.

Our programs are endorsed by more than 40 organizations spanning medicine and sport, including the American College of Sports Medicine, the National Athletic Trainers' Association and the American Medical Society for Sports Medicine.

USA Football is an independent nonprofit organization that works in partnership with the NCAA, NFL, National Federation of State High School Associations and Pop Warner Little Scholars, among others.

The purpose of this testimony is to outline three key elements of how USA Football advances concussion prevention and research for the good of young athletes who play our sport and gain its fitness and social benefits. These three key elements are education, research and innovation.

EDUCATION

USA Football trains more youth and high school football coaches combined than any organization in the United States.

Education has the power to change behavior for the better. This is the core of USA Football's Heads Up Football program, delivered through online courses, in-person clinics and continuing education opportunities.

Its six educational components are:

- CDC-approved concussion recognition and response
- Heat preparedness and hydration
- Sudden cardiac arrest protocols
- Proper equipment fitting
- Tackling techniques
- Blocking techniques

Heads Up Football was introduced nationally to youth football organizations in 2013 and to high schools in 2014. More than 6,300 youth leagues and 1,100 high schools spanning all

50 states and Washington, D.C., representing approximately 1 million players, enrolled in Heads Up Football in 2015.

Coaches enrolled in the program complete hands-on, in-person instruction as well as an online curriculum covering the topics bulleted above. USA Football also trains one representative from each school or youth organization to serve as its Player Safety Coach, reinforcing the program's teachings, guiding practices as needed throughout the season, seeing the skills put into action at games and serving as a resource for players, parents and coaches.

Every youth football coach within an organization enrolled in Heads Up Football is trained how to teach the game's fundamentals by completing USA Football's nationally accredited Level 1 Coaching Certification Course. High school coaches gain training through USA Football's High School Coach Certification course, developed in partnership with the National Federation of State High School Associations.

Heads Up Football is endorsed by 14 state high school associations and 11 state high school coaches associations. The Oregon State Activities Association this year is requiring all

football coaches in its 249 football-playing member high schools to participate in Heads Up Football prior to the start of the 2016 season.

Dr. Michael Koester, Chairman of the Oregon School Activities Association Sports

Medicine Advisory Committee said:

“The really exciting thing about this program is what happens at the high school level will spread throughout the youth programs in each community. This will allow kids to develop their skills in a culture that shares the same language, same techniques and same safety standards from grade school through high school. ... The committee sees this as a natural next step as we look to innovative ways to minimize the risk of all football injuries, but particularly concussions. This is an opportunity for high school coaches to set a standard for the youth leagues in their communities across the state. Ideally, we'll have youth coaches getting certified as well, allowing for continuity of tackling techniques and safety protocols through an athlete's entire playing experience.”

More on USA Football's Heads Up Football program may be found at

www.usafootball.com/headsup.

USA Football also has been honored nationally for its work to advance athlete safety by the National Athletic Trainers' Association (NATA), the professional membership association for certified athletic trainers and others who support the athletic training profession. Founded in 1950, the NATA has grown to more than 43,000 members worldwide today. In March of this

year, USA Football became the first national governing body of a sport to earn the NATA's Youth Sport Safety Ambassador Award for demonstrating significant contributions to the health and welfare of secondary school student-athletes. NATA's prestigious Youth Sports Safety Award recognizes those who have advanced athlete safety by providing exemplary youth sports safety protocols and advancing the provision of medical care, research, policy change and resource allocation. Along with USA Football, Project ADAM, and U.S. Representative Bill Pascrell, Jr., also were recognized with this honor in March 2016. More details can be found about this award at <http://www.nata.org/press-release/031516/nata-presents-2016-youth-sports-safety-ambassador-awards-seventh-annual-youth>.

Due in part to USA Football's medically endorsed programs and innovations, youth and high school football is changing for the better.

* * *

RESEARCH

USA Football advances player safety through supporting independent third-party research.

According to a 2014 Datalys Center for Sports Injury Research and Prevention study, encompassing more than 2,000 youth football players, when compared to leagues that did not employ Heads Up Football, players in leagues that did participate in the program showed:

- 76 percent reduction in all injuries during practices
- 38 percent reduction in all injuries during games
- 34 percent decline in concussions during practices
- 29 percent decline in concussions during games

The peer-reviewed study was published by *The Orthopaedic Journal of Sports Medicine* in July 2015.

A subset of this study encompassing 70 youth players showed that over the course of a season, those in leagues enrolled in Heads Up Football had 2-to-3 less head impacts of 10g or greater per practice compared to those in non-Heads Up Football leagues. This may prevent more than 100 such impacts over the course of a 12-week season.

“This is compelling data,” Datalys Center President and Injury Epidemiologist Dr. Thomas Dompier said. “I am actually surprised by the strength of the association but

completely confident in our findings. It's logical – in the first two years of research, we found that coach and player behavior was predictive of injury even though we hypothesized differently. That led us to pursue a third year of research to examine if coach education reduced injuries and head impacts, and we found that this was the case.”

Dompier continued: “If we had found that only injury rates or only head impacts were reduced but not both, I would not have been as confident with our results. However, combined with the first two years of data that pointed at coach and player behavior, these current data indicate that coach education can have a positive impact on player safety and may serve as a model for youth sports like soccer, ice hockey, lacrosse and others concerned with concussion and head impact risk.”

On the high school level, Fairfax County Public Schools, the 10th largest school district in the country, has employed Heads Up Football since 2013. In this time, the district has reported a 43.3 percent decline in concussions among its 3,000 football-playing student-athletes. During this same time span with all 25 of its high school programs enrolled in Heads Up Football, overall football injuries have declines 23.9 percent. Data was collected by Fairfax

County Public Schools' athletic trainers. "We have one consistent match of what we're talking about, of how we're teaching our athletes to play the game. From ankle biter through 12th grade, we have one consistent curriculum," said Bill Curran, Director of Student Activities and Athletics for Fairfax County School District. "We're able to show with data that there's a difference. You know, Centreville High School played in back-to-back state championships and had the fewest injuries of our 25 high schools. That's a big deal."

Similarly, high schools within the South Bend (Ind.) Community School Corporation (SBCSC), with approximately 1,000 football-playing student-athletes, reported concussions from football to decline by 40 percent from 2014 to 2015, the first year the school system implemented Heads Up Football district-wide. Although football participation increased across the district from 1,000 student-athletes to 1,037 during this time, concussions from football decreased from 53 to 32. Concussion data was recorded by the high schools' athletic trainers. "USA Football's 'Heads Up Football' program has been invaluable to us and we are so happy to have had the opportunity to become a part of the program," SBCSC Athletic Director Kirby Whitacre said.

USA Football is committed to continue commissioning independent studies into youth and high school player health and safety.

* * *

INNOVATION

USA Football provides practice guidelines, practice planning tools and defined Levels of Contact (www.usafootball.com/health-safety/levels-of-contact) for tackle coaches to properly teach player techniques in a progressive manner. More young football players than ever before are learning the fundamentals in a gradual and appropriate manner prior to advancing to full contact. Endorsed by the American College of Sports Medicine, the American Medical Society for Sports Medicine and the National Athletic Trainers' Association, USA Football's Youth Practice Guidelines set important standards for preseason heat acclimatization, regulating practice intensity and maintaining hydration levels to reduce the risk of injury and create the best environment for our children.

Among its pillars:

- No two-a-day practices in preseason or regular season

- Graduated equipment and contact levels in preseason to properly

acclimate players to exercise and heat

- No more than two hours of practice in any day
- No more than four football activity days per week, including practices and

games

- No more than 30 minutes of Live Action or “Thud” level contact per day

USA Football’s Levels of Contact focus on varying intensity levels throughout practices to build player confidence, ensure their safety and prevent both physical and mental exhaustion. Five intensity levels are used to introduce players to practice drills which position them to master the fundamentals and increase skill development.

- **Air** – Players run a drill unopposed and without contact
- **Bags** – Drill is run against a bag or other soft-contact surface
- **Control** – Drill is run at assigned speed with predetermined winner.

Contact remains above the waist and players stay on their feet.

- **Thud** – Drill is run at competitive speed with no predetermined winner.

Players stay on their feet and a quick whistle ends the drill. *It is important to note that USA Football considers “Thud” to be a full-contact level and limits the time that coaches can run drills at this speed and intensity. Other organizations – including the Ivy League and other college programs – do not include “Thud” as full contact.*

- **Live action** – Game-like conditions and the only time players are taken to the ground.

Through innovations such as the Youth Practice Guidelines and Levels of Contact, coaches instruct their players through a series of USA Football-developed drills to build confidence and instill the proper fundamentals. Through a player progression development model, players learn the right stage at the right age, using the same terminology as they mature mentally, physical and emotionally.

USA Football’s Heads Up Tackling technique teaches young athletes to make contact with their shoulders in an ascending strike and rip their arms up through the ball-carrier, grabbing the backside of the jersey – thus keeping the head and eyes up through the process.

Likewise, USA Football's Heads Up Blocking technique takes a player from stance to steps to contact, using their hands – not their helmets – to drive opponents out of the way. Laying the basic foundations, Heads Up Tackling and Heads Up Blocking fundamentals can be used to teach every type of tackle and block that a player needs to learn.

As Dr. Jon Devine, president of the American Medical Society for Sports Medicine, said: "We endorsed USA Football's Heads Up Football program in 2014, and it continues to advance player safety and change behavior for the better. Young athletes are safer when their coaches are trained, proper fundamentals are taught and protocols in the best available science are put into motion. Creating a program like Heads Up Football takes leadership – leadership one would expect from a national governing body of sport."

USA Football works every day to improve education, establish research and pave innovation toward creating a better, safer game for the young athletes who enjoy the fun, exercise and social benefits of an exceptional team sport.

#



June 30, 2016

The Honorable Tim Murphy
Chairman
Subcommittee on Oversight and
Investigations
2125 Rayburn House Office Building
Washington, DC 20515-6115

The Honorable Diana DeGette
Ranking Member
Subcommittee on Oversight and
Investigations
2125 Rayburn House Office Building
Washington, DC 20515-6115

The Honorable David McKinley
Vice Chairman
Subcommittee on Oversight and
Investigations
2125 Rayburn House Office Building
Washington, DC 20515-6115

Dear Honorable Representatives,

On May 12, 2016, USA Football submitted the written Testimony of Andrew Gregory, MD and PowerPoint slides in advance of his testimony the following day at the House Subcommittee on Oversight and Investigation hearing entitled "Concussions in Youth Sports: Evaluating Prevention and Research."

The written testimony and one of the slides we submitted erroneously cited results from a preliminary analysis of the data and not the results that were peer-reviewed and published in *The Orthopaedic Journal of Sports Medicine* in July 2015. The peer-reviewed and published results account for the positive effect of the Pop Warner Practice Guidelines – a second intervention that confounded the preliminary analysis. The correction may be found at page 5 of the enclosed corrected submission. Both sets of data support the efficacy of Heads Up Football in reducing injuries in youth football.

We apologize for the error and request that you update the record with this corrected version.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Steve Alic".

Steve Alic
Senior Director, Communications

Cc: Andrew Gregory, MD

Enclosure

Testimony of

ANDREW GREGORY, M.D., F.A.A.P., F.A.C.S.M.

Medical Advisory Committee Member

USA Football

Associate Professor of Orthopedics, Neurosurgery &
Pediatrics

Vanderbilt University Medical Center

Before the House Subcommittee on Oversight and
Investigation

“Concussions in Youth Sports: Evaluating Prevention and Research”

May 13, 2016 (as corrected June 30, 2016)

Chairman Murphy and Members of the Committee:

My name is Dr. Andrew Gregory. I am a pediatric sports medicine specialist at Vanderbilt University Medical Center. I am a fellow of both the American Academy of Pediatrics and the American College of Sports Medicine as well as a member of USA Football's Medical Advisory Committee. I have served USA Football in this capacity since 2013. I am not a USA Football employee nor do I receive compensation for being on the committee.

USA Football is the sport's national governing body and a member of the U.S. Olympic Committee. We do not operate youth football leagues nor lead high school teams. We create resources and direct programs that establish important standards using the best available science, educating coaches, parents and young athletes who play football.

Our programs are endorsed by more than 40 organizations spanning medicine and sport, including the American College of Sports Medicine, the National Athletic Trainers' Association and the American Medical Society for Sports Medicine.

USA Football is an independent nonprofit organization that works in partnership with the NCAA, NFL, National Federation of State High School Associations and Pop Warner Little Scholars, among others.

The purpose of this testimony is to outline three key elements of how USA Football advances concussion prevention and research for the good of young athletes who play our sport and gain its fitness and social benefits. These three key elements are education, research and innovation.

EDUCATION

USA Football trains more youth and high school football coaches combined than any organization in the United States.

Education has the power to change behavior for the better. This is the core of USA Football's Heads Up Football program, delivered through online courses, in-person clinics and continuing education opportunities.

Its six educational components are:

- CDC-approved concussion recognition and response
- Heat preparedness and hydration
- Sudden cardiac arrest protocols
- Proper equipment fitting
- Tackling techniques
- Blocking techniques

Heads Up Football was introduced nationally to youth football organizations in 2013 and to high schools in 2014. More than 6,300 youth leagues and 1,100 high schools spanning all 50 states and Washington, D.C., representing approximately 1 million players, enrolled in Heads Up Football in 2015.

Coaches enrolled in the program complete hands-on, in-person instruction as well as an online curriculum covering the topics bulleted above. USA Football also trains one representative from each school or youth organization to serve as its Player Safety Coach, reinforcing the program's teachings, guiding practices as needed throughout the season, seeing the skills put into action at games and serving as a resource for players, parents and coaches.

Every youth football coach within an organization enrolled in Heads Up Football is trained how to teach the game's fundamentals by completing USA Football's nationally accredited Level 1 Coaching Certification Course. High school coaches gain training through USA Football's High School

Coach Certification course, developed in partnership with the National Federation of State High School Associations.

Heads Up Football is endorsed by 14 state high school associations and 11 state high school coaches associations. The Oregon State Activities Association this year is requiring all football coaches in its 249 football-playing member high schools to participate in Heads Up Football prior to the start of the 2016 season.

Dr. Michael Koester, Chairman of the Oregon School Activities Association Sports Medicine Advisory Committee said:

“The really exciting thing about this program is what happens at the high school level will spread throughout the youth programs in each community. This will allow kids to develop their skills in a culture that shares the same language, same techniques and same safety standards from grade school through high school. ... The committee sees this as a natural next step as we look to innovative ways to minimize the risk of all football injuries, but particularly concussions. This is an opportunity for high school coaches to set a standard for the youth leagues in their communities across the state. Ideally, we'll have youth coaches getting certified as well, allowing for continuity of tackling techniques and safety protocols through an athlete's entire playing experience.”

More on USA Football's Heads Up Football program may be found at www.usafootball.com/headsup.

USA Football also has been honored nationally for its work to advance athlete safety by the National Athletic Trainers' Association (NATA), the professional membership association for certified athletic trainers and others who support the athletic training profession. Founded in 1950, the NATA has grown to more than 43,000 members worldwide today. In March of this year, USA Football became the first national governing body of a sport to earn the NATA's Youth Sport Safety Ambassador Award for demonstrating significant contributions to the health and welfare of secondary school student-athletes. NATA's prestigious Youth Sports Safety Award recognizes those who have advanced athlete safety by providing exemplary youth sports safety protocols and advancing the provision of medical care, research, policy change and resource allocation. Along with USA Football, Project ADAM, and U.S. Representative Bill Pascrell, Jr., also were recognized with this honor in March 2016. More details can

be found about this award at <http://www.nata.org/press-release/031516/nata-presents-2016-youth-sports-safety-ambassador-awards-seventh-annual-youth>.

Due in part to USA Football's medically endorsed programs and innovations, youth and high school football is changing for the better.

* * *

RESEARCH

USA Football advances player safety through supporting independent third-party research.

According to a 2014 Datalys Center for Sports Injury Research and Prevention study, encompassing more than 2,000 youth football players, when compared to leagues that did not employ Heads Up Football, players in leagues that did participate in the program showed:

- 87% lower injury rates during practice in organizations with Heads Up Football coach education plus Pop Warner practice guidelines that limit contact
- 63% lower injury rates during practice with Heads Up Football coach education only compared to those with no coach education or practice guidelines
- 82% lower concussion rate during practice with Heads Up Football coach education and Pop Warner practice guidelines that limit contact among 11-15 year-old athletes¹

The peer-reviewed study was published by *The Orthopaedic Journal of Sports Medicine* in July 2015.

A subset of this study encompassing 70 youth players showed that over the course of a season, those in leagues enrolled in Heads Up Football had 2-to-3 less head impacts of 10g or greater

¹ The written testimony submitted May 12, 2016 erroneously used results from Datalys' preliminary analysis of the data. The results cited here are results that were peer-reviewed and published and reflect the positive effect of the Pop Warner Practice Guidelines – a second intervention that confounded the preliminary analysis. See Zachary Y. Kerr et al., "Comprehensive coach education and practice contact restriction guidelines result in lower injury rates in youth American football." 3(7) *Orth. J. Sports Med* 2325967115594578 (Jul. 1, 2015).

per practice compared to those in non-Heads Up Football leagues. This may prevent more than 100 such impacts over the course of a 12-week season.

“This is compelling data,” Datalys Center President and Injury Epidemiologist Dr. Thomas Dompier said. “I am actually surprised by the strength of the association but completely confident in our findings. It’s logical – in the first two years of research, we found that coach and player behavior was predictive of injury even though we hypothesized differently. That led us to pursue a third year of research to examine if coach education reduced injuries and head impacts, and we found that this was the case.”

Dompier continued: “If we had found that only injury rates or only head impacts were reduced but not both, I would not have been as confident with our results. However, combined with the first two years of data that pointed at coach and player behavior, these current data indicate that coach education can have a positive impact on player safety and may serve as a model for youth sports like soccer, ice hockey, lacrosse and others concerned with concussion and head impact risk.”

On the high school level, Fairfax County Public Schools, the 10th largest school district in the country, has employed Heads Up Football since 2013. In this time, the district has reported a 43.3 percent decline in concussions among its 3,000 football-playing student-athletes. During this same time span with all 25 of its high school programs enrolled in Heads Up Football, overall football injuries have declines 23.9 percent. Data was collected by Fairfax County Public Schools’ athletic trainers. “We have one consistent match of what we’re talking about, of how we’re teaching our athletes to play the game. From ankle biter through 12th grade, we have one consistent curriculum,” said Bill Curran, Director of Student Activities and Athletics for Fairfax County School District. “We’re able to show with data that there’s a difference. You know, Centreville High School played in back-to-back state championships and had the fewest injuries of our 25 high schools. That’s a big deal.”

Similarly, high schools within the South Bend (Ind.) Community School Corporation (SBCSC), with approximately 1,000 football-playing student-athletes, reported concussions from football to

decline by 40 percent from 2014 to 2015, the first year the school system implemented Heads Up Football district-wide. Although football participation increased across the district from 1,000 student-athletes to 1,037 during this time, concussions from football decreased from 53 to 32. Concussion data was recorded by the high schools' athletic trainers. "USA Football's 'Heads Up Football' program has been invaluable to us and we are so happy to have had the opportunity to become a part of the program," SBCSC Athletic Director Kirby Whitacre said.

USA Football is committed to continue commissioning independent studies into youth and high school player health and safety.

* * *

INNOVATION

USA Football provides practice guidelines, practice planning tools and defined Levels of Contact (www.usafootball.com/health-safety/levels-of-contact) for tackle coaches to properly teach player techniques in a progressive manner. More young football players than ever before are learning the fundamentals in a gradual and appropriate manner prior to advancing to full contact. Endorsed by the American College of Sports Medicine, the American Medical Society for Sports Medicine and the National Athletic Trainers' Association, USA Football's Youth Practice Guidelines set important standards for preseason heat acclimatization, regulating practice intensity and maintaining hydration levels to reduce the risk of injury and create the best environment for our children.

Among its pillars:

- No two-a-day practices in preseason or regular season
- Graduated equipment and contact levels in preseason to properly acclimate players to exercise and heat
- No more than two hours of practice in any day
- No more than four football activity days per week, including practices and games
- No more than 30 minutes of Live Action or "Thud" level contact per day

USA Football's Levels of Contact focus on varying intensity levels throughout practices to build player confidence, ensure their safety and prevent both physical and mental exhaustion. Five intensity levels are used to introduce players to practice drills which position them to master the fundamentals and increase skill development.

- **Air** – Players run a drill unopposed and without contact
- **Bags** – Drill is run against a bag or other soft-contact surface
- **Control** – Drill is run at assigned speed with predetermined winner. Contact remains above the waist and players stay on their feet.
- **Thud** – Drill is run at competitive speed with no predetermined winner. Players stay on their feet and a quick whistle ends the drill. *It is important to note that USA Football considers "Thud" to be a full-contact level and limits the time that coaches can run drills at this speed and intensity. Other organizations – including the Ivy League and other college programs – do not include "Thud" as full contact.*
- **Live action** – Game-like conditions and the only time players are taken to the ground.

Through innovations such as the Youth Practice Guidelines and Levels of Contact, coaches instruct their players through a series of USA Football-developed drills to build confidence and instill the proper fundamentals. Through a player progression development model, players learn the right stage at the right age, using the same terminology as they mature mentally, physical and emotionally.

USA Football's Heads Up Tackling technique teaches young athletes to make contact with their shoulders in an ascending strike and rip their arms up through the ball-carrier, grabbing the backside of the jersey – thus keeping the head and eyes up through the process. Likewise, USA Football's Heads Up Blocking technique takes a player from stance to steps to contact, using their hands – not their helmets – to drive opponents out of the way. Laying the basic foundations, Heads Up Tackling and Heads Up Blocking fundamentals can be used to teach every type of tackle and block that a player needs to learn.

As Dr. Jon Devine, president of the American Medical Society for Sports Medicine, said: "We endorsed USA Football's Heads Up Football program in 2014, and it continues to advance player

safety and change behavior for the better. Young athletes are safer when their coaches are trained, proper fundamentals are taught and protocols in the best available science are put into motion. Creating a program like Heads Up Football takes leadership – leadership one would expect from a national governing body of sport.”

USA Football works every day to improve education, establish research and pave innovation toward creating a better, safer game for the young athletes who enjoy the fun, exercise and social benefits of an exceptional team sport.

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Mr. MURPHY. Thank you.
Now we'll hear the testimony of Mr. Margarucci. You're recognized for 5 minutes.

STATEMENT OF KEVIN MARGARUCCI

Mr. MARGARUCCI. Thank you, Chairman Murphy, Ranking Member DeGette, and distinguished members of the subcommittee. It's a privilege to be here today on behalf of USA Hockey to discuss the issue of player safety.

USA Hockey takes safety as a top priority and always has and has been one of the leaders in safety among youth sports entities. The safety starts with our leadership and goes on down to the rest of our organization, from our president, Jim Smith; our executive director, Dave Ogrea; our chief medical and safety officer, Dr. Michael Stuart, from the Mayo Clinic in Rochester, Minnesota; the chairman of our Safety and Protective Equipment Committee, Dr. Alan Ashare from the St. Elizabeth's Medical Center in Boston. He chairs a committee that has been around for some 40 years, which guides our board in making safety policies for our sport.

The USA Hockey Foundation yearly awards grants in the area of injury prevention and research with ice hockey injuries. Recently, I was hired as manager of player safety, a full-time position at USA Hockey, which further shows a commitment to safety in our sport.

And, finally, we've had the Hockey Equipment and Certification Council, which was urged to be formed by USA Hockey in 1978. This is an independent body which studies the equipment that manufacturers produce and makes sure that meets the standards for protection in ice hockey.

When we look at prevention, we start with our rules enforcement. We have a very strict officiating education program, which involves online modules for refs at every level, classroom work, and on-ice clinics. At every level, once officials are working, they are supervised, mentored, and given feedback, and shown videos of proper rule enforcement to make the game safer.

We have implemented stricter penalties, with emphasis on boarding, charging, checking from behind, and head contact. In 2009 and 2010, our rule book focused on the standards of play and emphasis on body checking. In 2011, our executive board ruled to make a rule change which increased the legal age of body checking in our sport from 12 and under level to the 14 and under level. This decision was based on a lot of scientific research, not only on player skill development, but also safety and injury risks between those age groups.

In 2009, USA Hockey created the American Development Model. This model is an age-appropriate skill development and training based off of research of long-term athlete development.

Our coaching education program has been a gold standard in youth sports for years. In 2011–2012, there became online required modules for our coaches, which include concussion awareness and recognition in all those modules for the age-appropriate levels.

Within this structure, we've published a checking the right way for youth hockey, which is an age-appropriate progression of skills required to properly body check in the game of hockey. It starts

with skating, and is always focused on attitude, ethics, and respect for the sport and your opponents. It goes from skating, positioning and angling, stick checking, body contact, and then body checking.

Heads Up, Don't Duck was a program initiated by Dr. Ashare in 1995. This was followed in 2010 by our Heads Up Hockey program. Both programs, the emphasis is playing the game with your head up, especially when coming in contact with the boards, goalposts, or opponents; keeping your heads out of taking and giving a body check; do not check from behind; and a library of skills and drills to teach these to our players.

We educate our members constantly through information available on our Web site; electronic communications through newsletters to our parents, players, coaches, officials, which often have concussion awareness and education materials in them. USA Hockey will start publishing an electronic newsletter specific to safety in the fall of 2016.

Currently, the Mayo Clinic sports medicine is doing research to identify objective testing to identify those athletes with potential concussion using blood biomarkers, sideline EEGs, and the King-Devick Test. And this study is funded by our USA Hockey Foundation.

Finally, on the treatment side, we have a comprehensive concussion management program available to all of our associations, which is the minimum standard for any USA Hockey program to follow. And the biggest message in this is when in doubt, sit them out.

Thank you for allowing me to speak here today on this important topic of player safety and concussions.

[The prepared statement of Mr. Margarucci follows:]



**Statement of Kevin Margarucci, Manager Player Safety of USA Hockey
Before The House Committee on Energy and Commerce
Subcommittee on Oversight and Investigations**

May 13, 2016

Introduction:

Thank you Chairman Murphy, ranking member DeGette and distinguished members of the sub-committee. It is a privilege to be here with you today to discuss an issue that is the top priority every day at USA Hockey and that is the safety of our participants. USA Hockey has long been a leader in safety among youth sports entities. Safety in the area of concussion prevention, education and research is no different. USA Hockey has incorporated many resources and research studies to develop rule changes, create educational materials and focus on age-appropriate athlete development. All of these have athlete safety in mind and are preventative concussion measures in our sport.

Body Checking Rule Change:

In 2011, the age level for legal body checking in games was increased from the 12U age group to the 14U age group. This decision was made based on multiple scientific research studies that concluded: Among 11-12 year-old ice hockey players, playing in a league in which body checking is permitted compared with playing in a league in which body checking is not permitted was associated with a 3-fold increased risk of all game-related injuries and the categories of concussion, severe injury, and severe concussion.

It is also known that the 11- year-old brain is more easily concussed, takes longer to recover from a concussion, and is more susceptible to more serious long-term effects if they suffer a concussion. In addition it is also known that the 11-year-old brain has not fully developed the ability to anticipate while multitasking. The ability to anticipate being hit is 50% of avoiding injury.

USA Hockey's Official Rules allows that any local governing body may prohibit body checking at any classification under Rule 604a.

Playing Rules:

Based on injury epidemiology we look at multiple factors: who's at risk, how do they get injured, and the severity of those injuries. Concussions in hockey are caused by hits to the head, unanticipated open ice collisions and illegal play. This information helps us create the standard of play in the game of hockey. More severe penalties have been put in place to decrease the likelihood of these occurrences to prevent injury including concussion. Specific penalties leading to concussion are head contact, checking from behind, boarding, and charging. All these infractions carry a penalty of the following nature:

1. A minor plus a misconduct or a major plus a game misconduct
2. A major plus a game misconduct shall be assessed when the opponent is injured due to the infraction
3. A match penalty for attempt to injure or deliberate injury may also be assessed.

The following is from the USA Hockey Official Rules:

Standard of Play and Rule Emphasis – Body Checking

Through the standard of rules enforcement, our game will continue to allow the opportunity for improved skill development and a more positive hockey environment for all participants. This initiative will result in greater emphasis on skating, puck possession and the proper use of the body to establish position and legally gain a competitive advantage. The goal of the enforcement standard is to create an environment that enhances player skill development by reducing intimidating infractions designed to punish the opponent. This standard is designed to improve the proper skill of legal body checking or contact at all levels of play and will not remove the physical component from the game. A hard body check or using body contact/position (Body Contact categories) to gain a competitive advantage over the opponent should not be penalized as long as it is performed within the rules. The focus of the body check should be to separate the opponent from the puck.

The principles of this enforcement standard include the following:

- The purpose of a body check is to separate the opponent from the puck.
- Only the trunk (hips to shoulders) of the body shall be used to deliver a body check.

- The check must be delivered to the trunk (hips to shoulders) and directly from in front or the side of the opponent.
- Players who use their physical skills and/or anticipation and have a positional advantage shall not lose that advantage provided they use their body to check the opponent within the rules.
- Players will be held accountable for acts of an intimidating or dangerous nature.

Enforcement Standard – These penalties are to be called with very strict enforcement.

BODY CHECKING (Body Contact Categories) Rule 604

A player cannot deliver a body check to any player while participating in a Body Contact category.

Examples include:

- Makes deliberate physical contact with an opponent with no effort to legally play the puck
- Uses overt hip, shoulder or arm contact with the opponent to physically force them off the puck.
- Physically impedes the progress of the opponent with hips, shoulders or torso without establishing legal body contact and having no intent of playing the puck.

BOARDING, Rule 603

A player cannot commit any infraction, including body checking, for the purpose of intimidation or punishment that causes their opponent to go violently or excessively into the boards.

Examples include:

- Accelerating through the check to a player who is in a vulnerable position off of the boards that causes them to go violently into the boards.
- Driving an opponent excessively into the boards with no focus on or intent to play the puck.
- Any other infraction (tripping, cross-checking, charging etc.) that causes the opponent to go violently and excessively into the boards.

CHARGING, Rule 607

A player cannot take more than two fast strides or travel an excessive distance to accelerate through a body check for the purpose of punishing the opponent. Examples include:

- Running or jumping into the opponent to deliver a check.

- Accelerating through a check for the purpose of punishing the opponent.
- Skating a great distance for the purpose of delivering a check with excessive force.

CHECKING FROM BEHIND, Rule 608

A player cannot deliver a body check to an opponent directly from behind, or diagonally from behind. The onus is on the player delivering the check to not hit from behind. Examples include:

- Body checking or pushing an opponent from behind directly into the boards or goal frame or in open ice.

HEAD CONTACT, Rule 620

A player cannot contact an opponent in the head, face or neck, including with the stick or any part of the players body or equipment. The onus is on the player delivering the check, regardless as to size differential, to not make contact in the head/neck area of the opponent. Examples include:

- A body check delivered with any part of the body that makes direct contact with the head or neck area.
- The use of the forearm or hands to deliver a check to the head or neck area of the opponent.

ROUGHING

A player cannot use the hands, stick or extension of the arms to body check an opponent or deliver an avoidable body check to a player who is not in possession and control of the puck. Examples include:

- Intentionally playing the body of an opponent who does not have possession and control of the puck.
- Delivering an avoidable check to a player who has already relinquished control of the puck by a pass or shot. This is oftentimes referred to as “finishing” the check.
- Any avoidable contact after the whistle shall be penalized strictly, including scrum situations around the goal or along the boards. Officials are instructed to assess an additional penalty to those players acting as the aggressor or who instigates any contact after the whistle.

SUMMARY

All USA Hockey members must demonstrate awareness and support for the application, spirit and the respect of the rules in order for continued improvement in the game of hockey. At the same time, it is important to remember that:

- A player is entitled to use proper body position and body contact in all age classifications in order to gain a

competitive advantage.

- Players are allowed to compete for body position using their strength and balance in front of the goal or along the boards.

- In Body Checking categories, the focus of the body check must be to separate the opponent from the puck.

The American Development Model (ADM)

The ADM was initiated in 2009 by USA Hockey. The ADM is an age-appropriate athlete development model created for the sport of ice hockey based on research and principles in the field of Long Term Athlete Development (LTAD). This model incorporates age appropriate training and skill development for hockey players at all levels 8U, 10U, 12U, 14U 16U, and 18U. Each level builds upon the skills and concepts of the previous level to ensure that athletes are being taught the appropriate skills they need and the appropriate time in their development. These skills and concepts at each age level are tailored for in-season, off-season, on-ice and off-ice training.

Coaching Education Program (CEP):

USA Hockey's Coaching Education Program embeds the concept of the ADM into the online educational modules. These modules are required for all USA Hockey registered coaches and teach the age appropriate concepts and skill development. In addition to hockey skill development, each age appropriate module has concussion education and awareness training. This material is presented by our Chief Medical and Safety Officer, Dr. Michael Stuart. After viewing the video portion of the concussion module there is a quiz which must be passed before moving on to the next section. This material is further enhanced with the CEP's in person Level 1-5 Coaching Clinics.

Another significant educational resource for coaches that ties into injury prevention is the publication, *"Checking the Right Way for Youth Hockey."* The core of this program is the gradual introduction of checking skills. In line with the ADM, the foundations of these skills are attitude, ethics and respect. Starting with the 8U through 10U, players should learn and develop skills of: 1) positioning and angling 2) stick checking and 3) body contact.

Body checking skills are phased in during the 12U level and progressed to the 14U-18U levels where they will play body checking hockey. This age-appropriate program is developed for on-ice skill acquisition as well as off-ice training.

USA Hockey Concussion Education Materials:

The following programs have been initiated by USA Hockey as important safety initiatives for prevention and education in the area of concussion. All material is accessible at USAHockey.com under safety:

1. *Heads Up, Don't Duck: 1995*. This program was initiated to teach coaches, athletes and parents the importance of playing the game of hockey with your head up to reduce the incidence of head/neck injuries.
2. *Heads Up Hockey: 2010*. This program expanded on the Heads Up, Don't Duck initiative and created a program guide with messaging including 1) the basic principles on how to give and take a body check while keeping your head out of it, 2) do not check from behind and 3) to always wear a properly fitted certified hockey helmet. The motto Heads Up, Don't Duck is at the forefront of the drills and educational materials included in this program. This program includes an educational section on identifying and managing a player with a suspected concussion.
3. *Resource Guide for Injury Management 2016*: This guide is a resource in all of our coaching education modules to further the recognition and management for concussions

USA Hockey Concussion Management Program:

Below is the minimum concussion protocol to be followed by all USA Hockey programs.



2015 Concussion Management Program

**Michael Stuart MD
Alan Ashare MD**

The standard of care for current medical practice and the law in most states requires that any athlete with a *suspected* concussion is *immediately removed from play*.

- A concussion is a traumatic brain injury- *there is no such thing as a minor brain injury.*
- A player does not have to be "*knocked-out*" to have a concussion- *less than 10% of players actually lose consciousness.*
- A concussion can result from a blow to head, neck or body.
- Concussions often occur to players who don't have or just released the puck, from open-ice hits, unanticipated hits and illegal collisions.
- The youth hockey player's brain is more susceptible to concussion.
- In addition, the concussion in a young athlete may be harder to diagnosis, takes longer to recover, is more likely to have a recurrence and can be associated with serious long-term effects.
- Treatment is individualized and it is impossible to predict when the athlete will be allowed to return to play- *there is no standard timetable.*

A player with any symptoms or signs; disorientation; impaired memory, concentration, balance or recall has a concussion.

Remember these steps:

1. Remove immediately from play (training, practice or game)
2. Inform the player's coach/parents
3. Refer the athlete to a qualified health-care professional
4. Initial treatment requires physical and cognitive rest
5. The athlete begins a graded exertion and schoolwork protocol.
6. Medical clearance is required for return to play

Diagnosis

Players, coaches, parents and health care providers should be able to recognize the symptoms and signs of a concussion:

Symptoms

- Headache
- Nausea
- Poor balance
- Dizziness
- Double vision
- Blurred vision
- Poor concentration
- Impaired memory
- Light Sensitivity
- Noise Sensitivity
- Sluggish
- Foggy
- Groggy
- Confusion

Signs

- Appears dazed or stunned
- Confused about assignment
- Moves clumsily
- Answers slowly
- Behavior or personality changes
- Unsure of score or opponent
- Can't recall events after the injury
- Can't recall events before the injury

Management Protocol

1. If the player is unresponsive- call for help & dial 911
2. If the athlete is *not breathing*: start CPR
 - ✓ DO NOT move the athlete
 - ✓ DO NOT remove the helmet
 - ✓ DO NOT rush the evaluation
3. Assume a neck injury *until proven otherwise*
 - ✓ DO NOT have the athlete sit up or skate off until you have determined:
 - no neck pain
 - no pain, numbness or tingling
 - no midline neck tenderness
 - normal muscle strength
 - normal sensation to light touch

4. If the athlete is conscious & responsive without symptoms or signs of a neck injury...
 - help the player off the ice to the locker room
 - perform an evaluation
 - do not leave them alone
5. Evaluate the player in the locker room:
 - Ask about concussion *symptoms* (How do you feel?)
 - Examine for *signs*
 - Verify *orientation* (What day is it?, What is the score?, Who are we playing?)
 - Check *immediate memory* (Repeat a list of 5 words)
 - Test *concentration* (List the months in reverse order)
 - Test *balance* (have the players stand on both legs, one leg and one foot in front of the other with their eyes closed for 20 seconds)
 - Check *delayed recall* (repeat the previous 5 words after 5-10 minutes)
6. A player with any symptoms or signs, disorientation, impaired memory, concentration, balance or recall has a concussion.

“When in doubt, sit them out”

- Remove immediately from play (training, practice or game)
 - Inform the player’s coach/parents
 - Refer the athlete to a qualified health-care professional
 - Medical clearance is required for return to play
7. If any of the signs or symptoms listed below develop or worsen: go to the hospital emergency department or dial 911.
 - Severe throbbing headache
 - Dizziness or loss of coordination
 - Memory loss or confusion
 - Ringing in the ears (tinnitus)
 - Blurred or double vision
 - Unequal pupil size
 - No pupil reaction to light
 - Nausea and/or vomiting
 - Slurred speech
 - Convulsions or tremors
 - Sleepiness or grogginess
 - Clear fluid running from the nose and/or ears
 - Numbness or paralysis (partial or complete)
 - Difficulty in being aroused

8. An athlete who is *symptomatic* after a concussion initially requires *physical and cognitive rest*.

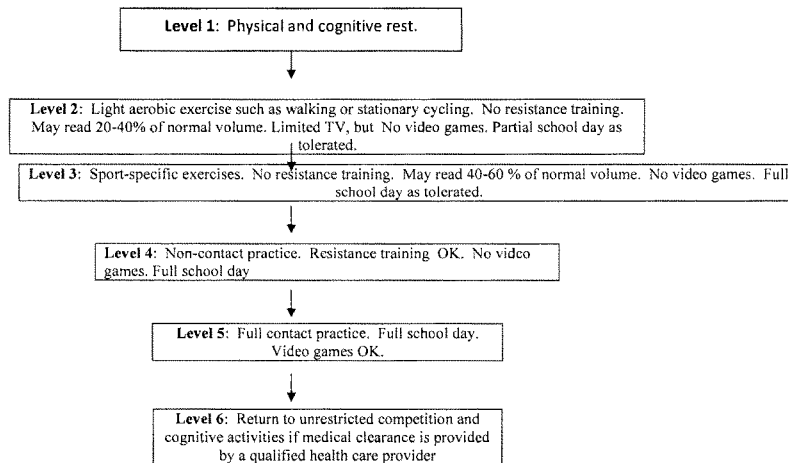
- A concussed athlete should not participate in physical activity, return to school, play video games or text message if he or she is having symptoms at rest.
- Concussion symptoms & signs *evolve over time*- the severity of the injury and estimated time to return to play are unpredictable.

9. A qualified health care provider guides the athlete through a **Functional Return to School/Play protocol**.

USA Hockey Post-Concussion Functional Return to School/Play Protocol

This protocol should not be initiated until after the athlete has been released to participate in the functional return to play protocol by a qualified health care provider. *If symptoms worsen during a functional test, the test should be stopped and the athlete monitored until symptoms resolve.* No further functional testing should be performed that day. Functional testing may resume the following day at the previously asymptomatic level if the athlete remains asymptomatic. If symptoms do not resolve, appropriate medical attention should be obtained.

After each phase of functional testing, the presence of post-concussive symptoms should be assessed and progression to the next phase of functional testing will require the absence of post-concussive symptoms. Each phase requires *a minimum of 1 day* before progressing to the next phase.



Additional Educational Material:

- USA Hockey sends out regular electronic newsletters to its members that periodically include information on concussion awareness and education.
- *USA Hockey Magazine* is a monthly publication mailed to USA Hockey members. It has provided information on numerous safety issues, including concussion recognition and prevention.
- USA Hockey is creating a safety newsletter that will be distributed to members (including players, parents, coaches, officials) focusing solely on issues related to safety, both on and off the ice. The first issue will be distributed this fall.

Future Directions:

USA Hockey is looking at expanding non-checking options for players that play in the body checking age groups.

USA Hockey took part in a Youth Sport Safety Governing Bodies Meeting over the last two years. This meeting was led by the Korey Stringer Institute. The end result of this meeting was to produce a consensus statement on best practices for safety in youth sports. Concussion was part of this discussion. This document can provide a youth association a blue print for implementing these practices within their governing body's structure and guidelines. The title of this document is: *"The Inter-Association Task Force for Youth Sports Emergency Health and Safety: Best Practices Recommendations"*

USA Hockey is piloting a program next season with a select group of our associations. This is an online software based health and safety platform. This will allow us to have a better look into the types of injuries, including concussion, which our athletes at different levels of play are reporting. The platform allows us to gather de-identified data to look at injury rates and trends to make more informed decisions in regards to rule changes etc.

USA Hockey Research Efforts:

The USA Hockey Foundation has awarded grants in the area of ice hockey injury research and prevention. The Mayo Clinic in Rochester, Minnesota is currently involved in concussion research made

possible through one of these grants. The study is looking into identifying objective measures to identify athletes who may have suffered a concussion by investigating blood biomarkers, sideline EEG results, and the utilization of the King Devick Test.

USA Hockey has been a major sponsor for the Mayo Clinic Sports Medicine Center's Ice Hockey Summit I/II: Action on Concussion (2010, 2013). There is a planned Ice Hockey Summit III: Action on Concussion for the fall of 2017.



**Summary of Kevin Margarucci, Manager Player Safety of USA Hockey
Before The House Committee on Energy and Commerce
Subcommittee on Oversight and Investigations**

Introduction:

USA Hockey has been a leader in safety among youth sports entities and has always had safety as its top priority.

- Safety and Protective Equipment Committee: This committee began some 40 years ago and is chaired by Dr. Alan Ashare from St. Elizabeth's Medical Center in Boston.
- Chief Medical and Safety Officer: Dr. Michael Stuart from the Mayo Clinic in Rochester, Minnesota.
- Created a Manager of Player Safety position and hired in 2015.
- USA Hockey Foundation commitment to funding research on injury prevention
- USA Hockey sponsorship of Ice Hockey Summit: Action on Concussion

Prevention:

- USA Hockey playing rules enforcement
- USA Hockey Standard of Play and Rules Emphasis: Body Checking
- USA Hockey rule change to increase the age for legal body checking
- Coaching Education
- American Development Model

Diagnosis:

- Coaching certification (mandatory to include concussion education)
- USA Hockey materials and resources for players, parents, coaches
- Mayo Clinic Research on finding objective testing for concussions

Treatment:

- USA Hockey Concussion Management Program

Mr. MURPHY. Thank you, Mr. Margarucci.
Mr. Stenersen, you're recognized for 5 minutes.

STATEMENT OF STEVE STENERSEN

Mr. STENERSEN. Good morning, Chairman Murphy, Ranking Member DeGette, and distinguished members of the House Oversight and Investigations Subcommittee of the Energy and Commerce Committee. My name is Steve Stenersen and I serve as CEO of U.S. Lacrosse, the sports Maryland-based national governing body.

Our nonprofit organization has proactively led and funded many sport-specific prevention and research initiatives that have resulted in a number of interventions in the areas of rules, equipment, and education. We also participate actively in the efforts of numerous national collaborations focused on reducing injury risk in youth sport, which I have referenced in my written testimony.

Lacrosse is the oldest sport native to the North American continent. Native American play was first documented by Jesuit missionaries in the 1600s. Modern rules for lacrosse were first adopted in the late 19th century, but two distinctly different versions of the sport for men and women evolved in the first half of the 20th century. Lacrosse has experienced an unprecedented surge of popularity in recent years, in part due to the formation of U.S. Lacrosse as the sport's first national governing body in 1998.

U.S. Lacrosse established a Sports Science and Safety Committee when the organization was formed, and that committee is comprised of prominent medical and research professionals representing a variety of specialties, as well as representatives from a number of multisport organizations. We've been described as one of the most proactive sports organizations in the country relative to our commitment to injury prevention, and we were recognized for our efforts in that regard last May through the introduction of a congressional resolution, H.R. 267.

Our Sports Science and Safety Committee prioritizes and oversees research initiatives, recommends interventions to the U.S. Lacrosse board of directors, and leads the development of educational initiatives intended to reduce injury risk and directed to coaches, officials, players, and their parents. My written testimony includes references to the published research and safety interventions U.S. Lacrosse has led.

We also have invested significantly in the development and deployment of the sport's first standardized coaching/officiating curricula. Unfortunately, public focus is too often directed at equipment interventions, which are less effective in preventing injury than assuring that players are properly taught and games are properly officiated. Among the biggest challenges we face is convincing youth leagues and State high school associations that requiring our standards for lacrosse-specific coach and official education is fundamental to a safer and more enjoyable playing experience.

The prevention of lacrosse-related concussion has been a particular area of focus for U.S. Lacrosse, and we've committed considerable time and resources to concussion education, research, and prevention. The benefits of playing youth sports are well docu-

mented. And while lacrosse is considered to be relatively safe compared to other sports and activities, serious injuries, such as concussions, occur.

There is much we have learned about the nature of concussion in recent years, particularly the critical importance of recognizing symptoms and removing children from play until cleared by a medical professional trained in concussion management. We've also learned that no piece of protective equipment on the market today can prevent a concussion; that the mechanism of injury is different from sport to sport; and in the case of lacrosse, different in boys lacrosse than girls lacrosse.

We've learned that the injury and its recovery can be a very different experience for girls than boys, which demands further focus and study. And we've learned that increased sport specialization at younger ages is increasing the number of injury exposures for young athletes and contributing to increases in overuse injuries on developing bodies.

Perhaps most importantly, we've learned that the vast majority of children who experience a concussion can recover fully if their injury is recognized quickly and they receive proper care.

Concussion remains a significant health concern in youth sports and it will remain a priority for U.S. Lacrosse. Accordingly, we'll continue to invest in research that helps us learn more about the mechanism and frequency of the injury in both boys and girls lacrosse in order to advance educational, rule, and equipment interventions most effective in reducing injury risk.

Thank you for the opportunity to share my thoughts on this important issue, as well as your efforts to increase the health and wellbeing of our Nation's young athletes.

[The prepared statement of Mr. Stenersen follows:]



US Lacrosse Testimony

Concussions in Youth Sports: Evaluating Prevention and Research

Oversight and Investigations Subcommittee of the United States House Committee on Energy &

Commerce

2123 Rayburn

May 13, 2016

Good afternoon Chairman Murphy, Vice Chairman McKinley, Ranking member DeGette and distinguished Members of the House Oversight and Investigations Subcommittee of the Energy & Commerce Committee. My name is Steve Stenersen, and I serve as the Chief Executive Officer for US Lacrosse, the sport's Maryland-based national governing body. Thank you for the opportunity to appear before you, as both a parent of lacrosse players and on behalf of US Lacrosse, to share our efforts to address player safety within boys' and girls' lacrosse, particularly in the area of sport-related concussion.

Our nonprofit organization has proactively led and funded many sport-specific injury prevention and research initiatives that have led to a number of recent interventions in the areas of rules, equipment and education. We also participate actively in the efforts of numerous national collaborations focused on reducing injury risk in youth sport, including the

American Orthopedic Society for Sports Medicine's STOP Sports Injuries campaign, the National Athletic Trainer's Association's Youth Sport Safety Alliance, and the United States Anti-Doping Agency's Supplement Safety Now initiative. I currently serve on the boards of the National Sport Concussion Coalition and PINK Concussions, and I have served as a member of the American College of Sports Medicine's Concussion Legislation Working Group, as well as the Ivy League Men's & Women's Lacrosse Committee on Concussion. US Lacrosse also collaborates regularly with the NCAA and NFHS on rule development and safety interventions in men's and women's lacrosse, and we continue to partner with the American Society of Testing & Materials and the National Operating Committee on Standards for Athletic Equipment to develop and refine lacrosse equipment standards. We collaborate with outstanding national and regional health organizations like the Centers for Disease Control & Prevention, MedStar Health and Fairfax County (VA) Public Schools to provide additional guidance and resources for our national membership.

Lacrosse is the oldest sport native to the North American continent. Native American play was first documented by Jesuit missionaries in the 1600s, so the sport has long been an integral part of Native American culture. Modern rules for lacrosse were first adopted in the late 19th century, but two distinctly different versions of the sport for men and women evolved in the first half of the 20th century. Participation in both versions of lacrosse grew incrementally until the sport experienced an unprecedented surge of popularity over the last twenty years, in part due to the formation of US Lacrosse as the sport's first national governing body in 1998. Since

that time, lacrosse has become one of the fastest-growing sports in the country, and US Lacrosse has grown to represent and serve over 450,000 members within 68 regional chapters throughout the United States.

While US Lacrosse operations have expanded significantly since the organization's inception, our commitment to lead and learn from lacrosse-specific research on the frequency and severity of injuries at every level of boys' and girls' lacrosse has always been a priority. We understand that effective stewardship of a sport requires empirical data on which to base effective safety interventions.

That's why we established a Sports Science & Safety Committee as one of ten board committees within our organizational structure when US Lacrosse was formed 18 years ago. This committee, which is currently chaired by Dr. Margot Putukian, Princeton University's Director of Athletic Medicine, is comprised of prominent medical and research professionals representing a variety of specialties, as well as representatives from a number of multi-sport organizations. Accordingly, US Lacrosse has been recognized as one of the most proactive sports organizations in the country relative to our commitment to injury prevention. In fact, US Lacrosse was recognized last May for its efforts to lead the sport in the areas of safety and education through the introduction of a Congressional Resolution, H.R. 267.

The US Lacrosse Sports Science & Safety Committee prioritizes and oversees research initiatives, recommends interventions to the US Lacrosse Board of Directors and leads the development of educational initiatives intended to reduce injury risk and directed to coaches, officials, players and their parents. The committee also issues position statements on various issues related to lacrosse safety.

The following represents a sampling of published research led by US Lacrosse and focused on player safety:

- Descriptive epidemiology of scholastic lacrosse injuries
- Head, face and eye injuries in scholastic and collegiate lacrosse
- Risks and mechanisms of severe injuries among youth, secondary school, collegiate and post-collegiate lacrosse players using insurance claims data
- Trends in high school lacrosse injuries
- Epidemiology of concussion in boys' and girls' high school lacrosse players
- Trends in sports-related concussion incidence at the high school level, 1998-2007
- Evaluation of the women's lacrosse protective eyewear mandate
- Epidemiology of lacrosse injuries among youth players

Additionally, the following are among US Lacrosse led or supported initiatives focused on injury prevention and education:

- Sponsorship of a bi-annual Lacrosse Sports Medicine Symposium
- Production of a lacrosse-specific concussion education video
- Development of an exercise program designed to reduce ACL injuries in lacrosse
- Development of women's lacrosse specific headgear performance standard
- Development of lacrosse-specific Concussion Management Plan Guidelines
- Enactment of playing rule changes that prohibit and more severely penalize body contact (boys) and stick checking (girls) at younger age levels
- Development of a Lacrosse Athlete Development Model based on the physical and cognitive development stages of children
- Development of single-age segmentation for boys' and girls' play

It's also important to note that US Lacrosse has invested significantly in the development and deployment of the sport's first standardized coaching and officiating education curricula, including accessible on-line resources and hands-on clinic sessions, which have formally trained and certified thousands of coaches and officials throughout the country in recent years. There is no more effective intervention to increase player safety than to require that coaches be properly trained to teach the sport...and that officials be properly-trained to consistently enforce rules. Unfortunately, public focus is too often directed at equipment interventions, which are far less effective in preventing injury than assuring that players are properly taught and games are properly officiated. Sport-specific education and certification programs offered by the national governing bodies of each sport should be a required credential for coaches and officials at every level play but, unfortunately, many youth and high school organizations do not require them. Among the biggest challenges US Lacrosse faces is convincing youth leagues and

state high school associations that requiring our national standards for coach and official education is fundamental to a safer and more enjoyable playing experience.

The prevention of lacrosse-related concussion has been a particular area of focus for US Lacrosse, we have committed as much or more time and resources to concussion education, research and prevention as any national amateur sports organization in the country, and the composition of our Sports Science & Safety Committee reflects that focus. Thankfully, our multi-faceted efforts appear to be making a difference.

It is well-documented that the benefits of playing youth sports far outweigh the risk of injury, and while the sport of lacrosse is considered to be relatively safe compared to other sports and activities, serious injuries such as concussions occur. There is much have we have learned about the nature of concussion injuries in recent years – particularly the critical importance of recognizing concussion symptoms, and removing children suspected of receiving a concussion from play until cleared by a medical professional trained in concussion management. Landmark legislation such as the Lystedt Law has been instrumental to increased knowledge and awareness of this serious injury. Unfortunately, the inconsistency of similar laws and their enforcement from state to state has not optimized the intended impact of this legislative intervention.

We have also learned that no piece of protective equipment on the market today will prevent the biomechanics that trigger a concussion injury, that the mechanism of injury is different from sport to sport and, in the case of lacrosse, different in boys' lacrosse than girls' lacrosse. We have learned that the injury and its recovery can be a very different experience for girls than boys, which demands further focus and study. And, we have learned that increased sport specialization at younger ages is increasing the number of injury exposures to young athletes and contributing to increases in overuse injuries on developing bodies. Perhaps most importantly, we have learned that the vast majority of children who experience a concussion can recover fully if their injury is recognized quickly and they receive appropriate care.

In recent years, the levels of sports-related concussion awareness and knowledge have been raised significantly thanks to greater leadership and collaboration among state and federal agencies, the allied health community, nonprofit leaders and youth-serving sports organizations, like US Lacrosse, that have embraced the responsibility to effectively balance the integrity of a particular sport with the safety of participants.

Concussion remains a significant health concern in youth sports, and it will remain a priority for US Lacrosse. Accordingly, we will continue to invest in research that helps us learn more about the mechanism and frequency of the injury in both boys' and girls' lacrosse in order to advance educational, rule and equipment interventions that will be most effective in reducing the risk of the injury.

Again, thank you for the opportunity to share my thoughts on this important issue, as well as your efforts to increase the health and well-being of our nation's young athletes. I would be happy to answer any questions that you may have.

Appendix

Compilation of Lacrosse Head and Other Injury Research (2002-2016)

Prepared by US Lacrosse

- 1) ILFWLA, Biomechanical Study of Crosse Design (L. Livingston), 2002
- 2) Journal of Applied Biomechanics, Physical and Mechanical Properties of Various Field Lacrosse Balls, (J Crisco, E Drewniak, M Alvarez, D Spenciner) 2005,
- 3) ASJM, Epidemiology of Lacrosse Injuries in high School – Aged Boys and Girls: A 3 Year Prospective Study (Hinton, Lincoln et. al), 2005. Published in the American Journal of Sports Medicine in 2005, the authors gathered data on girls’ and boys’ lacrosse injuries for 359,040 high school and 28,318 summer camp athletic exposures using a lacrosse-specific computerized injury surveillance system. They found overall injury rates for boys’ and girls’ high school lacrosse were significantly lower than collegiate play.
- 4) ASJM, Head, Face, and Eye Injuries in Scholastic and Collegiate Lacrosse: A 4-Year Prospective Study (Lincoln, Hinton et. al), 2007. This article was originally published online January 4, 2007 in the American Journal of Sports Medicine. The authors gathered data on 507,000 girls’ and boys’ high school and 649,573 women’s and men’s college lacrosse athletic exposures using sport-specific injury surveillance systems over four seasons. They identified most common scenarios for head, face, and eye injuries.
- 5) NCAA (ISS) Research for women’s lacrosse, 2006-2007

- 6) Descriptive Epidemiology of Collegiate Women's Lacrosse Injuries, Published in the Journal of Athletic Training in 2007, this partner report to the men's report cited above, reviews 16 years of National Collegiate Athletic Association (NCAA) injury surveillance data for women's lacrosse and identifies potential areas for injury prevention initiatives.
- 7) Effectiveness of Women's Lacrosse Eyewear (Hinton et. al), 2008
- 8) Catastrophic Sports Injury Research 1982-2009, (Mueller, Cantu), 2009
- 9) ACSM Video Analysis poster, 2009 (Caswell, Lincoln, Almquist, Dunn and Hepburn)
- 10) AAP, Clinical Report Sports Related Concussion in Children & Adolescents (M. Halstead and Walter), 2010
- 11) ACSM and AJSM, Concussion Trends in High School Lacrosse - A prospective 11 year Study (Caswell, Lincoln, Almquist, Hinton and Norris) 2011 (published in ASJM 1/29/11)
- 12) ACSM Abstract: Video Incident Analysis of Head Injuries in High School Girl's Lacrosse (Caswell, Lincoln, Almquist, Dunn), 2011
- 13) AJSM, Video Incident Analysis of Head Injuries in High School Girls' Lacrosse (S. Caswell, A. Lincoln, J. Almquist, R. Dunn, and R. Hinton), 2013
- 14) AJSM, Video Incident Analysis of Concussions in Boys' High School Lacrosse, (S. Caswell, A. Lincoln, J. Almquist, R. Dunn, and R. Hinton) 2013
- 15) Clinical Journal of Sport Medicine, Rate of Injury Among Youth Lacrosse Players, (A. Lincoln, M. Yeager-McKeeever, W. Romani, L. Hepburn, R. Dunn, and R. Hinton) 2013

- 16) *Journal of Applied Biomechanics*, Surrogate Headform Accelerations Associated with Stick Checks in Girls' Lacrosse (J. Crisco, L. Costa, R. Rich, J. Schwartz, and B. Wilcox) 2014
- 17) Johns Hopkins University, Bloomberg School of Public Health, Grand Rounds Presenter, Youth Sports Through A Public Health Lens (A. Lincoln, B. Griffin) 2014
- 18) *Injury Epidemiology*, The epidemiology of boys' youth lacrosse injuries in the 2015 season (Z. Kerr, S Caswell, A Lincoln, A Djoko, T Dompier) 2016
- 19) ASSM, Boys Lacrosse Tournament Game Injuries; Boston (L. Hepburn, A. Lincoln, S. Caswell, B. Griffin) 2016

Mr. MURPHY. Thank you, Mr. Stenersen.
Mr. O'Neil, you're recognized for 5 minutes.

STATEMENT OF TERRY O'NEIL

Mr. O'NEIL. Mr. Chairman, thank you.

Mr. MURPHY. Would you put your microphone on, please? Is it on? There should be a light. And just pull it as close to you as possible.

Mr. O'NEIL. So, Mr. Chairman, we'd like to begin, if we may, with a sound bite, 30 seconds from Dr. Ann McKee, which follows on many comments heard earlier this morning. Dr. McKee is one of our colleagues. These were her comments 2 months ago during your roundtable.

[Video shown.]

Mr. O'NEIL. "Immediately," Mr. Chairman, a word we heard this morning as well, and that's our middle name: immediately.

Let me begin by saying here's where we started with our chase for immediate results. The National Football League, 32 teams, 2,000 players, as you know, practicing for 5 months in regular and postseason. There were 271 total concussions in the NFL this last year, 271. Question: Not in the games, but in practice, how many concussions do you think on NFL practice fields last season? Answer: Eight, because they've learned how to practice. Those eight concussions in a universe of 271 represents 3 percent.

So now the big question. What is that number in high school football, do you think? What percentage of high school football head trauma occurs on the practice field? Sixty to 75 percent. The worst, most shameful statistic in all of football, and this is the reason we're in business. This is the reason why a number of Hall of Famers, at no appearance fee, chase around the country with us; among them Warren Moon, Anthony Munoz, Tony Dorsett, Mike Ditka, showing high school coaches on video how to practice with less contact. These men do this generously because they believe this is the future of football.

So let's quantify our recommendations. We're going to show you how they practice in the pros.

[Video shown.]

Mr. O'NEIL. This is called full-speed-to-contact practice, which means they run the play full speed to get the timing, the pacing, the choreography of the play, but at the last moment, the moment of imminent contact, rather than tackle, they break away from each other. It's football ballet, as you see it here.

Here's Dartmouth College.

[Video shown.]

Mr. O'NEIL. You'll see a pass down the middle. A safety in practice here could light up this receiver with a perfectly legal hit, but it's his teammate, so at the last minute, he veers away from it. He'll save that tackle for Saturday. OK?

In the NFL, Cleveland Browns, watch number 22 in white here. He'll track this play full speed. Everybody stays on their feet, because only bad things happen when you go to the ground. He tracks the ball carrier, but at the moment when he might tackle, he stops and let's the ball carrier continue. 48 in brown, lead block here, one of the most vicious hits in all of football. What's he do,

48 in brown, he comes—he identifies the player to be blocked, he comes to him, sinks his hips and just lays his hands on him. And what about this defensive back in the shadow? Is he going to tackle on a Wednesday or a Thursday? No. He did everything to put himself in position except make the tackle.

Seattle Seahawks, same thing. Are they going to tackle a teammate in the middle of the week or save it for Sunday? They save it for Sunday.

Contrast that now with high school football. Here's a high school scrimmage. A quarterback has four teammates with their hands on him. Are they going to hold him up, wrap him and hold him up, or take him to the ground? This has been a good practice exercise for everybody involved. We've learned a little something from it.

Let's go back to the quarterback. Did we take him to the ground or wrap him up and hold him? We took him to the ground and broke his wrist. Totally needless.

At this same high school in Connecticut, a young man named Cody Gifford played, son of Frank and Kathy Lee Gifford. Frank was a colleague of mine at ABC Sports many years ago. Cody actually made the team at USC as a walk-on. You can't believe how proud his father was. My son, Liam, also played at this same high school. He's now a backup quarterback at Tufts.

Frank Gifford and I used to talk about this frequently, and one day we sat and we put together the composite injuries in high school between our two sons, the concussions, the fractures, the knee ligaments. How many of those 10 major injuries do you think occurred in games and how many in practice? Two in games, eight in practice. Utter madness, Mr. Chairman.

So what do we recommend to rectify the problem? We are the only organization of the five national organizations who operate in this space that's committed to an immediate abolition of contact football below the age of 14 and ninth grade. We want to convert those leagues to flag. No contact until ninth grade.

Once in high school, no full contact in spring, summer, and off season; 3 hours total in preseason; 30 minutes a week during the season.

Mr. MURPHY. We're going to have to wrap up so we can continue on.

Mr. O'NEIL. How does this compare to the other major organizations operating in this space? National Federation of High Schools and USA Football, which operate in concert, allow three times as much contact as we do, Pop Warner four times as much contact as we recommend, and the NCAA six times as much as we recommend.

[The prepared statement of Mr. O'Neil follows:]

Testimony of Terry O’Neil

Founder/CEO, *Practice Like Pros*

Subcommittee on Oversight and Investigations

“Concussions in Youth Sports:

Evaluating Prevention and Research”

May 13, 2016

My name is Terry O’Neil, founder/CEO of *Practice Like Pros*. My first career was in network television at ABC, CBS and NBC. I produced telecasts of many NFL football games, including three Super Bowls, and was privileged to meet top coaches of that generation – Tom Landry of the Dallas Cowboys, Bill Parcells of the New York Giants, Joe Gibbs of the Washington Redskins, Dick Vermeil of the Philadelphia Eagles, Mike Ditka of the Chicago Bears, Bill Walsh of the San Francisco 49ers. I spent a lot of

time on their practice fields, saw how they prepared for games with minimal risk to their players.

In the late '90s, when Mike Ditka took the head coaching job at the New Orleans Saints, I went along. My office, overlooking the practice fields, offered a magnificent view of NFL football ballet -- skillful, efficient practice, rarely marred by injury.

A few years later, after our family had returned to Connecticut, my oldest son became a high school football quarterback. On his third day of practice as a freshman, he threw a touchdown pass but fractured his right index finger on the helmet of an onrushing lineman. This would never have happened in the NFL or college football, where they practice with a five-yard restricted zone, known as a "halo", around the quarterback.

When I asked one of Liam's coaches about rules of engagement in practice, he said, "Every player, every day, every practice, every drill, is live, including the quarterback." I told the story to Dick Vermeil.....he exhaled deeply and said, "Wow."

Due to injury, Liam missed exactly half of the 40 high school games his team was scheduled to play. These injuries nearly cost him a chance to play college football.

Frank Gifford, my former colleague at ABC Sports, lived in the same Connecticut town. His son, Cody, played football at the same high school a few years before Liam. Frank and I often commiserated. One day, we counted the combined major injuries suffered by Cody and Liam in high school football:

- 5 concussions,
- 4 orthopedic fractures,
- 1 torn knee ligament.

To our amazement, we realized that only two of these injuries had occurred in games. The other **eight were suffered in practice!**

So in 2013, I called a few players and coaches from my prior careers. Then I cold-called a few top names in medical science. Pretty soon, we had a squad to launch *Practice Like Pros*: **Mike Ditka, Archie Manning, Ronnie Lott, Warren Moon, Anthony Munoz, Tony Dorsett, Rocky Seto,**

Buddy Teevens, Dr. Robert Cantu, Dr. James Andrews, et al. See the full list at www.practicelikepros.com.

We found that Cody's and Liam's experiences were not all that unusual. In high school football, a shocking **60% to 75%** of head trauma occurs in practice. In the NFL, that number is **3%**. (Sources: NFLPA, Concussion Legacy Foundation.) That 60% to 75% is the worst, most shameful statistic in football because coaches and administrators control the rules of engagement in practice.

In the formative months of *Practice Like Pros*, I met plenty of resistance. Then I connected with Steve Dembowski, the head coach at Swampscott (Ma.) High School, who told me, "Terry, we'd all like to practice with less contact; we just don't know how."

Bingo! That became the immediate mission of *Practice Like Pros* -- showing high school coaches....not *telling* them, *showing* them with video from the Cleveland Browns, Seattle Seahawks, Jacksonville Jaguars and Dartmouth College.

Our first video clinic was staged August 10, 2013, in Worcester, Ma. Today's hearing on Capitol Hill is our 30th appearance. Here's our scoreboard: In three years-plus since the founding of *Practice Like Pros*, 44 of 50 states have voted to reduce contact on their high school football practice fields.

But we have so much more to accomplish, beginning with the conversion of youth (age 5 to 13) play from contact football to flag. All available science, including two recent studies by **Dr. Robert Stern**, confirm the belief first expressed by **Dr. Cantu** that boys should not begin playing contact football until ninth grade.

And once they enter high school football, they should: *Practice Like Pros*, i.e.:

- no full-contact in spring/summer/off-season,
- three hours full-contact total, including scrimmage(s), in pre-season,
- 30 minutes full-contact per week in regular season.

Our effort to implement these standards runs contrary to recommendations of four national governing bodies. For instance, in regular season, USA

Football and the National Federation of High Schools (NFHS) recommend **three times** the contact that we advocate, Pop Warner **four times**, and the NCAA **six times**.

In addition, none of these organizations opposes full-contact in spring/summer/off-season. Some states allow high school teams as much as 18 days of full-contact in spring! That's like playing another half-season.

Our pre-season and regular-season standards have been adopted by one state – Wisconsin – and the results have been superb. A study by the University of Wisconsin Medical School, published in October, 2015, reports that Wisconsin high school football concussions **have been reduced by more than half** since adoption of the new restrictions (see attachment).

At the college level, **Dartmouth Coach Buddy Teevens**, one of our leading supporters, has pioneered an outright ban on full-contact in practice. His team tackles only 10 times per year – on their 10 gamedays.

And in the NFL, progress has been undeniable since the revolutionary 2011 collective bargaining agreement. Last season, of 271 total NFL

concussions, only eight were suffered on practice fields in regular- and post-season.

So our template of limited-contact practice is available and thriving at all three levels. And again we emphasize: there should be no fourth level.....grade-school boys should play flag, not contact, football.

The question now is how quickly we can affect change. We quote the words of Dr. Ann McKee, speaking to this Committee March 14:

**If there is something we can do to limit this risk,
it must be done immediately.**

Respectfully submitted,

Terry O'Neil

Founder/CEO

Practice Like Pros

www.practicelikepros.com



Wisconsin Model



WISCONSIN INTERSCHOLASTIC ATHLETIC ASSOCIATION

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WIAA Football Player on Player Contact

Limitations are the following:

Drill Contact (Air, Bags and Wrap) is unlimited. Competition/Full Contact (Thud and Live/Full) has limitations. The Acclimatization Regulations also apply.

Week 1 – Only Drill Contact (Air, Bags and Wrap) is allowed and it is unlimited. Competition/Full Contact is not allowed.

Week 2 – Drill Contact (Air, Bags and Wrap) is unlimited. Competition/Full Contact (Thud and Live) is limited to 75 minutes per week (excluding a scrimmage).

Week 3 and beyond - Drill Contact (Air, Bags and Wrap) is unlimited. Competition/Full Contact (Thud and Live) is limited to 60 minutes per week (excluding games).

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SCHOOL OF MEDICINE
AND PUBLIC HEALTH

News and Events

Concussion Rates Way Down After New Rule in High School Football

Madison, Wisconsin - New research shows that limiting the amount of full-contact tackling during high school football practices can have a big impact on reducing the number of concussions among players.

A University of Wisconsin-Madison study examined sports-related concussion rates among Wisconsin high school football players after the state's interscholastic athletic association limited the amount and duration of full-contact activities during team practices.

The rule, which first went into effect for the 2014 season, prohibits full contact during the first week of practice, limits full contact to 75 minutes per week during week 2, and caps it at 60 minutes thereafter.

Full contact is defined as drills or game situations when full tackles are made at a competitive pace and players are taken to the ground.

Findings show that the rate of sports-related concussions sustained during high school football practice was more than twice as high in the two seasons before the rule change as compared to the 2014 season, said [Tom McGuire](#), senior scientist in the [department of orthopedics and rehabilitation](#) at the University of Wisconsin School of Medicine and Public Health.

The study was presented October 24 at the American Academy of Pediatrics national conference in Washington, D.C.

"This study confirms what athletic trainers in high-school football have long believed about the association of full-contact drills or practices and the likelihood of concussion," said McGuire. "This is probably also true for other football injuries such as sprains, fractures and dislocations."

The study used data from the Wisconsin Interscholastic Sports Injury Research Network, which has recruited and enrolled more than 16,000 adolescent athletes from 103 high schools and sport venues across Wisconsin. They serve as subjects for cross-sectional, cohort and randomized control trials.

The study's findings suggest that limiting full-contact high school football practices may be a no-brainer, McGuire said.

"Educating high school coaches about limiting the amount of full contact would be an effective and economical way to help protect students from head injuries," he said.

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smphweb@uwhealth.org

<http://www.med.wisc.edu/news-events/concussion-rates-way-down-after-new-rule-in-high-school-football/47263>

1/2

Reaction from Wisconsin Coaches, April 7, 2016

Mr. O'Neil,

It was great listening to you and Coach Teevens give your presentation at the WFCA clinic. It made me rethink how we do things from a contact standpoint.

Casey Hintz, Recruiting Coordinator/Inside Linebackers Coach
St. Norbert College

Good morning Terry,

Please send me your presentation from last night's WFCA convention. I really want to show it to all our other coaches, and start redesigning what we do for tackling.

Coach Ryan Karsten
Siren High School, Siren, WI.

Terry,

Great job at the WFCA clinic this past weekend – very much appreciated! Please send me the tackling videos. Our staff is looking forward to viewing the tape!

Skip Verick, ILB Coach
East Troy (WI.) High School

Terry,

Thank you for an excellent presentation at the WFCA. Please send me those videos. I want to incorporate a lot of it into our drills for the D-line here at UW-Lacrosse.

Coach Bob Lichty
University of Wisconsin-Lacrosse

Mr. O'Neil

Thanks for the presentation you and Coach Teevens made last night at our state clinic. It was incredibly valuable and eye opening. Please send the videos.

Coach Scott Cramer, Defensive Coordinator
Verona Area H.S. Wildcats, Verona, WI.

Thank you, Terry. It turned out great. Many positive comments on you and Buddy.

Dan Brunner, Executive Director
Wisconsin Football Coaches Association (WFCA)

Mr. MURPHY. Thank you. And during questions, if there's other conclusions you want to make, we'll—we're way over time.

Dr. Comstock, you're recognized for 5 minutes.

STATEMENT OF R. DAWN COMSTOCK

Dr. COMSTOCK. Thank you, Chairman Murphy. It's an honor to be asked to testify before this committee, particularly representing Colorado's School of Public Health at the University of Colorado Anschutz Medical Campus as a—under Congresswoman DeGette's in her State.

I'm here today because I run the National High School Sports-Related Injury Surveillance Study. I've done so for the last 11 years. In effect, I've dedicated my entire career to trying to improve high school athletes' safety, not because I'm a policymaker or a clinician, but because I collect the data that's needed to drive informed, evidence-based decisions. I want to share just a few examples today and describe why those are so important.

This first slide shows some high school RIO data, just simple concussion rates over time. You can see that concussion rates were stable for a few years before dramatically increasing, in fact, doubling between 2008 and 2012. They've leveled off in recent years.

Understanding trends over time like this is crucially important both so that we can evaluate the magnitude of the problem, but also so that we can determine which interventions may, in fact, be effective and which ones may not. Only long-term surveillance information can provide this data.

This next slide shows that some of the information I heard a little earlier that, you know, we don't want to wait to try to do intervention work because we don't want to wait for the years and years it takes to collect the data; we don't have to wait. I intentionally put just 1 year worth of high school RIO data up here to show you that, even with 1 year of surveillance, we can look at patterns and trends across sports, across genders, across type of activity. And this is just the tip of the iceberg.

I capture up to 300 variables on every concussion that's reported to my system. I can literally tell you when, why, where, how, and to whom each concussion occurred. This data can drive evidence-based intervention efforts.

And I and many other researchers in the United States have the drive, the desire, the resources, technological and methodological, and the experience to be able to do this work at the youth level, just as it's currently being done at the collegiate and high school levels. What we don't have is the funding.

Injury surveillance can also demonstrate positive outcomes as well; very important. This slide shows that we've actually had a big success when it comes to managing high school athletes' concussions. In the 2007–2008 academic year, 30 percent of high school athletes diagnosed with a concussion returned to play in less than 7 days, which is a violation of accepted return-to-play guidelines. And disturbingly, 8 percent returned to play the same day they were injured. That's unacceptable.

Look at how things have improved. Last year in 2014–2015, less than 10 percent of all athletes returned to play within 6 days, and less than 2 percent returned the same day they were injured. This

is the result of prevention; not equipment prevention, but education and regulation prevention. Effective prevention in public health, we talk about three legs of a stool. Equipment is one piece in terms of concussion, but educating individuals and providing good, strong policy based on evidence are the other two legs.

I would love to come away from the efforts of this committee, incredibly important efforts, with the ability to do this work at the youth level. Currently, no one can give you this type of data for children playing sports who are younger than high school age. That's a travesty. We've got to protect our children who are playing sports because we want them to play sports.

I'm not against sports, not even against contact sports. Despite my appearance, I played rugby for 13 years. Yes, I'm only 4' 11". I played rugby for 13 years. I appreciate the fact that participating in sports is a very important way that children can incorporate physical activity as part of a daily, healthy lifestyle.

We need everyone sitting at this table and our policy representatives, like the distinguished members of this panel, to work together to drive evidence-based prevention practices now. We don't want to wait for 30 years to learn about long-term consequences of concussion. That's secondary and tertiary prevention. We need primary prevention. I already know that concussions are bad for us. I want to keep kids from being injured in the first place.

Thank you.

[The prepared statement of Dr. Comstock follows:]

Summary of Testimony of Dr. R. Dawn Comstock for the U.S. House of Representatives' Committee on Energy and Commerce, Subcommittee on Oversight and Investigations hearing entitled "Concussions in Youth Sports: Evaluating Prevention and Research." Friday, May 13, 2016

- 1) There have been vast improvements in our knowledge of youth sports-related concussions over the past decade.
- 2) Sports are an important way for children to incorporate physical activity into a healthy lifestyle and parents should not be afraid to allow their children to play sports but it is imperative to make concussion prevention specifically and athlete health and safety in general a priority.
- 3) To date the majority of federally funded concussion work has focused on improving concussion diagnosis, improving management of concussed athletes, and improving our understanding of the long term negative health outcomes associated with concussion – all of which are important, but none of which reflect primary prevention efforts. It is time to shift the focus to primary prevention.
- 4) Effective concussion prevention efforts will need to be sport-specific, targeted, evidence-based, and multi-faceted.
- 5) We do not currently have any national sports injury surveillance programs capable of providing the information required to drive such prevention efforts for athletes younger than high school aged.

**Testimony of Dr. R. Dawn Comstock for the U.S. House of Representatives'
Committee on Energy and Commerce, Subcommittee on Oversight and
Investigations hearing entitled "Concussions in Youth Sports: Evaluating
Prevention and Research." Friday, May 13, 2016**

Chairman Murphy I am honored to testify on the important topic of youth sports-related concussions before the Committee on Energy and Commerce's Subcommittee on Oversight and Investigations today. It is with pride that I represent the Colorado School of Public Health as a constituent of the ranking member of the committee, Congresswoman DeGette.

As the Director of The National High School Sports-Related Injury Surveillance Study, more commonly (and more easily) referred to as High School RIO, I have spent my entire career attempting to improve young athletes' health by providing the evidence needed to make sports as safe as possible (see Appendix 1). I was asked to attend today's hearing to share the current state of research in the area of youth sports-related concussion. First I must note how much has improved over the past decade. When I established High School RIO in 2005 concussions were not yet resonating as a concern among parents of young athletes. Injured athletes were frequently said to have had their "bell rung" or to have been "dinged" and sports-related injuries, including concussions, were considered by most parents to be unavoidable, "just part of the game," or "the price you have to pay to play." Much has changed. Massive media attention, state level legislative efforts, and educational efforts by numerous organizations occurred concurrently with, and in fact were at

times driven by, great advancements in our understanding of the rates and patterns of concussion among high school athletes. I'll highlight a few advancements in our knowledge using examples from my High School RIO dataset.

1) Ongoing surveillance efforts have demonstrated a rapid increase in concussion rates over the past decade (see Appendix 2). Most believe this increase reflects better diagnosis and capture of concussion injuries rather than a true increase in the numbers of concussions. Encouragingly, surveillance data from the past few years demonstrates concussion rates have leveled off. However, continued surveillance is needed to monitor these ongoing trends.

2) Concussion rates vary by sport, gender, and type of athletic activity (see appendix 3). For example, first in terms of sport-specific differences, football has the highest rates of concussion in both competition and practice with other full contact sports (boys' ice hockey and lacrosse) also among the four sports with the highest rates. Many are surprised to learn girls' soccer has consistently had competition concussion rates as high as or higher than these boys' sports. However, practice is a different story. Cheerleading, which has a low competition/performance concussion rate relative to other sports has the second highest practice concussion rate. Conversely, boys' ice hockey has a low practice concussion rate relative to other sports. Second, in gender comparable sports girls have significantly higher concussion rates than boys. Finally, in nearly every sport, competition concussion rates are significantly higher than practice concussion rates. Understanding such differences is

essential as it demonstrates that concussion prevention efforts can't be "one size fits all." Rather effective, targeted prevention efforts must be evidence-based and sport-specific.

3) Improvements have been made in management of concussed athletes (see appendix 4). In 2007/08, over 30% of high school athletes diagnosed with a concussion returned to play within a week of their injury which is premature according to accepted return to play guidelines and, disturbingly, 8% were allowed to return to play the day they were injured. Following massive educational efforts by the National Federation of State High School Athletic Associations (NFHS), the Centers for Disease Control and Prevention's National Center for Injury Prevention and Control, and others we have observed very positive trends. Last academic year (2014/15) less than 10% of high school athletes diagnosed with a concussion returned to play within a week of their injury and less than 2% returned to play the day they were injured. These are encouraging trends indications the parents, coaches, and clinicians of young athletes are now all much more aware of the signs and symptoms of concussion, the importance of removing an injured athlete from play, and the need for an injured athlete to be kept out of play until released to return by an appropriate health care advisor.

At this point I feel it is important to note that I am not against sports, even contact sports. I don't want parents to be afraid to allow their children to play sports. We have an epidemic of obesity in our country and playing sports is a great way for our youth to incorporate daily physical activity into a healthy lifestyle.

Despite our current concern over concussions, the negative effects of an inactive lifestyle (e.g., diabetes, heart disease, etc.) are more concerning due to their relatively high likelihood compared to the very small likelihood that any individual child will sustain a serious sports-related injury resulting in life-long problems. Additionally, while you may have difficulty envisioning this looking at the middle aged, 4'11", slightly overweight woman sitting before you, I was a three-sport athlete at Centennial High School in Pueblo Colorado and as an undergraduate at Colorado State University I began playing rugby, a sport I pursued for 13 years. I learned about work ethic, teamwork, commitment, etc. from playing sports and because of my time playing rugby I recognize the sense of accomplishment and adrenalin rush one gets when you make a good tackle and I appreciate the life lessons embodied in picking yourself up and returning to play after being tackled. I understand that the culture of full contact sports must be respected if we are to make any progress toward concussion prevention. However the time has come and past for the adults involved in youth sports – the parents, coaches, administrators, educators, researchers, clinicians, policy makers, and regulators – to recognize that keeping young athletes as safe as possible must be made a priority and will only be effective if approached as a team effort.

With this in mind, I want to extend particular thanks to this committee for holding a hearing focused on prevention. When I was asked to present a researcher's view of the current state of concussion prevention I realized the importance of briefly noting the differences between primary, secondary, and tertiary prevention. Primary prevention is literally preventing a negative health

event, such as an illness or injury, from occurring in the first place while secondary and tertiary prevention encompass minimizing the clinical impact and life long effects of a negative health event after it occurs. This is pertinent to today's hearing because, to date the vast majority of federally funded concussion research has focused on improving concussion diagnosis, improving concussion management, and improving our understanding of the long-term effects of concussion (e.g., CTE). While each are incredibly important endeavors, they are clearly associated with secondary or tertiary prevention, having very little to nothing to do with primary prevention. I believe we should be spending much more effort working to prevent our young athletes from being injured in the first place.

To that end, I was also quite pleased to learn that today's hearing would be focused on prevention efforts other than equipment. Simply stated, there is no such thing as a perfect piece of protective equipment – for example, no helmet will ever be able to prevent all concussions. Unfortunately aggressive marketing and our tendency to look for quick and easy fixes has led far too many parents to put far too much faith in the unsubstantiated concussion prevention claims of far too many manufacturers. While it is important to ensure the effectiveness of protective equipment is not oversold, it is even more important for us to realize that protective equipment will always only be only one piece of the concussion prevention puzzle. In public health we speak of the “three-legged stool of prevention” – the concept that the most effective prevention efforts are multi-faceted. The three legs of the prevention stool are engineering, education, and regulation. Our roadways are safer today despite the ever-increasing density of motor vehicle traffic because we have

effectively combined engineering (e.g., air bags, anti-lock breaks, etc.), education (drivers education classes, don't text and drive advertising campaigns, etc.), and regulation (speed limits, drunk driving laws, etc.). Effective sports-related concussion prevention efforts will likewise require a multi-faceted approach. While efforts to improve protective equipment is one "leg of the stool" this must be accompanied by educational efforts (e.g., the National Federation of High School Athletic Associations' [NFHS] recent recommendations regarding limiting the number of days a week football coaches incorporate full contact activities in practice sessions, the Center for Disease Control and Prevention's National Center for Injury Control and Prevention's "Heads Up" concussion toolkits for coaches, etc.) and regulatory efforts (e.g., Pop Warner's elimination of kick offs in their youngest age groups, better enforcement of the existing soccer rules to reduce player-player contact, etc.). These multi-faceted concussion prevention efforts must be evidence-based and sport specific – the stool is only stable if all three legs are strong.

However, in order to develop evidence-based, sport specific interventions we need better information. While evidence of the association between single or repeated blows to the head sustained during sports activity and brain injury was published in the medical literature as early as 1928, in its 2013 report on youth sports related concussions the Institute of Medicine noted that "The National Collegiate Athletic Association Injury Surveillance System and High School RIO™ (Reporting Information Online) data system are the only ongoing, comprehensive sources of sports-related injury data, including data on concussions, in young athletes." As the IOM report pointed out there is no national data collection tool

capturing equivalent sports injury information on athletes younger than high school age or high school aged children participating in sports outside of the school setting (e.g., recreational leagues, summer leagues, travel teams, all-star tournaments, summer camps, etc.). This literally means that no one is currently capable of providing reliable data on concussion incidence, rates, or patterns among the many millions of U.S. children younger than high school age or high school aged athletes playing outside the school setting. This is simply unacceptable because the importance of such information is undeniable and the knowledge, experienced personnel, and technical/methodological resources to obtain such information exists – the only thing which is lacking is adequate funding.

The NCAA and NFHS have provided a roadmap for all youth sports organizations. Those two institutions made the commitment to improve athlete health and safety by utilizing injury surveillance data in informed discussions leading to evidence-based decisions. I hope the work of this committee will somehow result in some source of federal support for an equivalent surveillance program for injuries sustained by our youngest athletes which could then be used by the numerous sports governing bodies overseeing youth sports. If federal funding is not a possibility, perhaps it is time to acknowledge that youth sports have become big business and to demand that national governing organizations utilize some of their profits to establish their own injury surveillance systems. Knowledge is power – in this case the knowledge gained from surveillance data can power efforts to keep young athletes safe and healthy.

Appendix 1: Peer-Reviewed Scientific Publications Reporting Data from The National High School Sports-Related Injury Surveillance Study (High School RIO™). Note: Concussion publications are bolded and student/trainee authors are italicized.

Of the 71 scientific papers reporting findings from analysis of the High School RIO™ dataset that have been published to date or currently in print, 17 (24%) have focused solely on concussions.

1. ***Bryan MA, Rowhani-Rahbar A, Comstock RD, and Rivara FP. Sports- and Recreation-Related Concussions in United States Youth. Forthcoming, Pediatrics.***
2. Johnson B and Comstock RD. Epidemiology of Chest, Rib, Thoracic Spine and Abdomen Injuries Among United States High School Athletes, 2005/05-2013/14. Forthcoming, *Clinical Journal of Sports Medicine*.
3. ***Currie DW, Comstock RD, Fields SK, and Cantu RC. A Paired Comparison of Initial and Recurrent Concussions Sustained by US High School Athletes within a Single Athletic Season. E-pub ahead of print, Journal of Head Trauma Rehabilitation. Published online May, 2016. DOI: 10.1097/HTR.0000000000000240.***
4. *Tirabassi J, Brou L, Khodae M, Lefort R, Fields SK, and Comstock RD. Epidemiology of High School Sports-Related Injuries Resulting in Medical Disqualification: 2005-2006 Through 2013-2014 Academic Years. E-pub ahead of print, American Journal of Sports Medicine. Published online May 10, 2016. DOI: 10.1177/0363546544604.*
5. ***Collins CL, McKenzie LB, Ferketich AK, Andridge R, Xiang H, and Comstock RD. Concussion Characteristics in High School Football by Helmet Age/Recondition Status, Manufacturer, and Model: 2008/09 Through 2012/13 Academic Years in the United States. E-pub ahead of print, American Journal of Sports Medicine. Published online Feb 23, 2016. PMID: 26905506.***
6. *Pierpoint LA, Williams CM, Fields SK, and Comstock RD. Epidemiology of Injuries in US High School Track and Field, 2008-2009 through 2013-2014. E-pub ahead of print, American Journal of Sports Medicine. Published online Feb 26, 2016. PMID: 26920435.*

7. Collins CL, McKenzie LB, Ferketich AK, Andridge R, Xiang H, and Comstock RD. Dental Injuries Sustained by High School Athletes in the United States, from 2008/09 through 2012/13 Academic Years. E-pub ahead of print, *Dental Traumatology*. Published online Sept 26, 2015. PMID: 26408377.
8. Ashack KA, Burton KA, Johnson TR, Currie DW, Comstock RD, and Dellavalle RP. Skin Infections Among US High School Athletes: A National Survey. E-pub ahead of print, *Journal of the American Academy of Dermatology*. Published online Feb 2, 2016. PMID: 26850656.
9. Mitchell J, Graham W, Best TM, Collins CL, Currie DW, Comstock RD, and Flanigan DC. Epidemiology of Meniscal Injuries in US High School Athletes Between 2007 and 2013. *Knee Surgery, Sports Traumatology, Arthroscopy*, 24(3):715-722 (2016).
10. Currie DW, Fields SK, Patterson MJ, and Comstock RD. Cheerleading Injuries in United States High Schools. *Pediatrics*, 137(1):1-9 (2016).
11. Dizdarevic I, Low S, Currie DW, Comstock RD, Hammoud S, and Atanda A. Epidemiology of Elbow Dislocation in High School Athletes. *American Journal of Sports Medicine*, 44(1):202-208 (2016).
12. Reeser JC, Gregory A, Berg RL, and Comstock RD. A Comparison of Women's Collegiate and Girls' High School Volleyball Injury Data Collected Prospectively Over a Four-Year Period. *Sport Health*, 7(6):504-510 (2015).
13. Kriz PK, Zurakowski RD, Almquist JL, Reynolds J, Ruggieri D, Collins CL, d'Hemecourt PA, and Comstock RD. Eye Protection and Risk Risk of Eye Injuries in High School Field Hockey. *Pediatrics*, 136(3):521-527 (2015).
14. **Comstock RD, Currie DW, Pierpoint LA, Grubenhoff JA, and Fields SK. An Evidence-Based Discussion of Heading and Concussions in High School Soccer. *JAMA Pediatrics*, 169(9):830-837 (2015).**
15. Roos KG, Marshall SW, Kerr ZY, Golightly YM, Kucera KL, Myers JB, Rosamond WD, and Comstock RD. Epidemiology of Overuse Injuries in College and High School Athletes in the United States. *American Journal of Sports Medicine*, 43(7):1790-1797 (2015).
16. Mitchell J, Magnussen RA, Collins CL, Currie DW, Best TM, Comstock RD, and Flanigan DC. Epidemiology of Patellofemoral Instability Injuries among High School Athletes in the United States. *American Journal of Sports Medicine*, 43(7):1676-1682 (2015).
17. Monfort SM, Comstock RD, Collins CL, Onate JA, Best TM, and Chaudhari AM. Association between Ball-Handling versus Defending Actions and Acute Noncontact Lower Extremity Injuries in High School Basketball and Soccer. *American Journal of Sports Medicine*, 43(4):802-807 (2015).
18. Matic GT, Sommerfeldt MF, Best TM, Collins CL, Comstock RD and Flanigan DC. Ice Hockey Injuries Among United States High School Athletes from

- 2008/2009-2012/2013. *The Physician and Sportsmedicine*, 43(2):119-125 (2015).
19. **Schroeder AN, Comstock RD, Collins CL, Everhart J, Flanigan D, and Best TM.** Epidemiology of Overuse Injuries Among High-School Athletes in the United States. *The Journal of Pediatrics*, 166(3): 600-606 (2015).
 20. **Changstrom BG, Brou L, Khodae M, Braund C, and Comstock RD.** Epidemiology of Stress Fracture Injuries Among U.S. High School Athletes, 2005-06 through 2012-13. *American Journal of Sports Medicine*, 43(1):26-33 (2015).
 21. **Kerr ZY, Collins CL, Mihalik JP, Marshall SW, Guskiewicz KM, and Comstock RD.** Impact Locations and Concussion Outcomes in High School Football Player-to-Player Collisions. *Pediatrics*, 134(3):489-496 (2014).
 22. **Collins CL, Fletcher EN, Fields SK, Kluchurosky L, Rohrkemper MK, Comstock RD, and Cantu RC.** Neck Strength: A Protective Factor Reducing Risk for Concussion in High School Sports. *Journal of Primary Prevention*, 35(5):309-319 (2014).
 23. **Xiang J, Collins CL, Liu D, McKenzie LB, and Comstock RD.** Lacrosse Injuries Among High School Boys and Girls in the United States, 2008-2012, Four Academic Years. *American Journal of Sports Medicine*, 42(9):2082-2088 (2014).
 24. **Fletcher EN, McKenzie LB, and Comstock RD.** Epidemiological Comparison of High School Basketball Injuries Reporting to Emergency Departments and the Athletic Training Setting. *Journal of Athletic Training*, 49(3):381-388 (2014).
 25. **Rosenthal JA, Foraker RE, Collins CL, and Comstock RD.** National High School Athlete Concussion Rates From 2005-2006 to 2011-2012. *American Journal of Sports Medicine*, 42(7):1710-1715 (2014).
 26. **Robinson TW, Corlette J, Collins CL, and Comstock RD.** Shoulder Injuries Among US High School Athletes, 2005/2006-2011/2012. *Pediatrics*, 133(2):272-279 (2014).
 27. **Joseph AM, Collins CL, Henke NM, Yard EE, Fields SK, and Comstock RD.** A Multisport Epidemiologic Comparison of Anterior Cruciate Ligament Injuries in High School Athletics. *Journal of Athletic Training*, 48(6):810-817 (2013).
 28. **Smith DW, Myer GD, Currie DW, Comstock RD, Clark JF, and Bailes JE.** Altitude Modulates Concussion Incidence: Implications for Optimizing Brain Compliance to Prevent Injury in Athletes. *Orthopaedic Journal of Sports Medicine*, 1(6):1-7 (2013).
 29. **Swenson DM, Collins CL, Fields SK, and Comstock RD.** Epidemiology of US High School Sports-Related Ligamentous Ankle Injuries 2005/06-2010/11. *Clinical Journal of Sports Medicine*, 23(3):190-196 (2013).

30. Swenson DM, Collins CL, Best TM, Flanigan DC, Fields SK, and Comstock RD. Epidemiology of Knee Injuries Among US High School Athletes, 2005/06-2010/11. *Medicine & Science in Sports & Exercise*, 45(3):462-469 (2013).
31. Badgeley MA, McIlvain NM, Yard E, Fields S, and Comstock RD. Epidemiology of 10,000 High School Football Injuries: Patterns of Injury by Position Played. *Journal of Physical Activity & Health*, 10(2);160-169 (2013).
32. **Chrisman SP, Rivara FP, Schiff MA, Zhou C, and Comstock RD. Risk Factors for Concussive Symptoms of 1 Week or Longer in High School Athletes. *Brain Injury*, 27(1);1-9 (2013).**
33. Kerr ZY, Casa DJ, Marshall SW, and Comstock RD. Epidemiology of Exertional Heat Illness Among U.S. High School Athletes. *American Journal of Preventive Medicine*, 44(1);8-14 (2013).
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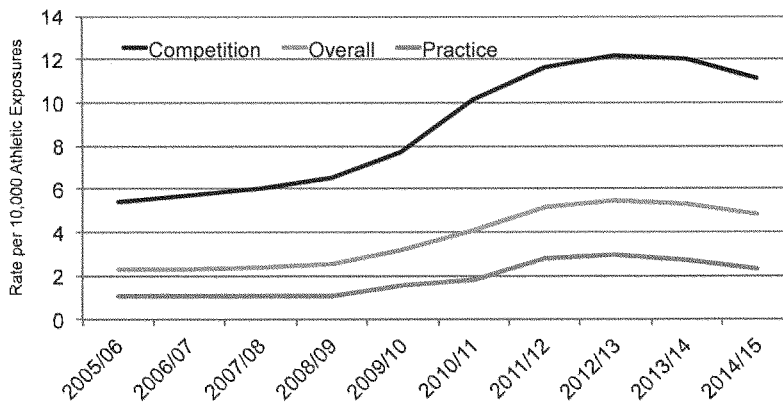
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45. Gilchrist J, Haileyesus T, Murphy M, Comstock RD, Collins C, McIlvain N, and Yard E. Heat Illness Among High School Athletes – United States, 2005-2009. *JAMA* 305(3);246-249 (2011) – (JAMA reprint of MMWR)
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50. Krajnik S, Fogarty KJ, Yard EE, and Comstock RD. Shoulder Injuries in US High School Baseball and Softball Athletes, 2005-2008. *Pediatrics* 125(3);497-501 (2010).
51. Yard EE, Collins CL, and Comstock RD. A Comparison of High School Sports Injury Surveillance Data Reporting by Certified Athletic Trainers and Coaches. *Journal of Athletic Training* 44(6);645-652 (2009).
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Appendix 2: Concussion Rates Over Time Among Athletes Participating in the Nine Popular U.S. High School Sports (Football, Boys' and Girls' Soccer, Girls' Volleyball, Wrestling, Boys' and Girls' Basketball, Baseball, and Softball) Which Have Been Under Continuous Surveillance Over the Past Decade, High School RIO™ Study, 2005/06 through 2014/15

Concussion Rates per 10,000 AE



**Appendix 3: Concussion Rates Among U.S. High School Athletes Vary by Sport
and Type of Athletic Activity, High School RIO™ Study, 2014/15**

Concussion Rates per 10,000 AEs: 2014/15

Sport	Competition	Rank	Practice	Rank
Football	30.5	1	5.0	1
Girls' Soccer	20.7	2	2.1	3
Boys' Ice Hockey	15.9	3	1.2	9
Boys' Lacrosse	11.3	4	1.0	11
Girls' Basketball	9.9	5	1.7	6
Boys' Wrestling	9.1	6	2.1	4
Boys' Soccer	8.9	7	0.9	12
Girls' Lacrosse	7.7	8	1.3	8
Field Hockey	7.1	9	0.9	13
Girls' Volleyball	4.9	10	1.9	5
Boys' Basketball	3.4	11	1.1	10
Softball	3.0	12	1.5	7
Baseball	2.4	13	0.5	14
Cheerleading*	1.8	14	2.6	2

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AE = Athletic Exposure with one athlete participating in one practice or competition representing one athletic exposure.

Appendix 4: Improvement in U.S. High School Athletes' Compliance with Return to Play Guidelines Over Time, High School RIO™ Study, 2005/06 through 2014/15

Trends in Return to Play Time (RTP)

% of HS Student Athletes in Each Category of RTP by Year

	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15
<1 day	7.9	2.6	1.5	0.8	1.8	0.6	0.9	1.7
1-2 days	6.7	6.4	4.0	2.4	1.9	0.8	1.0	0.9
3-6 days	21.4	19.5	17.9	12.9	9.0	8.3	7.6	7.0
Season DQ	2.8	3.6	4.6	4.1	4.4	3.0	2.6	2.4
Career DQ	0.2	0.1	0.3	0.3	0.2	0.4	0.4	0.4
Season ended	0.8	0.1	8.7	12.2	14.2	14.5	14.0	15.8
Athlete quit sports despite no DQ	0.4	1.4	1.2	1.4	1.9	1.9	2.7	1.9

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Note: column %'s do not sum to 100% because not all return to play categories captured by High School RIO™ are displayed in this table. Rather, only those categories indicating a failure to comply with return to play guidelines (i.e., <1 day, 1-2 days, and 3-6 days) or indicating concussions of particular concern or interest (i.e., all others included in this table) are presented.

Mr. MURPHY. Thank you very much, Doctor.
Now, Dr. Talavage, you're recognized for 5 minutes.

STATEMENT OF THOMAS M. TALAVAGE

Dr. TALAVAGE. All right. Thank you very much, Chairman.

So I'm Thomas Talavage. I'm a professor of electrical computer engineering and biomedical engineering at Purdue University, founding codirector of our MRI facility. I've been a member, in recent years, of the NCAA's Task Force on Concussions and I'm a member of the Scientific Advisory Board for the NCAA-DOD CARE Consortium. And I'm also one of the founding members of the Concussion Neuroimaging Consortium, which is a multi-institutional effort to bring together the researchers who have a history of publishing and doing research in the area of concussion and traumatic brain injury together to solve many of these problems. I serve for the Purdue Neurotrauma Group as our specialist in neuroimaging, and I'm also the lead PI for the Purdue College of Engineering's preeminent team on engineering healthier brains.

As a rabid sports fan of the Pittsburgh Steelers and the Pittsburgh Pirates and the father of four very, very active young children, this is an issue that is very near and dear to my heart and has been for a long time.

As a part of the Purdue Neurotrauma Group, I just wanted to summarize really quickly that our goals and our proposal into the future is to achieve safer participation in youth sports. Our goal here is to make sure that more children can participate in sports more frequently without really risk of injury, or at least a reduced risk of injury to something that is acceptable to us, such as riding a bicycle or playing baseball or playing basketball.

Our goal is to achieve the same through the education of athletes, parents, coaches, and health care providers regarding the risks of not only concussive, but also subconcussive injuries through engineering-based improvements in protective equipment, through modeling and appropriate preventative methodologies that allow us to monitor exposure to head injuries and the risk of head injuries, and, finally, through techniques such as have already been described with improved training of athletes.

Through the past 7 years, our pioneering study has been engineering based as following the model illustrated on the slide, where we're applying structural health monitoring, a technique developed from basic materials and basic structures in our everyday world, whether they be planes, bridges, automobiles, where you essentially do nondestructive evaluation, you document that a material is in good health before you continue forward with its use, and as that material starts to exhibit some sort of change, you effect either repair, or in the case of some materials, you allow them to rest, allowing them to recover.

This methodology has been applied now, as I said, for 7 years in the study of high school girls playing soccer and boys playing football. And our study, though, applying this methodology began like most of the other studies in this domain, where our real initial effort was to understand why some kids got a concussion and some kids didn't. But what we discovered very rapidly and has essentially driven our research since that time is that, in truth, many

of the children who we think are not injured are, in fact, showing changes in their physiology, changes in their brain that are strongly suggestive of underlying brain injury.

And what's really critical is that not only are athletes who are supposedly healthy, who do not have signs of a concussion, who are not diagnosed or even examined by their team's athletic trainer or their team's physician as having a concussion, will look abnormal in this manner for up to 5 months after the season, which means that they may be spending 8 to 9 to 10 months of the year in an abnormal state.

So while we already know ahead of time that it's never a good idea to hit your head, the question now becomes how long is it that these athletes are injured and what can we do to prevent that injury in the first place? So our study has, as I've already mentioned, been going for 7 years, and if we are able to find funding some time in the future, we will continue to study, ideally later this year.

I only wish to be working from this methodology with the goal being that if we understand how inputs, in this case mechanical inputs of heads being hit, whiplash events from the body being hit and the head snapping to the side, snapping forward, or rotating abruptly, will allow us to understand how each of those events affects the brain. Then we can go back and now correctly develop protective technologies, helmets, that will in fact prevent concussion rather than merely skull fracture. We can develop appropriate methodologies for identifying when an athlete should skip a practice, because clearly we want the kids to miss practice, not the games, and that's obviously what the kids want. And we will also then be able to evaluate whether or not recovery has been truly complete. Can we actually document that an athlete who has been pulled and is getting ready to return to play looks healthy enough that it makes sense for them to go back into play?

So with that, we really feel, as the Purdue Neurotrauma Group and as myself as a researcher in engineering, that most of these changes can be made with no cost to the enjoyment of the game, but they are very likely to improve the freedom or the comfort to engage in these activities without any substantial consequences beyond those associated with other noncollision sports, such as baseball, bicycling, or whatever. And we really feel that the science is far enough along, that these changes should be made now rather than to wait any more time such that 30 million kids every year are exposed to potential injury. There is no reason not to act.

[The prepared statement of Dr. Talavage follows:]

Written Testimony

Thomas M. Talavage, Ph.D.

*Professor of Electrical & Computer Engineering, Biomedical Engineering**Purdue University, West Lafayette, IN*

12 May 2016

Summary of Major Points from Written Testimony

- The Purdue Neurotrauma Group (PNG) proposes to achieve safer participation in youth sports by *(i)* education of athletes, parents, coaches, and healthcare providers, *(ii)* improved protective equipment, *(iii)* automated monitoring of exposure to head accelerations, and *(iv)* improved training of athletes.
- The PNG study, initiated in 2009, represents the largest and most comprehensive study of youth athletes exposed to repetitive head blows to-date in high school-aged girls *and* boys, playing soccer and football.
- A substantial number of statistically-significant short-term effects of repetitive head blows have been observed in the PNG study:
 - Decreases in functional MRI activation contrasts associated with working-memory task completion.
 - Decreases in MR spectroscopy-detected concentrations of neural metabolites.
 - Decreases in functional MRI measures of resting-state connectivity.
 - Decreases in functional MRI measures of regulation of neurovascular coupling.
 - Increases in white matter fractional anisotropy as assessed using diffusion-weighted MR imaging.
- Longer-term effects observed in the PNG study, by comparison of *pre-participation* assessments of soccer and football athletes with peers who do not participate in collision-based sports, provide evidence of neuroprotective/repair mechanisms that persist for at least several months after participation.
- These short- and long-term alterations, and their associations with exposure to head collision events, strongly suggest that limitation of exposure to head accelerations will reduce short-term consequences of participation and likely contribute to a reduction in the observation of concussion.
- Achievement of reduction in head acceleration event exposure *is technically feasible*, and should enable more youth to participate in more activities without increased risk of head injury.

Executive Summary

The Purdue Neurotrauma Group (PNG) has studied head injuries and the related changes in neurophysiology for seven years and our data set represents the largest and most comprehensive study of young male and female athletes exposed to repetitive head impacts to date. Our results demonstrate that the number of head impacts per week and their magnitude must be limited and that this monitoring is technically feasible. To achieve the goal of wider and safer participation, the PNG proposes the following four steps be taken. These are *(i)* improved education of stakeholders regarding what may be regarded as “safer” levels of head acceleration events and how to avoid inducing such events during practices, *(ii)* improved protective equipment, with emphasis on preventing energy transmission to the skull and brain, *(iii)* automated monitoring of athletes for exposure to head accelerations that are likely to contribute to brain injury, and *(iv)* improved training of athletes to minimize head acceleration (i.e., collision and whiplash) events.

The Study of Repetitive Subconcussive Injury in Youth Athletes

Since 2009, the PNG has conducted a longitudinal (within-season) and cross-sectional (across-season) evaluation of the effects of repetitive subconcussive exposure to head acceleration events in high school-aged athletes participating in contact sports. This study, comprising over 420 athlete-seasons of cognitive and advanced neuroimaging assessment in high school-aged girls playing soccer and boys playing football, represents the largest study to-date of the effects repeated subconcussive exposure and the linkage to traumatic brain injury in youth athletes.

Traumatic brain injury results from head accelerations that cause damage to the central nervous system. There are a variety of ways that this can happen and whiplash events may be just as dangerous as direct head impacts. Damage is ultimately caused by the dissipation of energy which, at the level of the brain, must occur through deformation of tissue (i.e., stretch and compression, typically quantified by strains), fluid movement, and mechanical disruption (e.g., cell rupture, myelin de-bonding, and synaptic derangement). While it is possible for

a single large blow to the head to cause any or all of these effects and result in symptoms, it is fortunate that these types of head impacts are relatively rare (Daniel et al. 2012). It should be noted, however, that even small head accelerations can produce these consequences within a localized region and, if the rate of healing does not keep up with the rate of damage accumulation, the athlete would be expected to eventually experience symptoms, even in the absence of any particularly large hits. In fact, every head impact or whiplash event would be expected to produce a unique spatial pattern of strains, and repeated exposure to such events increases the chance that the locations of maximum strains will overlap, resulting in these locations being progressively damaged over time. Eventually, the local tissue will have its resistance to injury reduced, or the small tears will preclude normal operation of the cells, much the same way in which overuse injuries (e.g., running or marching with heavy packs) may lead to stress fractures.

Over the past seven years, PNG has been the first to document statistically significant changes in brain structure, function, and chemistry in living football and soccer players who were not diagnosed with a concussion (Poole et al. 2014; Talavage et al. 2014; Abbas et al. 2015b; Svaldi et al. 2016). Two important features of these observed changes should be noted. First, they have been observed to affect a large fraction (30-60%) of players on the teams studied to date (Breedlove et al. 2014; Nauman et al. 2015; Talavage et al. 2016). Second, they have repeatedly been observed to be best-correlated with the measures of cumulative acceleration exposure, be they the number of head collisions experienced or the aggregate energy incident on the head (Breedlove et al. 2012; Svaldi et al. 2016). Taken together, it is clear that head accelerations (a more general term to encompass both direct blows to the head or whiplash events associated with blows to other locations on the body) that *do not* result in a near-term diagnosis of concussion can still cause cellular-level injuries that accumulate over time.

It is critical to note that the neuroimaging literature strongly suggests that some level of injury can be sustained without immediate presentation of symptoms. Damage or alterations in functional capacity at a single location in the brain need not produce corresponding changes in behavior (Viswanathan et al. 2015). Such injury could

range from ionic imbalance (Hovda 2014) to neuronal membrane damage (e.g., widening of the Nodes of Ranvier) that has not yet precluded delivery of information in the brain (Ouyang et al. 2010).

The potential for hidden/covert damage is what makes repetitive brain injury so insidious, and is hypothesized to have confounded past investigations into the causes and consequences of concussion. A critical concept for understanding “concussion” and the difficulty in quantifying its causes, is that an individual should not be expected to exhibit symptoms until information flow is interrupted, or at least sufficiently disrupted so as to reduce the reliability of neuronal summation in place and/or time. Rather, provided that the flow of information through the brain is not wholly impeded, behavior should be expected to be within normal performance limits, albeit possibly being considered more strenuous. Even if a location within the brain has been impaired such that information cannot pass through it, the presence of multiple pathways by which information may reach the intended destination within a necessary time frame may preclude any symptoms being evidenced by the individual. Therefore, it is likely that the entire communication process must be interrupted or significantly delayed for a failure of the system (i.e., a concussion) to be observed.

Overview of the Purdue Neurotrauma Group Study

The PNG study uses structural health monitoring (Talavage et al. 2015) as a framework in which to detect disordered conditions in brain behavior before symptoms arise: while there is obvious value in improving treatment and return-to-learn/play protocols, the greatest benefit is to be gained from preventing the underlying injury. Once the biochemical cascades are initiated, it may be possible to intervene and mitigate subsequent damage (Shi 2015), but the most effective “treatment” is prevention of those cascades in the first place.

Our study thus has initially been directed at characterization of brain changes associated with repeated exposure to subconcussive events (i.e., head accelerations that *do not* produce clinical observation of

symptoms) in youth athletes, particularly those exposed to repeated head acceleration collisions from sports such as football and soccer.

Combining cognitive testing, advanced neuroimaging, and daily monitoring of head acceleration events, the PNG study (Figure 1) tracks athletes before, during, and after exposure to events that are likely to contribute to brain injury. We now have data from football and women's soccer teams at three high schools and one college, comprising 420 athlete-seasons, more than 1,300 MRI sessions, and roughly 1,400 cognitive assessments. Partnering with multiple institutions (Bailes et al. 2015) conducting similar research via the Concussion Neuroimaging Consortium (<http://www.concussionimaging.org>), our goal is to evaluate biomarkers derived from these varied assessments to better characterize the risk that an individual who has been exposed to subconcussive events will exhibit abnormal brain behavior, and how elevated their risk might be for subsequent diagnosis of concussion.

Before discussing key findings of this study, it is critical to observe that a key component of the PNG study has not been widely replicated in any of the large, multi-institutional efforts currently being funded by federal sources. Specifically, the PNG study derives much of its benefit from the within-season longitudinal nature of its cognitive and neuroimaging assessments—the acquisition of a within-subject baseline, before participation/exposure, has proven to be critical to our understanding of both short- and long-term alterations in brain behavior and health. The value of a pre-participation assessment comes from the fact that most measures of brain function/physiology and cognitive performance used to study concussion exhibit appreciable population variance, complicating interpretation of differences between subjects. Within-subject changes in measurements, as a function of exposure, have frequently proven to exhibit greater variance than are exhibited across the source population prior to exposure. The ability, therefore, to recognize that a late-in-the-season individual no longer resembles the pre-participation population makes it straightforward to interpret changes in cognitive or neuroimaging biomarkers as meaningfully-related to the independent variable of exposure. Given

work by our group and others (McAllister et al. 2014; Johnson et al. 2014), the comparisons made in the large multi-institutional studies are at risk of revealing few differences between concussed and asymptomatic athletes. Lack of biomarker alteration due to concussion must not be misinterpreted to downplay the serious potential for long-term damage associated with this clinically recognized injury.

Findings of the Purdue Neurotrauma Group Study

Several key short-term findings in high school-aged athletes have been obtained from the PNG study as a consequence of the longitudinal nature of the study within each of the seven seasons of study to-date.

- a) The initial finding of the PNG study—in boys playing football—was the presence of statistically-significant decreases in functional MRI activation contrasts associated with completion of a rather simple working-memory task. While such a finding might not be remarkable on its own, these decreases were observed when the subjects (a) did not exhibit alterations in task success, and (b) did not exhibit outward symptoms associated with a diagnosis of concussion—i.e., were asymptomatic. Critically, these findings (Figure 2) proved to be best-correlated with recent exposure to head acceleration events (Breedlove et al. 2012; Talavage et al. 2014; Robinson et al. 2015), and the persistence of these decreases (Figure 3) appears to be related to average weekly exposure to head acceleration events experienced by the athletes (Breedlove et al. 2014; Nauman et al. 2015).
- b) A second finding in male football players was the presence of statistically-significant alterations in MR spectroscopic assessments of metabolite concentrations—in dorsolateral prefrontal cortex (DLPFC; a region associated with planning and executive function) and primary motor cortex (M1)—arising at the beginning of the period of exposure to collisions, and persisting throughout the competition season and beyond (Poole et al. 2014; Poole et al. 2015).
- c) An additional observation from male athletes participating in football (Abbas et al. 2015b; Abbas et al. 2015c) was that measures of the network connectivity, as assessed using functional MRI, exhibited statistically significant drops in the periods following increases in the average weekly exposure to head

- acceleration events—e.g., at the commencement of practices (typically associated with two contact activities per day), and late in the season (when activities intensify due to post-season tournaments).
- d) These findings were extended beyond male athletes to female athletes, with observation in functional MRI of decreased regulation of cerebrovascular reactivity (a measure of the coupling between brain activity and the vascular delivery of metabolites) in *both* male football and female soccer athletes (Figure 4) at the high school level, with the degree of this decrease in regulation linked to the number and aggregate energy associated with the history of head acceleration events as of the time of the assessment (Svaldi et al. 2015; Svaldi et al. 2016).
 - e) Finally, recent preliminary analyses further suggest that male athletes who are exposed to the highest levels of head acceleration events also exhibit the greatest *increases* in the directionality of the diffusion of water molecules in axonal tracts (i.e., increases in fractional anisotropy) as measured by diffusion-weighted MR imaging (Chun et al. 2015; Jang et al. 2016). This increase in the directionality of the diffusion of water (Figure 5) suggests that extracellular spaces—which normally do not restrict the diffusion of water—have been decreased, potentially through chronic inflammation of the brain.

In addition to these short-term observations, the cross-sectional nature of the study across seasons and associated comparison to peer controls (of like gender, and from the same high schools) who have not previously participated in contact sports, has highlighted population-level differences at the pre-participation assessment that suggest the presence of longer-term—possibly even persistent—alterations in brain behavior and health, that are likely to be undesirable for periods exceeding a few months (or even weeks) out of the year:

- a) Statistically-significant decreases in MR spectroscopy-assessed neural metabolites *during* the season, were found to represent drops from elevated concentrations *prior* to the season (Poole et al. 2014).
- b) Resting-state measures of brain connectivity, as obtained using functional MRI, were found to be elevated (relative to noncollision-sport peers) prior to the season, and to recover to these high levels once head acceleration levels stabilized during the season (Abbas et al. 2015b; Abbas et al. 2015c).

- c) Further analyses of brain networking using graph theoretic approaches (Bullmore and Sporns 2009) has revealed a meaningful dependence of pre-participation connectivity on *both* the (self-reported) history of concussion and the history of participation in sports involving repetitive exposure to head acceleration events, with a continuum appearing to exist from healthy noncollision-sport athletes without a history of concussion to collision-sport athletes having a history of concussion, with collision-sport athletes without a history of concussion lying at an intermediate location (Abbas et al. 2015a).

The tendency for both short- and long-term alterations to be associated with higher levels of exposure to head acceleration events strongly suggests that a key aspect to the prevention of subconcussive, and likely also concussive, injury is the limitation of exposure to such events. Approaches such as hit counts will not represent an ideal solution, when applied in a one-size-fits-all manner, but do represent an excellent first step in reducing the risks to youth athletes in regard to short- and long-term alterations in brain health. Enhanced modeling of individual athletes and continued exploration of the features of head accelerations that most contribute to subsequent alterations in cognitive and neuroimaging biomarkers can provide greater refinement in the future with regard to which events “matter” and are, therefore, appropriate to be “counted”. More critically, the potential that there does exist some axis (dimension) along which there is a minimum threshold above which head acceleration events are increasingly likely to contribute to short- and/or long-term alterations in brain health would argue that enhancements in protective measures and training could both contribute to an ultimate solution that reduces the risk of brain injury in youth athletes.

The Path to Prevention

Based on the findings above we propose the keys to safer participation include *(i)* improved education of coaches, officials, and parents regarding what may be regarded as “safer” levels of head acceleration events and how to control the incidence rate of these events during practices, *(ii)* improved protective equipment, increasing the efficacy in preventing energy transmission to the skull and brain, *(iii)* automated monitoring of

athletes for exposure to those head acceleration events that are most likely to contribute to brain injury, and (iv) improved training of athletes to minimize head accelerations associated with collision and whiplash events. As detailed in Talavage et al. (2015), the PNG study provides not only a means to detect and characterize changes as a function of acceleration event exposure, but also provides a framework in which prevention and intervention may be evaluated.

- (i) Educating athletes, coaches, athletic directors, officials, parents, and even healthcare providers so that they understand the mechanisms by which athletes expose themselves to large head accelerations, is an important step forward. Eliminating tackling from practice (as per the recent Ivy League mandate) was found in our study (Talavage et al. 2015) to appreciably decrease the average number of head impacts and concomitant alterations in observed biomarkers. Even if contact activities are not eliminated, altering participation schedules to provide more days off between such activities is likely to be beneficial due to the potential for natural repair processes to mitigate the cumulative damage.
- (ii) Beyond using some form of hit count to reduce the total number of head impacts, it is practical to improve safety equipment, including designing padding and helmets that absorb more energy and reduce the total energy delivered to the brain. While this is, in fact, not a difficult problem to solve, efforts have been slowed by the fact that equipment certification has focused on mitigating skull fractures and other major trauma, as opposed to concussion. Current helmet designs therefore prevent massive trauma (largely by spreading the force out over a larger area), but do little to reduce the energy transferred to the brain. Once the limits of energy transfer beyond which brain injury occurs are identified, it will be readily feasible to develop new design criteria for helmets and standards that, when combined with current testing protocols, will both eliminate massive trauma *and* dramatically decrease the energy transferred through the helmet to the brain.
- (iii) The PNG study has demonstrated that substantial changes in brain behavior can arise in the absence of (obvious) symptoms, and that these changes may accumulate over time. Consequently, improvement of diagnostic protocols—including both (a) telemetry-based monitoring of the number and magnitude of

head accelerations, and (b) clinical follow-up evaluations possibly including an array (e.g., blood and neuroimaging) of biomarkers and cognitive testing—should be expected, in the near future, to dramatically increase sensitivity and specificity of clinical assessments.

(iv) Continued educational protocols (akin to “Heads Up”) in conjunction with the telemetry argued for in (iii), have significant potential for rapidly enhancing player skill level, leading to improved techniques that decrease player risk of head injury. For example, low-cost sensors that monitor the number, magnitude, and location of head impacts can provide feedback to athletes and coaches, allowing them to encourage less-risky play and game techniques in real-time. Rapid and appropriate correction of poor tackling, heading, etc. will permit athletes to participate more frequently and more safely.

Concluding Thoughts

The search for neuroimaging biomarkers has yielded potentially powerful insights into the mechanisms of brain injury while also redefining what we should consider “injury” to be. Based on the PNG study findings that decreased exposure corresponds to fewer and smaller changes in brain function, it is critical that research efforts be put in place to enhance preventative approaches to brain injury, rather than solely focusing on post-injury recovery. Effecting these preventative approaches will require participation from multiple stakeholders, including parents, coaches, officials, and healthcare providers. All must advocate for measures that will further the *prevention* of brain injury, including reduction of exposure to head impacts, introduction of adequate rest periods between contact activities, and appropriate education of all participants in the sporting enterprise. In conjunction with the further advancement of the science, this joint effort has the greatest potential for improving the overall safety of youth, with long-term positive consequences for this vulnerable population.

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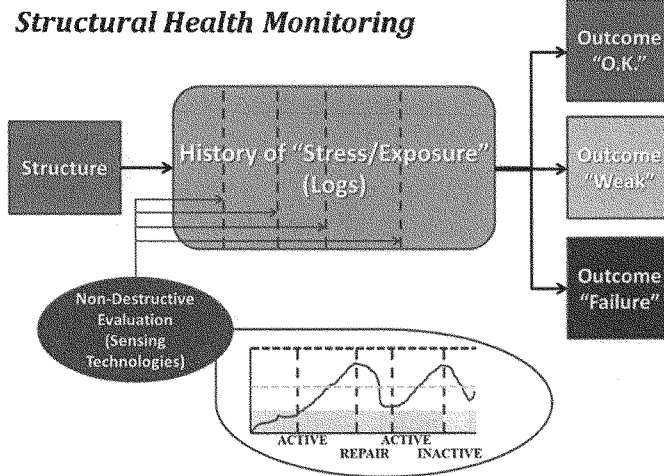


Figure 1: Block diagram illustrating the concept of Structural Health Monitoring (SHM). The structure of interest is monitored for usage over time, and periodically assessed using non-destructive evaluation methodologies. Each such assessment permits categorization of the structure as being healthy ("O.K."), altered ("Weak") or severely damaged ("Failure"). Note that depicted images are intended only as schematic representations of data and/or associated analyses. *From Talavage et al. (2016).*

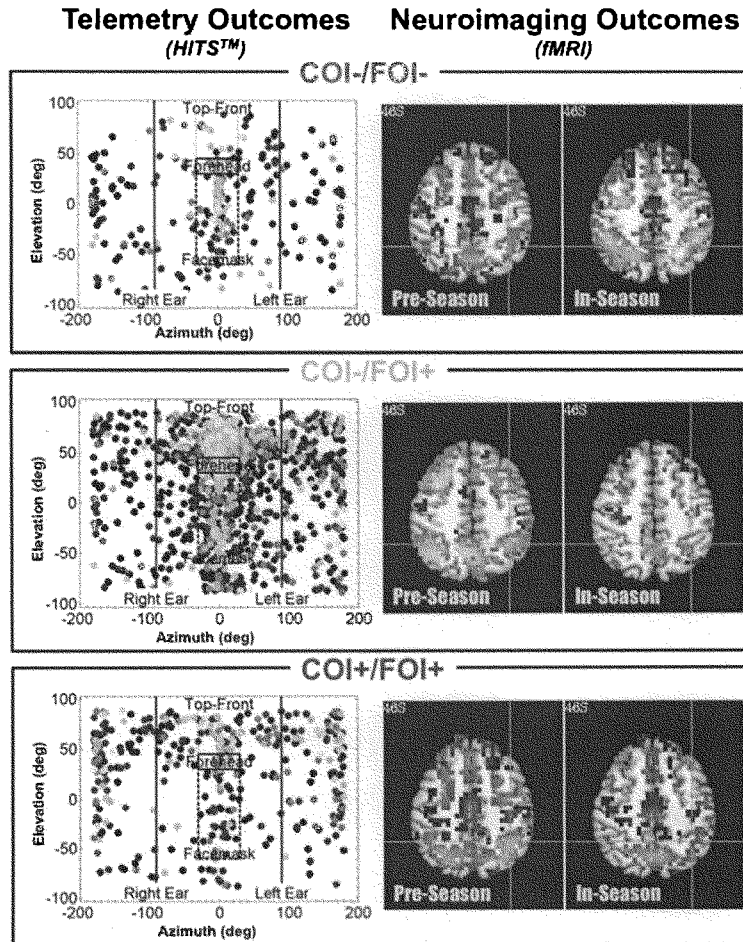


Figure 2: Comparison of (left column) head impact maps and (right column) fMRI measurements of "verbal" (letter-based) N-back working memory task for three high school athletes in the pre-season and subsequent to exposure to repeated head acceleration events. One athlete (top row) experienced a relatively low number of small magnitude hits and did not exhibit significant changes between pre-season and in-season scans. A second

athlete (*middle row*) exhibited a large number of hits primarily to the top front of the helmet and, although not diagnosed with a concussion, exhibited statistically significant changes in neurophysiology. This athlete was representative of a new category of impairment observed in 30-60% of high school football players studied. A third athlete (*bottom row*) who was diagnosed with a concussion took a number of large hits (orange and red circles) and exhibited substantial changes in neurophysiology. Activation is depicted for a 2-back vs. 1-back working memory contrast, with preferential activation for the 2-back task indicated by orange-red coloration, and for the 1-back task by blue-cyan coloration.

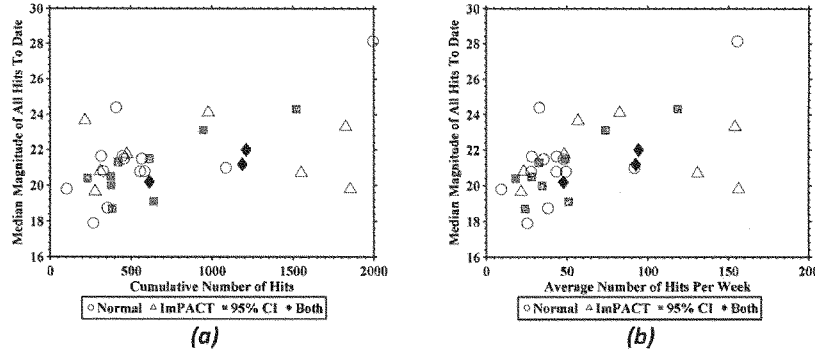


Figure 3: Relation of flagging category (ImPACT™ or fMRI or none) of players during post-season assessments, as related to the median magnitude of the blows taken over the course of the season and (a) the number of cumulative hits, or (b) average hits per week over the entire season. Open circles indicate that the subject's ImPACT™ and fMRI measures were within the normal range. Open triangles indicate that the subject's ImPACT™ test was flagged. Gray squares were used to denote those instances when at least 11 ROIs of a subject's fMRI scan exceeded the 95% confidence interval. Finally, black diamonds indicated those sessions where the subject's ImPACT™ and fMRI were flagged. A gap in our data occurred between 600 and 900 cumulative hits. Players who sustained more than 900 cumulative hits had a 75% chance of being flagged, whereas players who sustained fewer than 600 cumulative hits had only a 36% chance of being flagged. Similarly, a gap occurred in our data between 60 and 80 average hits per week.

Adapted from Nauman et al. (2015).

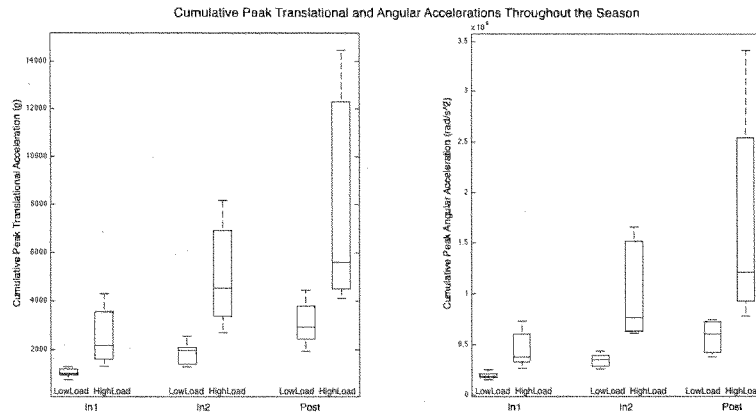


Figure 4: Box and whisker plots of cumulative peak translational acceleration (cPTA) and cumulative peak angular acceleration (cPAA) distributions for soccer athletes at each assessment session. Boundaries of boxes represent the 25th and 75th percentiles (1st and 3rd quartiles) and the line inside the boxes indicates the median (50th percentile) of the distribution. Assessment sessions *In1* and *In2* comprise intermediate measurements during first and second half of the competition season; and *Post* represents groupings based on end of season cumulative totals. Athletes are grouped by individual rank above (*HighLoad*; $n = 7$) or below (*LowLoad*; $n = 7$) the median Relative Cumulative Exposure (RCE; see text). Athletes in the *Top* group were observed to have experienced significantly greater cPTA and cPAA than athletes in the *Bottom* group at each session ($p_{FDR} < 0.05$, unpaired t -test). Note that the *HighLoad* and *LowLoad* groups are session specific—i.e., an athlete need not remain in the *HighLoad* or *LowLoad* group for all three assessment periods. Adapted from Svaldi et al. (2016).

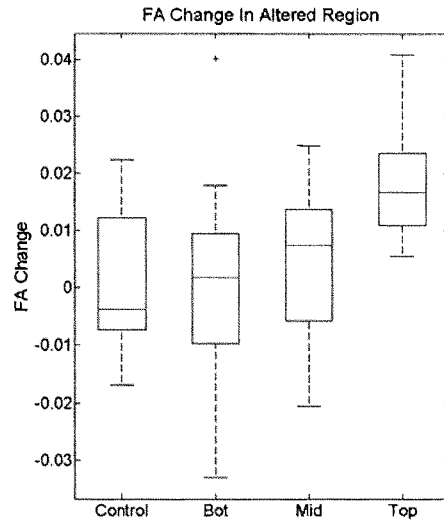


Figure 5: Distribution of fractional anisotropy (FA) changes in white matter regions of interest indicate that high school-aged male athletes participating in football who experience the highest levels of repeat exposure to head acceleration events (*Top*) exhibit statistically significant increases in FA relative to their pre-participation assessment. This elevation of FA suggests that these athletes are experiencing inflammation of the brain (Povlishock and Katz 2005). Test-retest contrasts are indicated for high school-aged male athletes participating in non-contact sports (*Control*; N=15) in addition to three groups of football players, divided into thirds (upper = *Top*, middle = *Mid*, lower = *Bot*; N=15 in each) based on accumulated counts of head acceleration events reported by the xPatch (X2 Biosystems, Inc.) to exceed 20 g (McCuen et al. 2015). From Jang et al. (2016).

Mr. MURPHY. Thank you, Doctor.

I do want to recognize—I'm going to start off with some questions here and let the members know that we're going to try and continue this. There will be one vote at some point. We're going to try and continue on and roll through that vote. So we'll just start.

I do want to recognize in the audience, we have Nick Lowery, Nick the Kick, right, played for the New England Patriots, the Jets, and the Chiefs. Good to have you here today. Thank you for your interest in concussions.

Also, Shawn Springs from the Ohio State, also the Redskins, Patriots, and Seahawks. I think you were the number one pick for the Seahawks, Pro Bowl. Both of you played Pro Bowl. Thank you for your interest also in concussions.

And a former colleague, Phil "the Doc" Gingrey, is here as well. We appreciate you coming back. I do want to say he didn't make the Georgia Tech team, but I do understand you drove the mascot car, the Ramblin' Wreck. So it's nice to know your skill sets were seen where they were placed by Georgia Tech. It's a good thing.

All right. I now recognize myself for 5 minutes.

This goes to Dr. Gregory, Mr. Margarucci, and Mr. Stenersen. From the perspective of a youth sport organization, what are the greatest needs in terms of research related to concussions and player safety? Can you comment on those?

Dr. GREGORY. Sir, for clarification, the greatest needs?

Mr. MURPHY. Yes.

Dr. GREGORY. So my first response would be to agree with Dawn Comstock that we have these databases in college and high school, and we don't have them in youth sports. And so establishing a database for youth sports injury, I think, is imperative.

Mr. MURPHY. Mr. Margarucci, do you have a comment on that?

Mr. MARGARUCCI. Yes. I would echo Dr. Gregory's statements, that we do need to have a database of injuries that are occurring in our youth sports so we can make these decisions. And it's hard—we don't want to wait for the future, but we need to start, I think, gathering some of this information right now.

Mr. MURPHY. Mr. Stenersen?

Mr. STENERSEN. I would agree. I mean, each of us as sports is trying to do our best to fund research to our nonprofitabilities, but we need greater resources here to be able to drive that research into the youths' play area.

Mr. MURPHY. So along those lines with research, do you encourage coaches? Is there a way to help coaches and teams also keep track of their own database? This also, I assume, Coach Teevens too, that coaches keep track of their own data to see what happens at their own coaching style as a comparison. Would any of you like to comment on that?

Mr. STENERSEN. Well, I would say, and Dr. Comstock probably has a word here, but the challenge with that is the quality of the data that's collected. And unless it's collected well and consistently, which coaches, generally speaking, are not want to do, then we're concerned about having flawed data.

Mr. MURPHY. Dr. Comstock, do you have a comment on that?

Dr. COMSTOCK. Yes, I agree. We are concerned about the quality of the data, and that is directly correlated to who's reporting the

data. At the high school and the collegiate level, we rely upon certified athletic trainers, certified athletic trainers, to report this data to us. However, I and others have been investigating ways that we could modify our surveillance systems to enable either a parent or a coach who is trained appropriately and appropriately motivated to be able to report, perhaps not 300 variables per injury, but at least enough variables that we could drive forward a lot of these discussions.

Mr. MURPHY. And, Coach Teevens, you did record, you did look for specific data.

Mr. TEEVENS. Through the conference in general overseas and each medical team within the institutions report back. So it's—

Mr. MURPHY. And that's helpful to give the feedback, then, along those lines?

Mr. TEEVENS. It is. You see where you stack up to some other teams in your league.

Mr. MURPHY. OK. So let me ask the panel too. How significant is the issue of athletes not reporting concussions? So if they themselves have symptoms, but they're not giving that information on. Can you comment on that? Who would like to comment?

Dr. Gregory?

Dr. GREGORY. Yes. So I can tell you at all levels that is an issue, that the problem's being knowing what the symptoms of concussion are, and then if you report it to somebody, that person knowing what the symptoms of concussion are. So I do think that what Dawn showed with that data, that concussion rates are actually coming back down, I think is a result of education of coaches, athletes, players on what the signs and symptoms of concussion are.

Having said that, I don't think we can stop there. We have to continue those efforts so that everybody is aware of that.

Mr. MURPHY. Anybody else want to comment on the player?

Yes, Dr. Comstock.

Dr. COMSTOCK. Yes, sir. Actually, that same graph that showed the doubling of concussion rates between 2008 and 2012, our high school athletes didn't suddenly become twice as fast, strong, and vicious. The years preceding that, there were concussions occurring that just went undiagnosed, unrecognized. So the increase in the concussion rates, I think, truly reflect the great deal of education that's been done by individuals on this panel as well as groups like CDC and CIPC, the National Federation of State High School Associations, to make sure that when a concussion occurs, it is recognized—

Mr. MURPHY. So it may not have been that prior to that increase that concussions weren't occurring, it's just they were just getting reported?

Dr. COMSTOCK. Exactly.

Mr. MURPHY. And that means educating the players as well as the importance of doing this.

Dr. COMSTOCK. Yes, sir. And the parents and families and—you know, the parents of these young athletes. It's important to educate them as well.

Mr. MURPHY. Do you see this as an ongoing problem with regard to injuries that this is working or you still have a ways to go?

Dr. COMSTOCK. Well, I think the fact that that curve has seemed to have peaked and leveled off, I think it actually is an indication, coupled with the last slide that I showed that shows how much better we're doing at managing concussions. I think both of those speak very highly to the success that we have had to date in educating parents, coaches, athletes, policymakers about concussion. We still have further to go, particularly in the younger groups.

Mr. MURPHY. Thank you.

I'll yield now to Ms. DeGette for 5 minutes.

Ms. DEGETTE. Thank you so much, Mr. Chairman.

I want to take a look at some of the science that's out there. And by the way, it was really an excellent panel with everybody giving a great perspective.

Dr. Talavage, your work examines high school football players as well as high school soccer players. Can you tell us, from your research, about the head impacts from contact sports and how they impact head injuries?

Dr. TALAVAGE. Yes. So what we've observed through our 7 years of study is that when the athletes take large amounts of blows per week, whether they be of a modest size, such as 10 G or above—10 G just as a reference, if you just stand up and drop down into your chair, you will generate roughly 10 times the force of gravity acceleration on your head.

So when players are taking numbers of 60 to 70 blows per week in football, for example, then those male athletes tend to start showing alterations in their brain physiology that are suggestive of either damage to neurons or at least some sort of impairment in the way information passes around your brain, and ultimately results in you being able to respond to a question or to answer a task or to achieve a target on a game or particular activity.

For our female soccer players that have been in our study, they do not take quite that number of blows, but one of the things we have observed is that they get hit pretty much every day. So in the State of Indiana, high school football is able to practice 2 days per week plus have a game. Soccer, there is no restriction. They tend to practice 5 to 6 days per week.

So we do find that not only are there changes from the actual raw number of blows, how frequently they're getting hit, but there strongly appears to be a consequence of how much time off are they given, which would suggest that there are natural repair mechanisms that we can exploit. And I believe that when we have these reduced contact cases, we are in fact benefiting our athletes.

Ms. DEGETTE. Thank you. We had a forum in this committee in March, you heard us talking about it, and at that forum, there were some researchers who suggested that we don't have enough science to act on this issue, and they said we should wait till there's more research. What's your response to this line of questioning? Very briefly.

Dr. TALAVAGE. I don't believe that.

Ms. DEGETTE. And that's because you actually have scientific research?

Dr. TALAVAGE. We have now about 16 papers in publication and we are working now with several other institutions around the country, including Penn State University, Northwestern Univer-

sity, Ohio State University, Michigan State University, and University of Nebraska to publish work that shows that there are, in fact, changes in the brain when you—

Ms. DEGETTE. If you wouldn't mind getting that data to this committee, that would be very helpful for us in our investigation.

Dr. TALAVAGE. Be very happy to.

Ms. DEGETTE. Thank you.

I just want to ask you a couple of questions, Dr. Comstock, about gender differences in concussions and head trauma. The surveillance data you collected shows that girls soccer has one of the highest rates of reported concussions among high school sports. What do we know about gender differences in concussion rates? Are girls more likely than boys to get concussions?

Dr. COMSTOCK. Yes. That's a million-dollar question, if you will. We first reported in 2007 that in gender-comparable sports, so sports that both boys and girls play by the same rules, using the same equipment on the same fields, sports like soccer and basketball, girls have higher concussion rates than boys. That's now been replicated by other researchers in other populations.

What we don't know at this point, people are working on the question, is, is it a biophysiological problem, are girls somehow—

Ms. DEGETTE. Right.

Dr. COMSTOCK [continuing]. Different—

Ms. DEGETTE. Right.

Dr. COMSTOCK [continuing]. And are they really sustaining more injuries, or is it a sociocultural issue? Because we don't have a definitive, objective diagnostic test for concussions, we're reliant on self-reports, and young female athletes may be more likely to report it when they're experiencing signs and symptoms.

Ms. DEGETTE. But do we need to get more data?

Dr. COMSTOCK. Well, we already have the data that's consistently shown this gender difference. We do—

Ms. DEGETTE. But what do we need to prove, then?

Dr. COMSTOCK. So this is one case where surveillance data isn't enough. We do need more detailed research to try to determine are there biophysiological differences or is it a sociocultural issue.

Ms. DEGETTE. And, Dr. Talavage, you're nodding your head yes, you agree.

Dr. TALAVAGE. Yes. I mean, this is exactly what the intent of our type of study is. If we can understand how the brains are changing, we can determine whether or not it takes less to do it.

Ms. DEGETTE. And you've got girls and boys?

Dr. TALAVAGE. We have girls and boys, 5 years—

Ms. DEGETTE. Now, Dr. Comstock, I'm almost out of time. I just want to ask one more question.

Dr. COMSTOCK. Yes, ma'am.

Ms. DEGETTE. You say that there's no data for—there's no surveillance for under high school ages. Do you think this is something that should be instituted so that people like you can get that data to see exactly what's going on?

Dr. COMSTOCK. Yes. I would love to do it. I'll give you the name of ten other researchers that can. This is imperative.

Ms. DEGETTE. Who should set it up?

Dr. COMSTOCK. My work has not been federally funded. I've had nine different funding sources in 11 years of surveillance. The NCAA funds their own system. I think it should be a Federal effort, but I don't care if it's a joint effort of every one of these organizations of youth sports. Somehow we have to get it done.

Ms. DEGETTE. One has to do it.

Dr. COMSTOCK. We have to get it done.

Ms. DEGETTE. Thank you very much. Thank you for coming.

Mr. MURPHY. Thank you.

Just to remind members that votes are called. We're going to continue to roll through.

Dr. Burgess, you're recognized for 5 minutes.

Mr. BURGESS. Thank you, Mr. Chairman. I thank the panel for being here this morning.

Coach Teevens, can I just ask you, I mean, your testimony, when I read through it last night, it was like, wow, this is a revelation, and it seems so obvious. Once you understand that, oh, my gosh, this is a repetitive injury, so you're not repeating the injury during practice, and so the only contact is on game day. But that must have been kind of a hard decision to make, because, I mean, when I was a kid growing up, it was always repetition, repetition, repetition, practice, practice, practice. Remember the old commercial? So what—

Mr. TEEVENS. When I announced it to my coaching staff, they were waiting for the punch line. They thought I was kidding. But I put enough time and effort into it. I thought it was the appropriate approach to reduce injury with my players.

Mr. BURGESS. And you feel now—of course, you, what, 5 years into this, you feel you have—

Mr. TEEVENS. It's made a decided difference in the way that we practice, the safety. Peripheral injuries have dropped as well, just the confidence. My frontline guys practice through the course of the season. Defensively I had two players miss games this year. One had a high ankle sprain, and at our discretion we kept him out. Another had a lacerated kidney, a leg whip, a freak incident, he missed five games. That was it.

So the regularity and the players—and I tell them, the rules of the game are get the guy on the ground; not injured, get him out of the game, get him on the ground. And you can teach that skill set. And we just—we practice it extensively, and I think we do a very good job, understanding it's an injurious—there's a risk playing the game, and we can minimize the risk.

Mr. BURGESS. Let me ask you this, and maybe you—and I'm sorry I wasn't here for your testimony, but when you go back and look at your record prior to instituting this program and in the years since, is there a marked difference?

Mr. TEEVENS. We were 0 and 10, 2 and 8, and we ended up the last two seasons 8 and 2, and this past year 9 and 1.

Mr. BURGESS. So you've become remarkably better as a coach in that time?

Mr. TEEVENS. Yes. Appreciably better, appreciably so.

Mr. BURGESS. Well, that's, again, fascinating story. It seems so obvious when you look at it. OK. Repetitive injury: We're going to

reduce the risk by reducing the repetition, then—I, you know, certainly want to thank you for—

Mr. TEEVENS. Quite simply, the more you hit, the more you get hurt.

Mr. BURGESS. I want to thank you for bringing that—

Mr. TEEVENS. Thank you, sir.

Mr. BURGESS [continuing]. To the committee today. I don't—I mean, again, I don't know that I was aware of that. I don't know how I would have been aware of it.

Mr. O'Neil, I wanted to ask you, because, you know, when I first started reading your testimony and Practice Like the pros, and I thought, oh, my gosh, that would be dangerous, wouldn't it? Because, I mean, those are the guys that really—dreadful stories you read about people who actually try to hurt each other in a game. But you had the observation with watching a practice that you said it was almost like a ballet. Is that—do I understand that correctly?

Mr. O'NEIL. Yes, sir, it is, in that, as we pointed out with the video, the players execute every aspect of the play in rehearsal for Sunday until the moment of imminent contact, at which point they break away from each other and pat each other on the back.

In the high school level, the proof of the efficacy of this is in the State of Wisconsin, the only State that is adhering to our standards at this point, put the standards in 2 years ago for the 2014 season. The University of Wisconsin Medical School did a study that year, the results published last October. Wisconsin high school football cut its concussions by more than half simply by adhering to our standards. That's a—that is a breathtaking number in our business, to cut your concussions by more than half in 1 year. The quality of Wisconsin football has never been better, the players are fresh and ready to play. It is the high school model of what Mr. Teevens is describing at Dartmouth.

Mr. BURGESS. And has there been sort of widespread acceptance of that in the high school level?

Mr. O'NEIL. I'm glad you asked. Coach Teevens and I went to the Wisconsin high school clinic about 7 weeks ago in Madison. Because of these restrictions and because the coaches need to know how to practice with less contact, we had enormous attendance, more than 125 coaches. And the greatest followup that we've experienced in our 30 clinics around the country, more than half of those coaches asked for copies of our videos so that they could take them, show them to their staffs, show them to their players, and teach their players in the 30 minutes, just 30 minutes of contact per week in practice, how to practice like pros or like the Dartmouth Big Green.

Mr. BURGESS. You know, I can't help but observe that Emmitt Smith won "Dancing With the Stars" a few years ago, probably based on that same concept. Because weren't some pro players using essentially dance moves and ballet moves to improve their performance?

Mr. O'NEIL. They were. And, Congressman, this—this approach of less contact in the pros actually dates way back to Bill Walsh at the 49ers in the 1980s, and has been refined and developed by his disciples along the way to a point where so many college players look forward to entering the pros in order to avoid the carnage

of 90 minutes, twice a week, full contact in college practice, and instead practice the way the Dallas Cowboys have for many years.

Mr. BURGESS. Thank you very much.

Thank you, Mr. Chairman. I yield back.

Mr. MURPHY. I thank you.

I now recognize Ms. Schakowsky for 5 minutes.

Ms. SCHAKOWSKY. First of all, I want to thank the moms that were here. I want to thank Kelli Jantz and Karen Kinzle Zegel.

Mr. O'Neil, you showed that video of Dr. Ann McKee answering my question at that—

Mr. O'NEIL. Yes, ma'am.

Ms. SCHAKOWSKY [continuing]. At that roundtable. And I wanted to focus on CTE, because I think very little focus has been on the subconcussive brain injuries. And as she said, it's about limiting the head injury that occurs on every single play of the game at every single level of the game. And I followed up that question to Jeff Miller of the NFL, he's the chief person for health and safety, and said, what do you think? Is it—is CTE linked to football? And he said, "Yes, certainly."

And little did I know that this was a kind of explosion that happened outside, outside that room, and even has started some conversation about what is the future of football? Is there a future for the kind of football that we play?

So there's been a lot of talk about concussion, but I wanted to ask now more about CTE. So, Dr. Talavage, what does your research indicate about the effect that routine hits sustained by high school football players and younger have on brain function, even though they don't rise to the level of concussion? What about CTE?

Dr. TALAVAGE. So at this point, the linkage to CTE is a little bit nebulous from our—coming from our end. Obviously, from Ann's end, where you're able to look and see that individuals who have experienced larger numbers of hits over their career and over their lifespan tend to have more deficits and tend to be more likely to evidence CTE, as per brain banks, I think there's at least good circumstantial evidence for there to be a clear linkage between the total exposure and the total amount of brain stress that's accumulated from getting hit repeatedly day after day after day, year after year.

Within our own athletes, though, what we can at least identify is that our athletes spend probably 5 to 8 months of the year in what appears to be a state of almost chronic inflammation. And when you have chronic inflammation, we know in the rest of the body that's a bad thing in the context that the cells are not able to eliminate waste, they're not able to bring in nutrients to keep those cells healthy.

And so if what we're seeing is, in fact, proven to be true in our continued study, that we do have a level of chronic inflammation essentially for 5, 8 months of the year, then we are definitely putting our athletes at risk of precisely the types of biochemical processes that are going to lead to CTE.

Mr. SCHAKOWSKY. Is there any test for CTE before an autopsy after death?

Dr. TALAVAGE. There are several imaging methodologies that propose to identify the presence of Tau biomarkers within the body, but there's nothing that has yet been confirmed.

Mr. SCHAKOWSKY. My understanding is the kind of subconcussive events have to do with the brain inside the skull, and has virtually nothing to do with helmets?

Dr. TALAVAGE. So a helmet can, in fact, absorb energy, and it would be very easy, in fact, to improve helmet designs, but the companies aren't terribly interested in it at this point. Their goal is to meet the standards. The standards that are set forth are to prevent skull fracture and death on the field, which is clearly a goal, which they are very effective, but they do nothing to prevent concussion at this point in a meaningful sense. Energy absorption would reduce the amount of energy that reaches the brain. If you reduce the amount of energy that reaches the brain, you are going to reduce the amount of torsion, pulls, stress, compression on the cellular tissue. And if you do that, you will, in fact, start to see a reduction in the consequence of subconcussive hits. You should see a reduction in the observation of concussion, and you should, in the long term, see the reduction in the situation such as CTE.

Mr. SCHAKOWSKY. Dr. Comstock, you don't think that kids under what age should be playing tackle football?

Dr. COMSTOCK. That's actually—I've never made any recommendation.

Mr. SCHAKOWSKY. Oh, I thought you said something about it.

Dr. COMSTOCK. Yes. I am aware of other researchers that have given exact cut points.

Mr. SCHAKOWSKY. Did someone on the panel say that?

Mr. O'NEIL. I did, Your Honor—Ms. Schakowsky. Our organization is the one in five national organizations operating in this space that believes strongly that grade school boys and girls should play flag football exclusively, and that contact football should start in ninth grade with a transitional phase in seventh and eighth grade where in shorts and T-shirts, boys who intend to play in ninth grade begin to learn how to tackle and how to block using the state-of-the-art in tackling technique called Sea Hawks tackling pioneered by the coaches, Pete Carroll and Rocky Seto of the Seattle Seahawks; Mr. Seto, being one of our leading supporters and a fellow who tours with us and had made a number of videos for us.

Mr. SCHAKOWSKY. Now, there's been a good deal of pushback after Jeff Miller made his—his comment, Jerry Jones, the owner of the Dallas Cowboys, you know, has absolutely disregarded that. There's actually been some mocking of that, and this idea of the conduction between manliness and football, I think, is really concerning. And I wanted just to ask—let's see. I had a couple of other questions.

Dr. Gregory, I am particularly—you know, if once all the—well, let me ask you before my time runs out. That USA Football's guidelines limit full contact practices to four times a week, but I note that this represents more contact practices than at current higher levels of football, such as the college level and even in the NFL.

So, you know, given all this evidence about repeated hits to the head, why hasn't USA Football taken steps to further limit full contact practice for young children?

Dr. GREGORY. So the question is a good one, in that we recognize that tackling causes injuries. If you look at data that we do have in youth football—

Mr. SCHAKOWSKY. My time is up. So why haven't you?

Dr. GREGORY. So what we have instituted is ways of trying to decrease the number of hits that there are. The concern is if you take it away completely—

Mr. SCHAKOWSKY. What about the four times a week?

Dr. GREGORY [continuing]. If you take it away completely, you still have to learn the skill. At the youth level, we don't have the resources that you have at the high school or college level to teach the skill. That's what we're trying to do is teach the skill to learn how to tackle appropriately gradually over time. That is the goal, to do it well, to protect your head.

Mr. HUDSON [presiding]. Thank you.

At this time, I'll recognize myself for 5 minutes to ask questions.

Mr. O'Neil, thank you for the work you do. I appreciate the information you gave us today. You advocate that children under 14 should not be permitted to tackle, and should be limited to high school athletes. How do we assure that young athletes learn proper tackling techniques so when they do enter game situations, that they are not going to resort to distinct or more dangerous tackling, head down, whatever the case may be? If they don't get that practice when there's—contact is not as hard as it would be later, is there a concern of them internalizing those techniques?

Mr. O'NEIL. If staff would, possibly, allow me to queue up a 17-second video clip—

Mr. HUDSON. Sure.

Mr. O'NEIL [continuing]. Of Rocky Seto, which is number 24 on our agenda here.

Coach Seto is the guru of tackling. He and Pete Carroll had devised this system in Seattle that has become the standard in just 2 years, introduced 2 years ago in the spring. They put out three videos. And as I say, Coach Seto tours with us.

No, it's not that. It's a—as I say, number 23, Rocky Seto tackling in shorts. Just to answer your question, Mr. Hudson, is what we recommend in seventh and eighth grade, is rather than hitting each other, these boys need to learn in shorts and T-shirts. They need an introduction to weight training. They need some strengthening of their necks, which I think all the scientists here would agree is important in preventing concussion. They need to learn how to wear the pads and be ready with this gradual run-up to ninth grade to be prepared without the many, many collisions involved in youth contact football.

As we heard from Dr. Ann McKee so eloquently 2 months ago, it's the cumulative head trauma that causes brain injury. And you don't want to start that at age 5, which is permissible, according to some of the organizations represented here today, boys of 5 years old playing contact football is, in our minds, quite surprising.

Any luck, Jake?

Mr. HUDSON. We'll look at the video after.

Mr. O'NEIL. I will be happy to show it to you, Mr. Hudson.

Mr. HUDSON. Thank you.

So are there examples of cases where young kids have not had contact, have been until they reach high school age where they have been successful and—

Mr. O'NEIL. Thank you for asking. Tom Brady, Eli Manning, Peyton Manning.

Mr. HUDSON. I've heard of those folks.

Mr. O'NEIL. Archie Manning has waxed eloquently in The Washington Post here just a few years ago. I think his phrase was, God, what a great game flag football is.

My son, a quarterback at Tufts University, would not be playing college football if he hadn't played flag instead of contact. It taught him everything he needed about reading defenses, making decisions, making good throws, all the teamwork, all the character building. Believe me, those who suggest that those qualities can only be developed in contact football have not heard my younger son and his teammates in the back seat of the car, as I drive them around, recounting their victories in flag football 4 and 5 years ago.

The highlight of their athletic careers, they were already made football fans for a lifetime. They wore the NFL Jersey in playing flag. They came out of it healthy with an experience that has—has made them the young men they are.

Mr. HUDSON. Great. Thank you for that.

Coach Teevens, do you have any thoughts on this, just in terms of if you wait until you are older to start learning tackle techniques, is that going to be a problem?

Mr. TEEVENS. If it deprives people of an opportunity, they are still going to catch up real quickly. One of nine kids, six boys, we all played football in high school, and that was it, and all had fairly successful careers. There are a litany of people that have gone on. I don't think it's absolute. The big thing is it to educate. If they are going to play a young age, educate them properly, start slowly and make sure that you deprive them of as much contact as possible.

Mr. HUDSON. Thank you for that.

Dr. Gregory, you have anything you want to share on this?

Dr. GREGORY. I'll only add in that I think if you are going to take the contact away, that the education piece on how to tackle is imperative, and that is the challenge for us in youth sports without the resources. I will also add that USA Football administers the largest flag football league in the country, and so, we are proponents of flag football. It isn't USA tackle football; it is USA Football, which is all inclusive. And so, I think it's important that we promote flag football as well.

Mr. HUDSON. Thank you.

Let's go back to Mr. O'Neil. Your organization is trying to change the culture of high school football advocating this limited contact, more akin to what's being used at the professional level. Is your testimony—or in your testimony, highlight the fact that only one State has adopted your standards so far? In light of the successful outcomes in that State, have others expressed interest?

Mr. O'NEIL. It's a good question, Mr. Hudson. What we need is more participation from the State governing bodies around the country. And the word is traveling. We find that when the State governing body gets behind it, as happened in California 2 years

ago, a piece of legislation passed there for the first time in any State limiting contact on the practice field.

But they invited us out for a tour. Coach Seto of the Seahawks, Coach Teevens, Anthony Munoz, Warren Moon, we hit four cities in 2 days, and we had enormous participation because the CIF, which governs athletics in California, made it mandatory for every State—for every coach in the State. So we saw 1,200 coaches in 2 days. We are going to Alabama in July, same thing occurred there.

A very enlightened State, an executive director who understands, has made our clinic, after seeing us last year, mandatory for every coach in the State. So we will greet a ballroom full of more than 1,000 coaches in Alabama on July the 20th.

Mr. HUDSON. Great. I've got 15 seconds. Any opposition you've received? You want to briefly describe that?

Mr. O'NEIL. Oh, absolutely. I've dragged Coach Teevens to places where there were 450 coaches at a convention, and at our session, 20 showed up, and the other 430 were standing out in the hallway saying that they didn't want to hear it right now. Absolutely. It's not like we're having raging success. It's very mixed around the country, and will be until, as I say, until the State governing bodies at least give us a hearing and mandate that all the stakeholders, not just the coaches, come into the room and hear what we have to say and see it on video. When they do, we almost never fail to convert.

Mr. HUDSON. Great. Thank you.

At this time, I'll recognize Mr. Pallone for 5 minutes for any questions he may have.

Mr. PALLONE. Thank you. Earlier this year, the Ivy League received significant press attention for their move to eliminate tackling during regular season practices. And the league now has no contact practices during the regular season, as well as strict rules about the amount of contact and practice during the spring and preseason. So I wanted to ask Mr. Teevens—if I'm pronouncing it correctly—you implemented these changes at Dartmouth several years before they were adopted by the Ivy League. What motivate you to reduce the amount of contact in your practices, and what was the initial reaction when you proposed those changes?

Mr. TEEVENS. Well, the injury rate was the stimulus, and we just had too many guys going down, like what's the story, concussion, all that type of thing resurfacing, and it just struck me we can do this in a better way, watching what we did during research on tackling, and we started to do it. It was not well received. Still not well received by an awful lot of people. I did make a recommendation through Robin Harris at the Ivy level, and it was a 5-minute discussion. All of the coaches that played against Dartmouth, they know how we played, they know how effectively we tackle, and the vote was unanimous. It was progressive in mindset to say Hey, this is the direction we should travel.

Mr. PALLONE. And how have the rates of head injuries changed since you implemented these no-contact policies? Have you seen any other benefits?

Mr. TEEVENS. Five years ago, I was, like, most programs in the country, maybe 15 to 20 during the course of the year, and this past season we had two—two preexisting situations, both young

men that can no longer participate. Our defense, which was nationally ranked, had zero concussion this year. Spring practice last 2 years, if my numbers are correct, we've had zero in spring practice, and that's similar to concussion season in college football.

Mr. PALLONE. Great. In your opinion, are full contact practices necessary to ensure success on game day and for athletes' future careers?

Mr. TEEVENS. No, I don't believe so. To the point of imminent contact, you can do everything you need to; you can replicate tackling styles on bags and pads and with sleds, and I really believe and I tried to convince high school coaches of this as well. You can do it at any level. I've got a 3-year-old grandson. I have him tackle pads off the side of the couch, and see he gets it. And I think that, again, crawl, walk, run, mindset can introduce skill sets that would be helpful down the road, but don't have to be practiced live that frequently.

Mr. PALLONE. Now, given the research, do you think that engaging in full contact practices three, four, five times a week bear significant risk for young athletes?

Mr. TEEVENS. Without question. The more you hit, the greater—the greater the risk of injury. And by just eliminating, we've seen that, quite frankly, in all aspects of our game; shoulders, necks, backs, arms have diminished appreciably, and it's made up a better football program.

Mr. PALLONE. Well, thank you.

I wanted to ask Mr. O'Neil. We've seen many different rule changes being implemented across sports, across leagues, across States. There has been some criticism that these rule changes upset the integrity of the game. What do you think about the recent announcement that Pop Warner is eliminating kickoffs and kick returns? Will that prevent brain injuries, in your opinion?

Mr. O'NEIL. Good question, Mr. Pallone. My reaction is this is Pop Warner's way of saying that grade school boys are not capable, physically, of playing the game the way it's designed. This is—they are making our argument. They are making the argument that these boys should be converted to flag football until they reach a physical maturity at 14 or 15 to play the game the way it's structured. We advocate no basic changes in the game. We also say, there will not be any further rule changes that we don't believe that will make the game noticeably less dangerous. The game is the game. We don't advocate any major change to it, but we do say very strongly, boys in grade school are not nearly prepared to play it the way it's designed, the way adults play it. And, therefore, both boys and girls ought to be playing flag football until boys make a transition, if they choose, to play contact in ninth grade.

Mr. PALLONE. So just so I understand, you're not recommending—you don't think any other changes would better protect the kids other than if they continue with the present play?

Mr. O'NEIL. Mr. Pallone, it won't be football if we continue to strip away the kick return, the punt return, the three-point stance, there are any number of proposals out there. We are opposed to all of them. We think that those are ways—likewise, heads-up tackling, heads-up tackling is an attempt to somehow sanitize the very difficult, very physical act of tackling. It can't be done. Tackling is

tackling. Rocky Seto's Seahawks' tackling defines it exactly as it's done, and should be done, at the three levels of football where the game should be played. If boys can't tackle the way the technique was designed, they shouldn't be playing contact football; they should be playing flag until such point as they are ready physically to play.

Mr. PALLONE. I thank you.

Mr. HUDSON. I thank the gentleman. At this time, I'll recognize my colleague from Virginia.

Mr. GRIFFITH. Thank you. Thank you, Mr. Chairman.

I do apologize. I took my jacket off and over ran to vote, ran back in the rain, and I got wet. So I took by jacket off. I do apologize for that.

Mr. HUDSON. You're forgiven.

Mr. GRIFFITH. Mr. O'Neil, my boys are 8 and 10. My 10-year-old tried tackle football. When my 8-year-old was 7, he played flag. It's not available for him now. Have you all done some studies here? In all your testimony, have you done some studies on how many kids, because they are not ready to do tackle, actually drop out of the sport?

Mr. O'NEIL. It's a very—we haven't, sir, but it's a very, very good point. Football loses any number of good candidates for the fact that we throw these boys in unprepared physically at a young age.

There is a sound bite—I'm now adding sound bites that I would like to play for you when we finish. But I have 1 minute of John Madden, my former colleague at CBS, the coach and broadcaster. He tells a story wherein his son coached ninth grade football at a school in California for 15 years. And John said to him, if you take a boy who did not play contact youth football, and he's a pretty good athlete, match him up against the boy who did play contact football through grade school, how long would it take the boy who did not play to catch up with the skills of the boy who did? Joe Madden, his son, said to him, One week. One week it would take him to catch up to what supposedly had been learned by a youth contact player those 8 years that he took all that head trauma from age 5 to 13.

Mr. GRIFFITH. And I appreciate that.

I am going to have to move on.

Dr. Comstock, I was intrigued with your testimony about young women have more concussions than young men. Do you find that to be true? Do you have an—is that true through all age groups, middle school, high school, and college?

Dr. COMSTOCK. So in the age groups that we have, good surveillance data, it has been consistent, both with my data and other good surveillance systems, so across slightly different populations and the high school and collegiate age group. We, in the middle school and younger age group, we only have very small studies of like one league or one school district. Based on those, it appears it's also so on the underage groups, but we don't have national data to answer that question.

Mr. GRIFFITH. I appreciate it. I'm sorry we have some limited time here.

Mr. Stenersen—I apologize for my pronunciation—U.S. Lacrosse has invested in the development and deployment of the sports first

standardized coaching and officiating education curricula. In your testimony, you observed that properly trained coaches and officials are the most effective interventions for players' safety. Is that conclusion based, at least in part, on the changes you've seen in injury rates since deploying the curriculum?

Mr. STENERSEN. In part, yes. But it's—it's more based on kind of our fundamental belief that if you can't teach a sport correctly, and according to the rules, the outcomes are going to be not what you want.

So—and I would add that part of the challenge we see that hasn't been mentioned yet is in youth sports such as soccer and lacrosse and ice hockey, I think we are seeing a significant privatization of the sport, which means that kids are playing more frequently, more games, at younger age levels. And that privatization in sports specialization is compounding this concern in our sport.

Mr. GRIFFITH. OK. I appreciate that. You also mention that one of the biggest challenges is getting youth leagues in State high school associations to buy in to your standards. Why do you think this is a challenge? If you can be quick, I would appreciate it.

Mr. STENERSEN. Culture and tradition.

Mr. GRIFFITH. OK. And I have to tell you, the good news is my 16-year-old daughter had a concussion this year, and they pulled her out for about 2 weeks. And, you know, she got it playing lacrosse.

Mr. Margarucci, I've only got a minute left. Is there something you haven't had an opportunity to touch on that you'd like to? Because by the time I get a question out, the time would be up.

Mr. MARGARUCCI. No.

Mr. GRIFFITH. Would you agree with these folks that the more we can do to train folks on how to do it right and how to do the checks right or the hits right—

Mr. MARGARUCCI. Yes. We have a lot of that built into your coaching education, the checking progression and everything like that already, which we've had.

Mr. GRIFFITH. And do you have the same buy-in difficulties that Mr. Stenersen indicated he was having?

Mr. MARGARUCCI. Yes, to a degree. Not all high school associations, hockey leagues, are governed by USA Hockey, and so we don't have any influence there.

Mr. GRIFFITH. Right.

Mr. MARGARUCCI. So, again, there's no uniformity, sometimes, amongst those leagues.

Mr. GRIFFITH. And there is a lot of privatization, not only do you all have that, but Mr. Stenersen mentioned that, and my 8-year-old is also playing youth lacrosse, and that's completely outside the city rec league any of the high schools or any of the school systems. It's a private institution.

Listen, I came back because I thought this was an extremely important hearing. I appreciate all of your testimony, and we'll continue to work on this. And I yield back, Mr. Chairman.

Mr. HUDSON. I thank the gentleman. At this time, I'll recognize Mr. Tonko for 5 minutes.

Mr. TONKO. Thank you, Mr. Chair. And I appreciate all of our witnesses being here today and having this panel of expert wit-

nesses is a good opportunity to have dialogue on how we can further enhance the safety of youth sports.

I would like to ask some questions about changes to rules governing contact, especially for kids.

And, Dr. Gregory, you are here as a member of the USA Football's medical advisory committee. What can you tell us about the guideline changes USA Football has made to make the sport safer for young athletes?

Dr. GREGORY. Well, as you're probably aware, there are practice guidelines now in place to limit contact, which has, as part of the heads-up program, shown good evidence of decreasing injury, and that is limiting contact to 30 minutes per practice, no more than four practices a week, and no more than 2 hours in total length of practice.

So, decreasing the number of potential hits, which has been shown to occur by limiting the amount of time.

Mr. TONKO. Thank you. And it's my understanding that USA Football does not operate its own teams?

Dr. GREGORY. That is correct. So we can only make suggestions to the leagues that are underneath us. The same problem that all youth sports have. We want these leagues to follow our recommendations, but we can't enforce them.

Mr. TONKO. So, in other words, there's—it's just a recommendation? There's no way to implement those guidelines?

Dr. GREGORY. There's no way to enforce it. We've got to get buy-in, just like what my other colleagues have talked about here. By showing them that it works, get buy-in from these youth coaches.

Mr. TONKO. And, Dr. Gregory, have you been monitoring the rate of injuries, particularly head injuries since implementing these changes?

Dr. GREGORY. So in the three areas that we showed with the dataless youth football study, the Fairfax County information here, and in South Bend, Indiana, the programs that implemented the heads-up football, which is the educational proponent and the practice limitations, all injuries, head injuries, all went down in both practice and games.

Mr. TONKO. Do you have any—do you know anything more than that, other than dropping in—

Dr. GREGORY. Well, I gave the numbers already, but I can give them to you again.

Mr. TONKO. OK. No, just as long as the committee has them—

Dr. GREGORY. Yes.

Mr. TONKO [continuing]. That will be fine.

And we have heard from Coach Teevens about his success at Dartmouth in eliminating contact practices and from Mr. O'Neil about practice like pros advocacy for additional rule changes to reduce contact, particularly for young players. The whole Ivy League has now eliminated contact practices, and the NFL allows only 14 contact practices over the 18-week regular season.

Dr. Talavage—did I say that correctly?

Dr. TALAVAGE. Talavage.

Mr. TONKO. Talavage, I'm sorry. What do these measures, like reducing the number of contact practices and giving players longer

rests between such practices do for players, in particular, what is the effect as it relates to the brain?

Dr. TALAVAGE. The more time off they have, the more opportunity there is for the body's restorative practices to repair any damage that's occurred from being hit. So the more time you can give them off, the less likely they are to be impaired, the less likely they are to be injured in the future.

Mr. TONKO. Thank you.

And, Dr. Gregory, given what the science is telling us, why has USA Football not considered stricter rules or guidelines to reduce or eliminate contact for young players?

Dr. GREGORY. So what I will tell you is that what has been demonstrated, both at Dartmouth and then high school level, is it's fairly new, and I would say it's very compelling, and the challenge is can we replicate this at the youth level without the resources that they have at the collegiate and high school level? And that's the difficulty. And, again, we can make recommendations; we can't enforce it. So for us, we have to make sure that if we make a recommendation like that, that we back that up by understanding that it can be implemented if we recommend it. And that's—that's what we need the resources to do.

Mr. TONKO. And yesterday, Pop Warner announced that it would eliminate kickoffs and kick returns to reduce head injuries. It will also reduce contact practice time from 33 percent to 25 percent.

Dr. Talavage, do you think these measures will be effective at reducing head injuries for kids?

Dr. TALAVAGE. They are a good start. We'll say that much. The main issue, I think, just to tie back to one quick comment from before, is that eliminating one or two or three or four big hits per game isn't going to have a terribly substantial effect. I'd be more excited about the reduction in the contact practice time.

Mr. TONKO. OK. So those are—those would be the first additional changes that you would encourage?

Dr. TALAVAGE. Yes.

Mr. TONKO. Dr. Gregory, is USA Football considering similar measures?

Dr. GREGORY. Considering—say that again.

Mr. TONKO. Is USA Football considering similar measures as those introduced by Pop Warner?

Dr. GREGORY. Well, so one of the things that's pretty clear is this is an evolving game, so this is definitely up for consideration. And rule implementations like this would be looked at and studied and see if—if it does, indeed, have the same effect to youth that it has at other levels.

Mr. TONKO. Thank you.

Finally, earlier this month, committee Democrats sent a letter to Scott Hallenbeck, executive director of USA Football, about how the organization is ensuring the safety of young football players in addressing the risk posed by both concussive and subconcussive hits. We have asked for a response by May 25th.

Dr. Gregory, can you confirm that USA Football will provide the committee with a response by that date?

Dr. GREGORY. I can confirm that. Thank you.

Mr. HUDSON. Thank you.

Mr. TONKO. With that, I yield back.

Mr. HUDSON. Thank you, sir.

At this point, we'll recognize Ms. Clarke for 5 minutes.

Ms. CLARKE. Thank you, very much, Mr. Chairman.

I thank our ranking member. I thank our witnesses for bringing your expertise before us today.

I'd like to talk about the change in culture. As we approach the issue, we have to address sports culture and the attitude of toughness. For a long time, kids have watched their idols deliver the hardest hits on the field and get the most fights on the ice. As we make changes to play and practice, we also need to ensure that that permeates the culture of sports as well.

Look, my first question, Mr. Teevens, is do you believe that players are convinced of the importance of reporting concussions?

Mr. TEEVENS. I think they are getting there. I think it's incumbent upon the coaching staff to make players aware that it's oK for coaching staff members, says, Hey, you tough guy, the old school mind set, players may not respond if it's opened and it's oK, culture sports it, they will report.

Ms. CLARKE. OK. And do you believe that the coaches and the medical staffs at the higher levels of play take concussions seriously?

Mr. TEEVENS. I think they do. I think coaching profession is conservative, and a lot of guys that have played less than 5 years ago, or started coaching 5 years ago or greater, they grew up in a time when you didn't self-report; you didn't know about concussive head injury, and a lot of people teach what they were taught as players. That's part of the culture that needs to change. It's a different time.

Ms. CLARKE. There needs to be a disruption.

Do you think that we have been successful in spreading that message?

Mr. TEEVENS. Not as successful as we need to be, and the broader the better. Again, limiting the injury is—it's what we're all about.

Ms. CLARKE. Mr. O'Neil, the same questions. How can we convince players and coaches to report concussions and treat them seriously?

Mr. O'NEIL. Ms. Clarke, it's a great question. And I'd say this to you, when we do our clinics around the country, we have quantified the 19 cases of suspected second impact syndrome that you heard about earlier this morning. We tell those stories in detail with video of the players involved. We tell the stories of catastrophic injury in an effort to scare straight through the coaches these young boys who need this information.

I show my son's concussions as an example. I showed how he lied about his symptoms, did everything to stay on the field. Only when confronted with an impact test that showed he had failed the cognitive efficiency index test, only then did he admit that, yes, he was suffering a concussion and he was going to have to miss 3 or 4 weeks of play.

It is a huge problem still in high school football, and we think it's a subject about which we need to be direct with players. We tell these stories to the coaches, and we give them the video. We en-

courage the coaches to tell the players the story of what catastrophic injury can be in their lives if they don't report, self-report, and self-diagnose.

Ms. CLARKE. Many kids try to model their behavior after the athlete they revere. We need to ensure that the athletes at the highest level of play, college and pro, are sending the right messages about taking brain trauma seriously.

So, Mr. Teevens and Mr. O'Neil, what can the college and professional athletes and leagues do in carrying that message forward?

Mr. TEEVENS. I think the coaches would have to drive that message. I say frequently, unless we change the way we coach the game, we won't have a game to coach. And putting into place—we have an MVP, a mobile virtual player tackling device, that has been tremendous, because we now replicate a moving target at no risk of injury to the player tackling it. Steps like that.

The players will follow the direction of the coaching staffs, and I think coaching to coaches is absolutely critical to get our message across.

Mr. O'NEIL. Ms. Clarke, what's effective for us is when we take these Hall of Famers around the country, Warren Moon tells the audience, he suffered his first concussion at the age of 7 on a practice field in California, needlessly, not in a game, in a practice at the age of 7, and tells his personal story about hiding symptoms and then coming to a recognition later in his career how foolish that was.

We take Anthony Munoz around, and he tells a story of playing for a coach in Cincinnati who wanted to hit and hit and hit every single day, even the day before games on a Saturday. They're hitting each other in goal lines and short yardages drills before a Sunday game. Then he said we had a new coach, and that coach took our approach, which is virtually no contact during the week. And he said, we won both ways, but he said I sure felt a lot better and my teammates did, too, in that second approach, which is so much more effective.

Ms. CLARKE. Any of you have any comments about what you think the fans should be requiring of this sport?

Mr. TEEVENS. I think fans should be aware of it as well, and it's not gladiatorial, it's we have someone's child who is playing the game, and understand some of those big hits. The rules of the game don't dictate taking people out of play by force and injury. It's just get them on the ground. And if there is understanding that long term, people can be in jeopardy if we don't change the way we approach the game.

Dr. GREGORY. The other thing I would add is that the media which is on ESPN, the Hits of the Week, are not good hits, if you ask us. Right? That's what's being shown as a highlight. That's not the goal. We've got to change that.

Ms. CLARKE. We have to change the culture, then, that requires that everyone that is participating and reveres this game.

With that, I yield back. Thank you, Mr. Chairman.

Mr. HUDSON. I thank the gentlelady. I ask unanimous consent that the Institute of Medicine, National Research Council report entitled "Sports-Related Concussions in Youth: Improving the Science, Changing the Culture" be introduced into the record.

Without objection, the document will be entered in the record.¹

I also want to do another promotion of the briefing that Congressman Butterfield and I are hosting on pediatric trauma, May 24th. Encourage all my colleagues and any interested parties to attend that briefing.

And, in conclusion, I would like to thank all of you, witnesses and the Members who participated in today's hearing. A very important issue. I think we've gained a lot of insight today.

I remind Members they have 10 business days to submit questions for the record. I ask all witnesses to agree to respond promptly to those questions.

With that, the subcommittee is adjourned.

[Whereupon, at 12:19 p.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

PREPARED STATEMENT OF HON. FRED UPTON

This hearing marks the second event of the committee's comprehensive review of concussions. We first had a roundtable discussion in March that highlighted not only the gaps in our scientific and medical understanding of these injuries but also the risks they pose to all members of society. These injuries occur not only on the field of play or in service to the Nation, but also in the school yard, in auto accidents, or even something as simple as slipping on a patch of ice. They do not discriminate.

There are no easy answers when it comes to head trauma. It may take time for research to provide the concrete answers the public demands but that is not an excuse for inaction. There has been tremendous progress in the last decade but we can, and must, do more. And this must be a collective effort as no one individual, group, or organization can solve this public health challenge.

We are here today to examine what is being done to protect one the largest at-risk populations for concussions, youth athletes. Every year, in Michigan and across the country, tens of millions of children compete in youth sports. From community recreational teams to elite travel clubs, children have countless opportunities to engage in athletic competition. These activities provide tremendous benefits to our children, influencing their physical and psychological health, academic performance, and social well-being—both now and in the future.

Despite these benefits, with everything we see in the press about concussions and the long-term effects of head injuries, countless parents are asking themselves, is it safe for my child to play sports?

This is a difficult question to answer. To start, we know relatively little about the prevalence, effects, and long-term outcomes of concussions or head injuries in pediatric populations, including youth sports. This group has been dramatically underrepresented in existing research. Do children respond differently than adults? How does the developing brain respond? Does it heal faster or does it create long-term effects? These are just a few of the many questions science simply cannot answer at this point.

In the absence of scientific answers, we look for opportunities to limit exposure to head injuries. Due to the nature of concussions, management of these injuries is difficult even in controlled settings such as pro sports where you have individual leagues with a limited number of teams and athletes. At the youth level, there are thousands of leagues, organizations, and clubs—making the challenge exponentially more difficult and harder to control. The adoption and enforcement of rules, policies, or education programs often depends on the commitment of individual leagues, teams, coaches, parents, and athletes.

Some progress has occurred in recent years as a number of leagues and organizations are taking steps to limit contact in practice and games. Others are conducting outreach and education to improve awareness and understanding for coaches, parents, and athletes. Whether these efforts are effective or go far enough remains a question and one that we should continue to evaluate. Collectively, however, these efforts reflect a growing shift in the culture of sports regarding concussions and head injuries. Today's discussion is an important step in the right direction.

¹The information has been retained in committee files and also is available at <http://docs.house.gov/meetings/IF/IF02/20160513/104914/HHRG-114-IF02-20160513-SD099.pdf>.



U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON ENERGY AND COMMERCE

May 11, 2016

TO: Members, Subcommittee on Oversight and Investigations

FROM: Committee Majority Staff

RE: Hearing entitled "Concussions in Youth Sports: Evaluating Prevention and Research."

I. PURPOSE

On May 13, 2016, at 9:30 a.m. in 2123 Rayburn House Office Building, the Subcommittee on Oversight and Investigations will hold a hearing entitled "Concussions in Youth Sports: Evaluating Prevention and Research."

In December 2015, the Committee announced plans to begin a comprehensive review of the causes, effects and treatments of concussions. On March 14, 2016, the Subcommittee held a roundtable as the first step in the Committee's effort to begin a constructive dialogue about the risks of concussions and how we can address this public health challenge – not only for athletes and service members, but society as a whole. At the roundtable, Members and participants discussed what is known about concussions, what gaps exist in the scientific and medical community, why these gaps exist, and what is being done to address those gaps.

This hearing is the second public event in the Committee's ongoing review and will focus on concussions in youth sports, specifically issues related to prevention and research. Estimates suggest that more than 30 million children (ages 5-18) participate in organized sports each year. Given the number and complexity of youth sports organizations, multi-sport athletes, disparities in the quality of coaching, and social and cultural influences, youth athletes face significant risk of being overlooked in the event of an injury.

II. WITNESSES

Panel One:

- Kelli Jantz, R.N., the mother of Jake Snakenberg and Concussion Advocate ; and
- Karen Zegel, the mother of Patrick Risha and Chronic Traumatic Encephalopathy (CTE) Advocate .

Panel Two:

- Eugene F. (Buddy) Teevens III, Head Football Coach, Dartmouth;

- Andrew Gregory, MD, Member of Medical Advisory Committee, USA Football; Pediatric Sports Medicine, Vanderbilt University Medical Center;
- Kevin Margarucci, Manager, Player Safety, USA Hockey;
- Steve Stenersen, President and CEO, US Lacrosse;
- Terry O'Neil, Founder, Practiee Like Pros;
- Dawn Comstock, PhD, Associate Professor, Department of Epidemiology, Colorado School of Public Health; and
- Thomas Talavage, PhD, Professor, School of Electrical & Computer Engineering, Weldon School of Biomedical Engineering, Purdue University.

III. BACKGROUND

Concussions

Concussions are a mild form of traumatic brain injury (TBI). TBI occurs when normal brain function is disrupted by “a bump, blow or jolt to the head or penetrating head injury.”¹ There are three general classifications of TBI severity: mild, moderate, and severe. In 2010, the Centers for Disease Control and Prevention (CDC) estimated approximately 2.5 million emergency room visits, hospitalizations, and deaths due to or involving TBI.² This data, however, does not account for those who were not treated, individuals treated through outpatient or primary care office visits, or those treated at federal facilities, including current and former members of the military.³ Most cases of TBI are mild (mTBI), otherwise known as a concussion, and these are the most likely cases to be treated outside of emergency rooms or to go unreported. Thus, the actual number of concussions sustained annually in the United States remains unknown, but it is likely a substantially higher number than CDC's estimate.

Until recently, public discourse and research related to TBI focused heavily on moderate and severe TBI. In the past decade, however, high profile events have increased public awareness of the risks and dangers of concussions (mTBI). This has invigorated the research community and led to significant improvements in the management and care of these injuries. Understandably, athletes and service members have been the focal point of public interest on this issue, especially given their heightened risk of injury and the potential for repetitive trauma. However, concussions pose a significant health risk to all members of society, and additional work remains to be done to ensure everyone receives the education, attention and care necessary

¹ Report to Congress, Centers for Disease Control and Prevention, U.S. Dept. of Health and Human Services, *Traumatic Brain Injury in the United States: Epidemiology and Rehabilitation* (2014), available at http://www.cdc.gov/traumaticbraininjury/pubs/congress_epi_rehab.html.

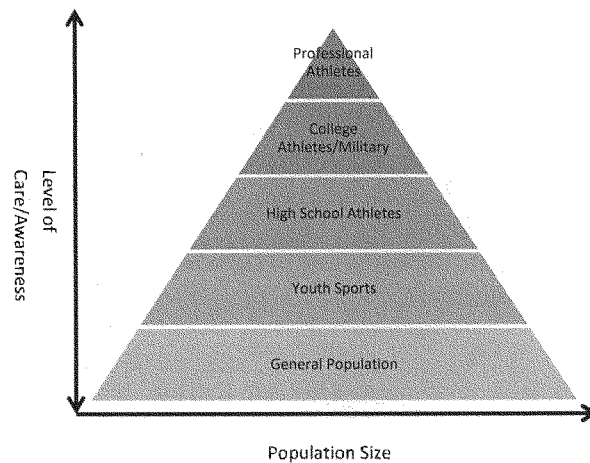
² *Id.* at 19.

³ *Id.*

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to manage these injuries. Chart 1 provides a simplified summary of the correlation between population size and awareness/standard of care.

Chart 1:



Research

Despite recent progress, significant challenges remain due to deficiencies in our scientific and medical understanding of the effects of concussions, including the history, causes, and symptoms, the short and long term effects, the variations based on such factors as age and gender, and the appropriate length of recovery. These gaps in knowledge hinder the development of effective protections, programs, and treatments to limit and mitigate the detrimental effects of concussions.

In recent years, the federal government, athletic institutions, and others have partnered with the scientific and medical community to launch critical research projects necessary to address these knowledge gaps, as well as identify technologies and innovative products that have the potential to protect against or minimize the risk of concussions. At the federal level, the Department of Defense (DOD) is a leading sponsor of research into concussions. TBI has always been a concern for DOD, but until recently, most of this work was focused on moderate to severe TBI. However, 93 percent of TBI in the military are concussions and 85 percent of these concussions occur “in garrison” (non-combat settings), prompting new attention to these injuries. Another leader in the federal space is the National Institutes of Health (NIH), in particular the National Institute of Neurological Disorders and Stroke (NINDS). In addition, both DOD and NIH have partnered with external entities — including the NFL and NCAA—on concussion research, as well as other federal stakeholders (the Centers for Disease Control and

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Prevention, the Department of Veterans Affairs, etc.). As an example, the NCAA-DOD Concussion Assessment, Research, and Education (CARE) Consortium represents the largest and most comprehensive study of sport-related concussions to date. Further research is being conducted by academic and medical research institutions across the country.

Moving forward, effective leadership and coordination will be necessary to ensure the research community is working efficiently and collaboratively to address the numerous gaps in our scientific and medical understanding of concussions.

Youth Sports

Youth sports are not only the largest population group of athletes, they are also the most underserved when it comes to awareness and care for head injuries. Estimates suggest that more than 30 million children (ages 5-18) participate in organized sports each year. Given the number and complexity of youth sports organizations, multi-sport athletes, disparities in the quality of coaching, and social and cultural influences, youth athletes face significant risk of being overlooked in the event of an injury. In addition, pediatric populations, including athletes, are significantly underserved or represented in current research. Little is known about the short- and long-term effects of individual or repetitive head injuries in younger individuals.

However, progress has been made in recent years, reflecting a positive shift in the attitude towards concussions and head injuries in youth sports. For example, all 50 states and the District of Columbia have concussion laws, and some leagues have implemented policies to reduce the prevalence of head injuries in youth sports. USA Hockey raised the age for legal body checking to the Bantam age group (13-14 years) and implemented rules to prohibit any check to head or neck region.⁴ In November 2015, U.S. Soccer announced new initiatives to reduce the prevalence of concussions in youth soccer, “including the limitation and/or outright banning of heading the ball for players under the age of 13.”⁵ Under this new protocol, children ages 10 and under are barred from heading the ball during any official practice or game, while players ages 11 to 13 are limited to heading during training sessions.⁶ In addition, Pop Warner Football was the first youth football organization to officially limit contact during practices in June 2012, adding two new rules and amending one of their existing rules. The first rule bans full speed head-on blocking or tackling drills in which players line up more than three yards apart. The second rule reduces the amount of contact at each practice to a maximum of one-third of practice time. In addition to the new rules, Rule 14, which has to do with blocking and tackling restrictions, was amended to emphasize technique when it comes to teaching safe blocking and tackling.⁷

⁴USA Hockey, Body-Checking Rule, *available at*, <http://www.usahockey.com/page/show/908033-body-checking-rule>.

⁵NBC Sports, November 9, 2015, *No More Heading: US Soccer Unveils New Concussion Protocol for Youth Soccer*, Andy Edwards, *Available at*: <http://soccer.nbcsports.com/2015/11/09/no-more-heading-us-soccer-unveils-new-concussion-protocol-for-youth-soccer/>.

⁶*Id.*

⁷Pop Warner, Rule Changes Regarding Practice & Concussion Prevention, June 13, 2012, *Available at*: http://www.popwarner.com/About_Us/Pop_Warner_News/Rule_Changes_Regarding_Practice___Concussion_Prevention_s1_p3977.htm.

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While recent policy changes reflect a positive shift in attitude, questions remain about whether they go far enough. For example, due to concerns about the long-term consequences of repetitive—or sub-concussive—head injuries, some groups advocate eliminating head contact from youth sports or establishing a “hit count,” similar to a pitch count in baseball. While these concepts appear logical and may ultimately be proven by science, a 2014 report by the Institute of Medicine and National Research Council (hereinafter, “IOM Report”) found that “implementing a specific threshold for the number of impacts or the magnitude of impacts per week or per season is without scientific basis.”⁸ This is not to suggest that proposals advocating less contact or a “hit count,” for youth athletes are not without merit. In fact, ongoing research continues to suggest the need for greater attention to this concern. This example, however, highlights the challenge of developing appropriate policies in the face of limited and evolving scientific research of head injuries in youth populations.

This challenge is further illuminated by numerous gaps in our scientific and medical understanding of head injuries in youth athletes identified in the IOM Report. After reviewing a large quantity of existing research, the authors observed a number of weaknesses and challenges that effect prevention efforts, including, but not limited to, a lack of injury surveillance data for athletes younger than high school age or for athletes participating in club or recreational sports outside of an academic setting; inconsistency in how concussions are defined in research; minimal attention to factors such as race, ethnicity, or socioeconomic status; limited research focused on changes in the brain for youth athletes following concussions, including the predispositions for multiple concussions or negative outcomes; the need for more clarity on differences between male and female athletes; and inconclusive evidence regarding the long-term effects of repetitive—or sub-concussive—head injuries.⁹

Improving the safety of youth sports is not just about science. Culture plays a critical role in improving awareness, attention, and care for youth athletes. Despite recent progress in improving attitudes and appreciation of the risks of head injuries, the IOM Report noted that “there is still a culture among athletes and military personnel that resists both the self-reporting of concussions and compliance with appropriate concussion management plans.”¹⁰ Educational and training programs, such as USA Football’s Heads-Up initiative, seek to enhance the level of awareness and knowledge of coaches, players, and parents, at all levels. These programs, however, are not enforceable and depend on the sustained commitment of all involved, and research is currently ongoing to evaluate the success of these initiatives.

One of the greatest challenges for addressing concussion risks in youth populations stems from the volume and relatively decentralized nature of disparate leagues, club teams, and other recreational opportunities available to young athletes. Professional sports leagues are relatively

⁸ Institute of Medicine (IOM) and National Research Council (NRC). 2014. *Sports-related concussions in youth: Improving science, changing the culture*. Washington, D.C.: The National Academies Press, at 11.

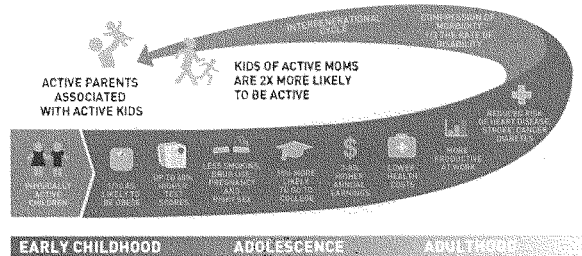
⁹ (The examples provided in this memo reflect weaknesses that effect areas such as research and prevention. The memo does not include all findings of the IOM report, especially those addressing concussion management and treatment, equipment standards, etc.) Institute of Medicine (IOM) and National Research Council (NRC). 2014. *Sports-related concussions in youth: Improving science, changing the culture*. Washington, D.C.: The National Academies Press, at 7-11.

¹⁰ *Id.* at 7

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small populations governed by a set of enforceable rules. For example, in the NFL, teams are limited to less than one contact practice per week during the regular season. Many colleges follow a similar model, regardless of specific conference or NCAA rules, and the Ivy League recently announced unanimous agreement to eliminate all full contact from practice during the regular season, on top of already stringent limits on contact during the preseason and spring practice. The situation at the high school and especially youth levels is far more complex due to the number of different governing bodies, leagues, and teams. As a result, the health and safety of the largest population of athletes—and those who have the least amount of experience—depends on the level of awareness, education, and care provided by their respective leagues, teams, coaches—many of whom are volunteers with minimal expertise—and parents.

Many youth athletes will never play in high school, let alone at the collegiate or professional level. Research by the NCAA found that the probability of high school athletes competing in college athletics, across most major sports, was less than 10 percent.¹¹ Only a few sports—ice hockey and lacrosse for both men and women—yielded a greater than 10 percent probability at competing at the collegiate level.¹² Only 6.7 percent of high school football players will play in the NCAA, across all divisions,¹³ and only 1.6 percent of those collegiate football players will play in the NFL.¹⁴ These numbers are important in the context of youth sports because most young athletes are there to have fun and enjoy the benefits of team competition. These experiences provide numerous health and developmental benefits and encourage continued physical activity later in life, whether through team sports or other avenues. Developing an interest in physical activity at a young age has tremendous benefits throughout life, demonstrated in this chart developed by the Aspen Institute as part of their Project Play initiative.¹⁵



Unfortunately, research suggests that participation in youth sports is declining.¹⁶ While there are a number of factors influencing this decline, a 2014 espnW/Aspen Institute survey found that

¹¹ NCAA Research, "Estimated probability of competing in college athletics" (Updated April 25, 2016), available at <http://www.ncaa.org/about/resources/research/estimated-probability-competing-college-athletics>.

¹² *Id.*

¹³ *Id.*

¹⁴ NCAA Research, "Estimated probability of competing in professional athletics" (Updated April 25, 2016) available at <http://www.ncaa.org/about/resources/research/estimated-probability-competing-professional-athletics>.

¹⁵ The Aspen Institute, Project Play, "Sport for All, Play for Life: A playbook to get every kid in the game." Available at <http://youthreport.projectplay.us/the-solution>.

¹⁶ *Id.* at, <http://youthreport.projectplay.us/the-problem>.

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87 percent of parents are concerned about injuries in youth sports, especially concussions.¹⁷ At the time, a quarter of parents had considered preventing their child from playing a sport due to concerns about head injuries.¹⁸ It is important, therefore, to ensure that parents have the information necessary to weigh the risks of head injuries against the benefits of sports and athletic competition.

IV. ISSUES

This hearing is focused specifically on the areas of prevention and research, and the following issues are expected to be examined at the hearing:

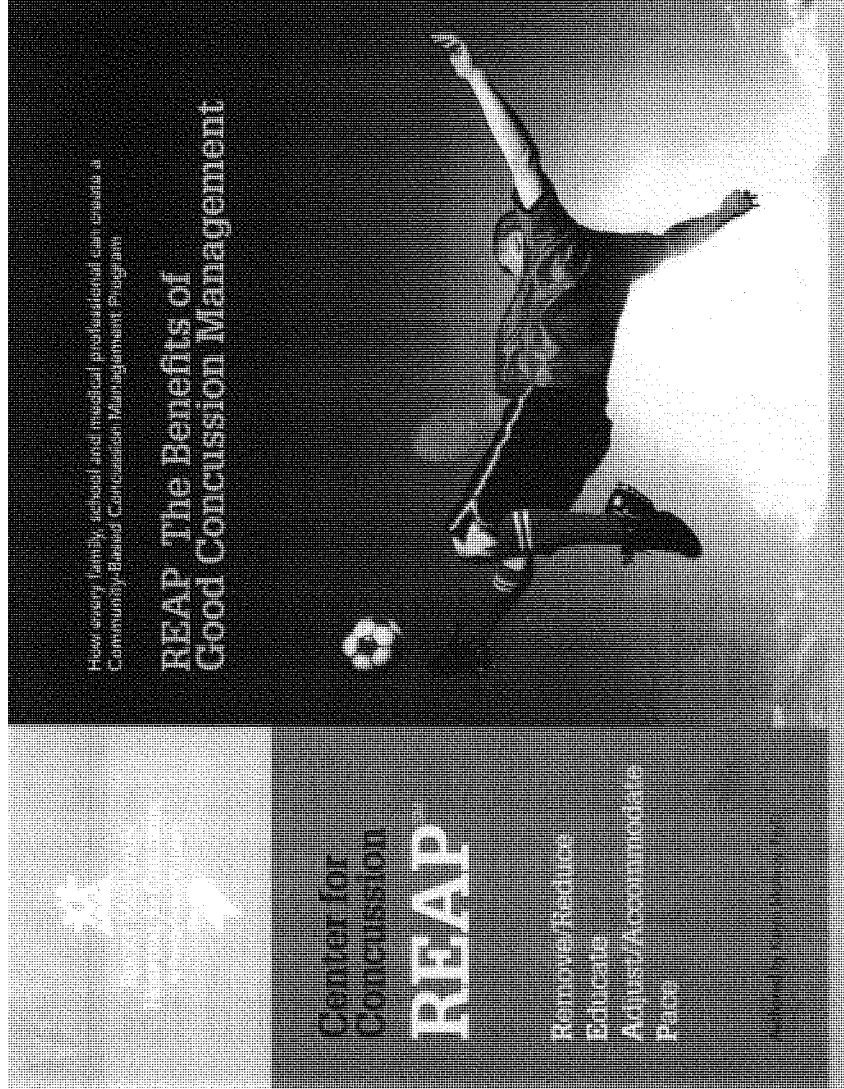
- Effects on children and the disproportionate lack of attention on this large population group;
- Policies or guidelines for practice and game situations;
- Educational and training policies for athletes, coaches, and parents;
- The current scientific and medical knowledge around concussions in youth athletes and its effect on policy or rules development;
- The role of culture in youth sports; and
- Research related to youth athletes.

V. STAFF CONTACTS

If you need any assistance or have any questions, please do not hesitate to contact John Ohly or Brittany Havens of the committee staff at (202) 225-2927.

¹⁷ Tom Farrey, ESPNW, “ESPN Poll: Most Parents have Concerns About State of Youth Sports.” (October 13, 2014) available at <http://espn.go.com/espnw/w-in-action/article/11675649/parents-concern-grows-kids-participation-sports>.

¹⁸ *Id.*



From every family, school and medical professional can benefit at
Community-Based Concussion Management Program

**REAP The Benefits of
Good Concussion Management**

**Center for
Concussion**

REAP

Remove/Rest
Educate
Adjust/Accommodate
Pace

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In recent years growing public and medical concern has been focused on the issue of concussions. From our youngest students/athletes to professional team competitors, awareness of a concussion's influence on both short-term and long-term health has escalated in the past decade.

New clinical studies surrounding this growing concern have led to youth concussion clinics opening in most states. However, this proliferation of concussion clinics comes at a time when there is little clear medical consensus on a way to manage and treat concussions.

The REAP approach, developed for Rocky Mountain Hospital for Children's Center for Concussion, offers guidance on a coordinated team approach that will lessen the frustration that the student/athletes, their parents, schools, coaches, certified athletic trainers and the medical professional often experience as they attempt to coordinate care.

REAP has grown as a training resource over the past five years and it is continually updated with the most current research and guidance. In fact, in November of 2013, the American Academy of Pediatrics released a Clinical Report on Returning to Learning Following a Concussion (PEDIATRICS Volume 132, Number 5, November 2013) "based upon expert opinion and adapted from a program in Colorado". Rocky Mountain Hospital for Children is proud to announce that the program referenced in the AAP Clinical Report is REAP!

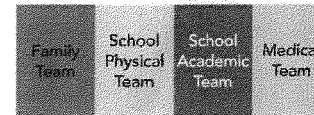
Reginald Washington, MD
FAAB, FAAC, FAHA
Chief Medical Officer
Rocky Mountain Hospital for Children - HealthONE

REAP is authored by: Karen McAvoy, PsyD

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Revised 8/2013. Printed 8/2013.

REAP, which stands for **Remove/Reduce · Educate · Adjust/Accommodate · Pace**, is a community-based model for Concussion Management that was developed in Colorado. The early origins of REAP stem from the dedication of one typical high school and its surrounding community after the devastating loss of a freshman football player to "Second Impact Syndrome" in 2004. The author of REAP, Dr. Karen McAvoy, was the psychologist at the high school when the tragedy hit. As a School Psychologist, Dr. McAvoy quickly pulled together various team members at the school (Certified Athletic Trainer, School Nurse, Counselors, Teachers and Administrators) and team members outside the school (Students, Parents and Healthcare Professionals) to create a safety net for all students with concussion. Under Dr. McAvoy's direction from 2004 to 2009, the multi-disciplinary team approach evolved from one school community to one entire school district. Funded by an education grant from the Colorado Brain Injury Program in 2009, Dr. McAvoy sat down and wrote up the essential elements of good multi-disciplinary team concussion management and named it REAP.

With the opening of Rocky Mountain Hospital for Children in August of 2010, Dr. McAvoy was offered the opportunity to open and direct the Center for Concussion, where the multi-disciplinary team approach is the foundation of treatment and management for every student/athlete seen in the clinic.



The benefits of good concussion management spelled out in REAP are known throughout communities in Colorado, nationally and internationally. REAP has been customized and personalized for various states and continues to be the "go-to" guide from the emergency department to school district to the office clinic waiting room.

Download a digital version of this publication at RockyMountainHospitalForChildren.com.

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Endorsed by:



The Brain Injury Alliance of Colorado



How to use this Manual

Because it is important for each member of the Multi-Disciplinary Concussion Management Team to know and understand their part and the part of other members, this manual was written for all of the teams. As information is especially pertinent to a certain group, it is noted by a color.

Pay close attention to the sections in **ORANGE**

FT	Family Team	Student, Parents, may include Friends, Grandparents, Primary Caretakers, Siblings and others...	For more specific information, download parent fact sheets from the various "Heads Up" Toolkits on the CDC website: cdc.gov/concussion/headsup/pdf/Heads_Up_factsheet_english-a.pdf and cdc.gov/concussions/pdf/Fact_Sheet_ConcussionTBI-a.pdf .
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Pay close attention to the sections in **DARKER BLUE**

ST/A	School Physical Team	Coaches, Certified Athletic Trainers (ATC), Physical Education Teachers, Playground Supervisors, School Nurses and others...	For more specific information, download the free "Heads Up: Concussion in High School Sports or Concussion in Youth Sports" from the CDC website: cdc.gov/Concussion/HeadsUp/high_school.html
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Pay close attention to the sections in **DARKER BLUE**

ST/A	School Academic Team	Teachers, Counselors, School Psychologists, School Social Workers, Administrators, School Neuropsychologists and others...	For more specific information, download the free "Heads Up to Schools Know Your Concussion ABCs" from the CDC website: cdc.gov/concussion/headsup/school.html and cdc.gov/concussion/pdf/TBI_Returning_to_Schools.pdf
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Pay close attention to the sections in **GREEN**

MT	Medical Team	Emergency Department, Primary Care Providers, Nurses, Concussion Specialists, Neurologists, Clinical Neuropsychologists and others...	For more specific information, download the free "Heads Up: Brain Injury in your Practice" from the CDC website: cdc.gov/concussion/HeadsUp/Physicians_tool_kit.html
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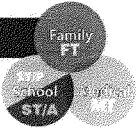
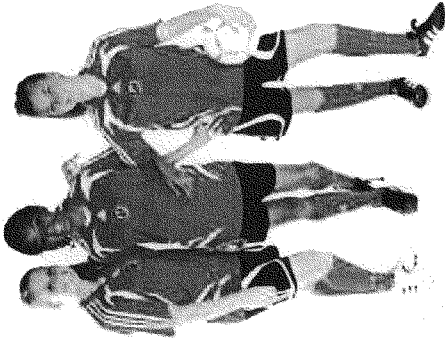


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Common Concussion Myths...

<p>TRUE or FALSE?</p>	<p>Loss of consciousness (LOC) is necessary for a concussion to be diagnosed.</p>
<p>FALSE! LOC occurs in approximately 10 to 15 million sports and recreational injury concussions per year in the United States each year.¹ Many individuals do not reach a loss of consciousness. Up to every individual receiving a concussion have neurological symptoms, regardless of their consciousness level. Some patients exhibit isolated symptoms -- such as, loss of memory, headache and fatigue and/or behavioral changes.</p>	<p>TRUE or FALSE?</p>
<p>TRUE or FALSE?</p>	<p>Patients should avoid swimming, cycling, and other activities for a period of 2 weeks after a concussion.</p>
<p>FALSE! Activity, a concussion is generally benign and self-limiting. The symptoms of a concussion are highly variable by patient and may include headache, dizziness, irritability, loss of interest, memory loss, altered attention, emotional responses, behavioral changes, and others. You can't predict how severe a concussion will be of looking at the symptoms, all that is the time of the injury.</p>	<p>TRUE or FALSE?</p>
<p>TRUE or FALSE?</p>	<p>A concussion is usually diagnosed by neurophysiologic tests.</p>
<p>FALSE! Concussion cannot be detected by neurophysiologic tests. "Neurophysiologic" tests, such as EEG, are generally used to detect abnormal electrical activity in the brain. Concussion is a clinical diagnosis, not a laboratory diagnosis. Concussion is usually diagnosed by neurophysiologic tests.</p>	<p>TRUE or FALSE?</p>





Did You Know...

More than 80% of concussions resolve very successfully if managed well within the first three weeks post-injury.² REAP sees the first three weeks post-injury as a “window of opportunity.” Research shows that the average recovery time for a child/adolescent is about three weeks, slightly longer than the average recovery time for an adult.³

REAP works on the premise that a concussion is best managed by a **Multi-Disciplinary Team** that includes: the Student/Athlete, the Family, various members of the School Team and the Medical Team. The unique perspective from each of these various teams is essential!

The first day of the concussion is considered **Day 1**. The first day of recovery also starts on Day 1. REAP can help the Family, School and Medical Teams mobilize immediately to maximize recovery during the entire three week “window of opportunity.”

Medical note:
Randy S. Kraft, MD,
Associate Director of the
Center for Concussion

When it comes to concussion, the newest recommendations are that kids and teens should be treated much more conservatively than adults. Little is known about the long term risks of concussion that occur in childhood and adolescence, but there is concern that concussions can add up over time and cause permanent problems.

Message to Parents

To maximize your child's recovery from concussion, double up on the **R's**: **REDUCE** and **REST**! First, that your child rest, especially for the first few days following the concussion and throughout the three-week recovery period. Some symptoms of concussion can be so severe on the first day or two that your child may need to stay home from school. When your child returns to school, request that he/she be allowed to “sit out” of sports, recess and physical education classes immediately after the concussion. Work with your Multi-Disciplinary Concussion Management Team to determine when your child is ready to return to physical activity (rest and/or PE classes see PACE).

Don't let your child convince you he/she will rest “later” (after the prom, after final, etc.). Rest must happen immediately! The school team will help your child reduce their academic load (see Adapt/Accommodate, however, it is your job to help to reduce anxiety load at home). Advise your child/teen to:

- avoid loud group functions (games, dances)
- limit video games, text messaging, social media and computer screen time
- limit reading and homework

A concussion will almost universally slow reaction time; therefore, driving should not be allowed pending medical clearance.

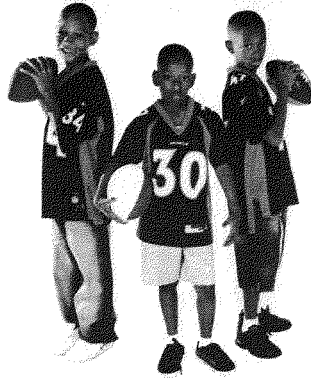
Plenty of sleep and quiet rest activities after the concussion maximizes your child's chance for a great recovery!

When should your child go back to school?
See page 8.

Supplemental information and downloadable forms for parents can be found at RockyMountainHospitalForChildren.com.

EVERY Member of Every Team is Important!

Every team has an essential part to play at certain stages of the recovery



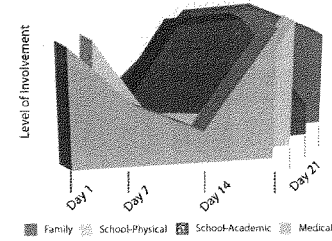
FIRST the School Physical Team (coach, ATC, playground supervisor) and/or the Family Team (parent) have a critical role in the beginning of the concussion as they may be the first to **RECOGNIZE** and **IDENTIFY** the concussion and **REMOVE** the student/athlete from play.

SECOND The Medical Team then has an essential role in **DIAGNOSING** the concussion and **RULING-OUT** a more serious medical condition.

THIRD for the next 1 to 3 weeks the Family Team and the School Academic Team will provide the majority of the **MANAGEMENT** by **REDUCING** social/home and school stimulation.

FOURTH when all **FOUR** teams decide that the student/athlete is 100% back to pre-concussion functioning, the Medical Team can approve the Graduated Return to Play (RTP) steps. See the PACE page.

FINALLY when the student/athlete successfully completes the RTP steps, the Medical Team can determine final "clearance."

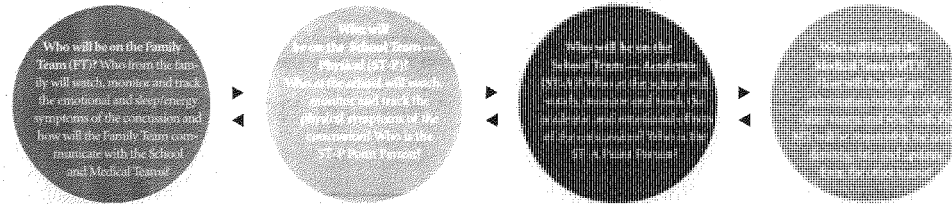


The **FOUR** teams pass the baton from one to the other (and back again), all the while communicating, collaborating and adjusting the treatment/management.

Communication and Collaboration = **Teamwork!**

Multi-Disciplinary Teamwork = the safest way to manage a concussion!

A "Multi-Disciplinary Team" Team members who provide **multiple perspectives** of the student/athlete AND Team members who provide **multiple sources of data**



REMOVE/REDUCE EDUCATE ADJUST / ACCOMMODATE PACE SPECIAL CONSIDERATIONS RESOURCES APPENDIX

TIMEFRAME

REAP suggests the following timeframe:

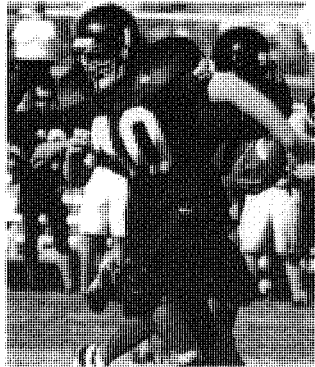
TEAM		Week 1	Week 2	Week 3
FT	Family Parents/Guardians/Adults/Primary Care Provider (Assign 1 point person to oversee/ manage cognitive/emotional symptoms)	<ul style="list-style-type: none"> Monitor child. Assess symptoms daily, especially monitor school/athletic and emotional symptoms. 	<ul style="list-style-type: none"> Continue to monitor symptoms at least 2X week or more as needed, monitor cognitive/emotional symptoms. Continue to assess symptoms and monitor for postural stability at home/academically. 	<ul style="list-style-type: none"> Continue with all assessments at least 2X week or more as needed. Continue to assess symptoms and monitor for postural stability at home/academically.
STP	School Team Physical Coach/ATC/School Nurse (Assign 1 point person to oversee/ manage physical symptoms)	<ul style="list-style-type: none"> REMOVE from all play/physical activities! Assess physical symptoms daily, use objective rating scale. ATC: assess postural-stability (see NATA reference in RESOURCES). School Nurse: monitor visits to school clinic. If symptoms at school are significant, contact parents and send home from school. 	<ul style="list-style-type: none"> Continue to assess symptoms (at least 2X week or more as needed). ATC: postural-stability assessment. 	<ul style="list-style-type: none"> Continue with all assessments (at least 2X week or more as needed). ATC: postural-stability assessment.
ST/A	School Team Academic Educators, School Psychologist, Counselor, Social Worker (Assign 1 point person to oversee/ manage cognitive/emotional symptoms)	<ul style="list-style-type: none"> REDUCE (do not eliminate) all cognitive demands. Meet with student periodically to create academic adjustments for cognitive/emotional reduction no later than Day 2/3 and then assess again by Day 7. Educate all teachers on the symptoms of concussion. See ADJUST/ACCOMMODATE section. 	<ul style="list-style-type: none"> Continue to assess symptoms at least 2X week or more as needed and slowly increase/decrease cognitive and academic demands accordingly. Continue academic adjustments as needed. 	<ul style="list-style-type: none"> Continue with all assessments at least 2X week or more as needed and increase/decrease cognitive and academic demands accordingly. Continue academic adjustments as needed. Assess if longer term academic accommodations are needed (may need to consider a 504 Plan beyond 3+ weeks).
MT	Medical Team	<ul style="list-style-type: none"> Assess and diagnose concussion. Assess for head injury complications, which may require additional evaluation and management. Recommend return to school with academic adjustments once symptoms are improving and tolerable, typically within 48 to 72 hours. Educate student/athlete and family on the typical course of concussion and the need for rest. Monitor that symptoms are improving throughout Week 1 — not worsening in the first 48 to 72 hours. 	<ul style="list-style-type: none"> Continue to consult with school and home teams. Follow-up medical check including comprehensive history, neurologic exam, detailed assessment of mental status, cognitive function, gait and balance. 	<ul style="list-style-type: none"> Continue to consult with school and home teams. Weeks 3+, consider referral to a Specialty Concussion Clinic if still symptomatic. <p>It is best practice that a medical professional be involved in the management of each and every concussion, not just those covered by legislation.</p>

*Family should sign a Release of Information so that School Team and Medical Team can communicate with each other as soon as possible.

Don't be alarmed by the symptoms - symptoms are the hallmark of concussion. The goal is to watch for a slow and steady improvement in ALL symptoms over time. It is typical for symptoms to be present for up to three weeks. If symptoms persist into Week 4, see SPECIAL CONSIDERATIONS.

REMOVE/REDUCE

Once a concussion has been diagnosed:



Jake Snakenberg
April 19, 1990 - September 19, 2004

In the Fall of 2004, Jake Snakenberg was a freshman football player at Grandview High School. He likely sustained a concussion in a game the week prior, however, he did not fully understand that he had experienced a concussion and he did not report his symptoms to anyone. One week later, Jake took a typical hit in a game, collapsed on the field and never regained consciousness. Jake passed away from "Second Impact Syndrome" on September 19, 2004.

STEP ONE: REMOVE student/athlete from all physical activities. REDUCE school demands and home/social stimulation.

The primary concern with returning to play too soon is the risk of injuring the brain again before recovery. The concussion state is a vulnerable state and even a minor impact can result in a much more serious injury with risk of permanent brain damage or death. "Second Impact Syndrome" or "SIS" is thought to occur when an already injured brain takes another hit resulting in possible massive swelling, brain damage and/or death. Therefore, once a concussion has been identified, it is critical to REMOVE a student/athlete from ALL physical activity including PE classes, classes, after school, recreational and club sports until medically cleared.

Secondly, within this period of total rest/recovery, all school demands and home/social stimulation should be REDUCED. Reducing demands on the brain will promote REST and will help recovery.

FT	Family Team	<p>REMOVE student/athlete from all physical activity immediately including play at home (i.e. playground, bikes, skateboards), recreational, and/or club sports.</p> <p>REDUCE home/social stimulation including texting, social media, video games, TV, driving and going to loud places (the mall, dances, games).</p> <p>Encourage REST.</p>
ST/P	School Physical Team	<p>REMOVE student/athlete from all physical activity immediately.</p> <p>Support REDUCTION of school demands and home/social stimulation.</p> <p>Provide encouragement to REST and take the needed time to heal.</p>
ST/A	School Academic Team	<p>REMOVE student/athlete from all physical activity at school including PE, recess, dance class.</p> <p>REDUCE school demands (see ADJUST/ACCOMMODATE for Educators on pages 9-10).</p> <p>Encourage "brain REST" breaks at school.</p>
MT	Medical Team	<p>REMOVE student/athlete from all physical activity immediately.</p> <p>RULE-OUT more serious medical issues including severe traumatic brain injury. Consider risk factors — evaluate for concussion complications.</p> <p>Support REDUCTION of school demands and home/social stimulation.</p> <p>Encourage REST.</p>

STEP TWO: EDUCATE all teams on the story the symptoms are telling.
It might be two steps forward...one step back.

After a concussion, the brain cells are not working well. The good news is that with most concussions, the brain cells will recover in 1 to 3 weeks. When you push the brain cells to do more than they can tolerate (before they are healed) symptoms will get worse. When symptoms get worse, the brain cells are telling you that you've done too much. As you recover, you will be able to do more each day with fewer symptoms. If trying to read an algebra book or going to the mall flares a symptom initially, the brain is simply telling you that you have pushed too hard today and you need to back it down... try again in a few days. Thankfully, recovery from a concussion is quite predictable... most symptoms will decrease over 1 to 3 weeks and the ability to add back in home/social and school activities will increase over 1 to 3 weeks. Therefore, learn to "read" the symptoms. They are actually telling you the rate of recovery from the concussion.

NOTE: Home/social stimulation and school tasks can be added back in by the parent/teacher as tolerated. Physical activities, however, cannot be added back in without medical approval (see PAGE).



PHYSICAL (SYMPTOMS)		COGNITIVE (SYMPTOMS)	
Headache/Pressure	Nausea	Feeling "foggy"	Feeling "blank/stupid"
Blurred vision	Vomiting	Difficulty remembering	Difficulty concentrating/focus/attention
Dizziness	Murderous/tingling	Slowed speech	Easily confused
Postural balance	Sensitivity to light		
Blurred noises	Sensitivity to noise		
Seeing "stars"	Disorientation		
Worst case/Clonus eyes	Black Box		
EMOTIONAL (SYMPTOMS)		SLEEP/ENERGY (SYMPTOMS)	
Inappropriate emotions	Irritability	Fatigue	Overwhelmed
Personality change	Sadness	Restless sleep	Sleeping less than usual
Nervousness/fear	Lack of motivation	Headache/fatigue	
Feeling alone "exceptional"			

Do not worry that your child has symptoms for 1 to 3 weeks; it is typical and natural to notice symptoms for up to 3 weeks. You just want to make sure you are seeing slow and steady resolution of symptoms every day. To monitor your child's progress with symptoms, chart symptoms periodically (see TIMEFRAME on page 5) and use the Symptom Checklist (see APPENDIX). In a small percentage of cases, symptoms from a concussion can last from weeks to months. (See SPECIAL CONSIDERATIONS on page 13.)

Medical Box

Medical Box

IMPORTANT

IMPORTANT

GOING BACK TO SCHOOL

Chris was 15 years old when she suffered a concussion while playing basketball. Her symptoms of passing out, vomiting, headache and fatigue returned five to six months after the incident. Over a two-year period, Chris was unable to complete her school year.

It really helped me when my teachers had about 10 minutes of prep time. They would look at the syllabus and let me know what was important and how to study for it. They would also let me know if there were any tests or assignments. I was able to catch up on my own time. I had some classes that were more difficult than others. I was able to catch up on my own time. I had some classes that were more difficult than others. I was able to catch up on my own time.

ADJUST ACCOMMODATE

STEP THREE: ADJUST/ACCOMMODATE FOR PAIN/MS

ADJUST/ACCOMMODATE FOR PAIN/MS

ADJUST/ACCOMMODATE FOR PAIN/MS

ADJUST/ACCOMMODATE FOR PAIN/MS

ADJUST/ACCOMMODATE FOR PAIN/MS

Medical Box

**STEP THREE: ADJUST/
ACCOMMODATE for EDUCATORS.**



School Team Educators

Alternate challenging classes with lighter classes (e.g. alternate a "core" class with an elective or "off" period). If this is not possible, be creative with flexing mental work followed by "brain rest breaks" in the classroom (head on desk, eyes closed for 5-10 minutes).

Medical Box

Medical Box content is intentionally blurred in this image.

Most Common "Thinking" Cognitive Problems Post-Concussion

And suggested adjustments/accommodations

Area of concern	Suggested Accommodations for Return-to-Learn (RTL)
Fatigue, specifically Mental Fatigue	<p>Reduce the amount of work, do not add any new work until the student reaches an individual "baseline."</p> <p>Allow the student to complete a 15-20 minute rest period following each class period. A class period for the student to be removed from recess/activities during school to the degree already advised.</p> <p>Use classroom "quiet reading" as seen for all students.</p> <p>Consider having the student have headphones, earplugs, or earbuds.</p>
Difficulty concentrating	<p>Reduce the cognitive load — it is a fact that smaller amounts of learning will take place during the recovery.</p> <p>Since learning during recovery is compromised, the academic team must decide: What is the most important concept for the student to learn during this recovery?</p> <p>Be careful not to tax the student cognitively by demanding that all learning continue at the rate prior to the concussion.</p>
Slowed processing speed	<p>Provide extra time for tests and projects and/or shorten tasks.</p> <p>Assess whether the student has large tests or projects due during the 3-week recovery period and remove or adjust due dates.</p> <p>Provide a peer notetaker or copies of teacher's notes during recovery.</p> <p>Grade work completed — do not penalize for work not done.</p>
Difficulty with working memory	<p>Initially exempt the student from routine work/tests.</p> <p>Since memory during recovery is limited, the academic team must decide: What is the most important concept(s) for the student to know?</p> <p>Work toward comprehension of a smaller amount of material versus rote memorization.</p>
Difficulty converting new learning into memory	<p>Allow student to "study" the material during the week.</p> <p>Monitor "study" work that is not intended for completion. Having the student do "memorize" for all of the work intended during the recovery period is a goal. Please create cognitive and emotional goals for teacher and may involve recovery accommodations that may be necessary during this time.</p>
Emotional symptoms	<p>The handful of emotional symptoms that students are often scared, overwhelmed, frustrated, irritable, angry and depressed as a result of concussions. They require need to support and reassurance that what they are feeling is often the typical course of recovery. Watch for secondary symptoms of depression — usually from social isolation. Watch for secondary symptoms of anxiety — usually from concerns over make-up work or slipping grades.</p>

**ADJUST /
ACCOMMODATE**

STEP THREE: ADJUST/ACCOMMODATE for EDUCATORS continued.

Typically, student's symptoms only require 2 to 3 days of absence from school. If more than 3 days are missed, call a meeting with parents and seek a medical explanation.

Teachers, please consider categorizing work into:

- Work REMOVED** Consider removing at least 25% of the workload.
- NEGOTIABLE** Consider either "adjusting" workload (i.e. collage instead of written paper) OR "delaying" workload...however, be selective about the workload you postpone.
- Work REQUIRED** Consider requiring no more than 25% of the workload.

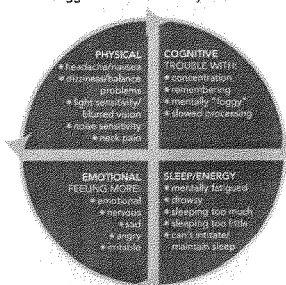
Adapted from William Heinz, M.D.

Academic adjustments fall within the purview of the classroom/school. They are NOT determined by a healthcare professional. The teacher has the right to adjust up or down academic supports as needed, depending upon how the student is doing daily. Medical "release" from academic adjustments is not necessary.

- PHYSICAL:**
- "Strategic Rest" scheduled 15 to 20 minute breaks in clinic/quiet space (mid-morning, mid-afternoon and/or as needed)
 - Sunglasses (inside and outside)
 - Quiet room/environment, quiet lunch, quiet recess
 - More frequent breaks in classroom and/or in clinic
 - Allow quiet passing in halls
 - REMOVE from PE, physical recess, & dance classes without penalty
 - Sit out of music, orchestra and computer classes if symptoms are provoked

- EMOTIONAL:**
- Allow student to have "signal" to leave room
 - Help staff understand that mental fatigue can manifest in "emotional meltdowns"
 - Allow student to remove him/herself to de-escalate
 - Allow student to visit with supportive adult (counselor, nurse, aide/etc)
 - Watch for secondary symptoms of depression and anxiety usually due to social isolation and concern over "make-up work" and slipping grades. These extra emotional factors can delay recovery

Symptom Wheel
Suggested Academic Adjustments



Read "Return to Learning: Going Back to School Following a Concussion" at nasponline.org/publications/ccy/40/6/return-to-learning.aspx

Interventions:

Keep in mind, brain cells will heal themselves a little bit each day. Students should be able to accomplish more and more at school each day with fewer and fewer symptoms. Therefore, as the teacher sees recovery, he/she should require more work from the student. By the same token, if a teacher sees an exacerbation of symptoms, he/she should back down work for a short time and re-start it as tolerated.

Data collection:

How the student performs in the classroom is essential data needed by the healthcare professional at the time of clearance. Schools should have a process in place by which a teacher can share observations, thoughts, concerns back to the parents and healthcare professional throughout the recovery. Healthcare professionals should REQUIRE input from teachers on cognitive recovery before approving the Graduated Return-to-Play steps. (See Teacher Feedback Form in APPENDIX.) Parents should sign a Release of Information at the school and/or at the healthcare professionals office for seamless communication between school teams and medical team.

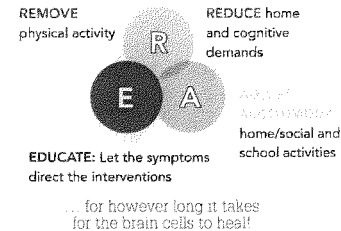
Supplemental materials and downloadable forms for teachers may be found at RockyMountainHospitalForChildren.com.

How do I get back to my sport? A.K.A. How do I get "cleared" from this concussion

While 80 to 90% of concussions will be resolved in 3 to 4 weeks, a healthcare professional, whether in the Emergency Department or in a clinic, cannot predict the length or the course of recovery from a concussion. In fact, a healthcare professional should never tell a family that a concussion will resolve in X number of days because every concussion is different and each recovery time period is unique. The best way to assess when a student/athlete is ready to start the step-wise process of "Returning-to-Play" is to ask these questions:

- Is the student/athlete 100% symptom-free at home?
 - Use the Symptom Checklist every few days. All symptoms should be at "0" on the checklist or at least back to the perceived "baseline" symptom level.
 - Look at what the student/athlete is doing. At home they should be acting the way they did before the concussion, doing chores, interacting normally with friends and family.
 - Symptoms should not return when they are exposed to the loud, busy environment of home/social, mall or restaurants.
- Is the student 100% symptom-free at school?
 - Your student/athlete should be handling school work to the level they did before the concussion.
 - Use the Teacher Feedback Form (APPENDIX) to see what teachers are noticing.
 - Watch your child/teen doing homework; they should be able to complete homework as efficiently as before the concussion.
 - In-school test scores should be back to where they were pre-concussion.
 - School workload should be back to where it was pre-concussion.
 - Symptoms should not return when they are exposed to the loud, busy environment of school.
- If the school or healthcare professional has used neurocognitive testing, are scores back to baseline or at least reflect normative average and/or baseline functioning?
- If a Certified Athletic Trainer is involved with the concussion, does the ATC feel that the student/athlete is 100% symptom-free?
 - Ask ATC for feedback and/or serial administrations of the Symptom Checklist.
- Is your child off all medications used to treat the concussion?
 - This includes over the counter medications such as ibuprofen, naproxen and acetaminophen which may have been used to treat headache or pain.

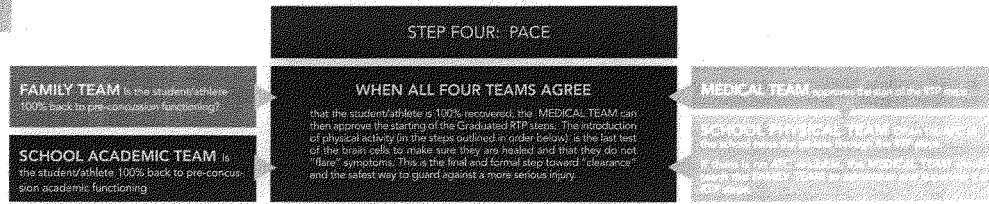
If the answer to any of the questions is "NO," stay the course with management and continue to repeat:



The true test of recovery is to notice a steady decrease in symptoms while noticing a steady increase in the ability to handle more rigorous home/social and school demands.

PARENTS and TEACHERS try to add in more home/social and school activities (just NOT physical activities) and test out those brain cells!

Once the answers to the questions above are all "YES," turn the page to the PACE page to see what to do next!



A Graduated Return-to-Play (RTP) Recommended by The 2012 Zurich Consensus Statement on Concussion in Sport*

STAGE	ACTIVITY	FUNCTIONAL EXERCISE AT EACH STAGE OF REHABILITATION	OBJECTIVE OF STAGE
1	No activity <i>When 100% symptom free for 24 hours proceed to Stage 2. (Recommend longer symptom-free periods at each stage for younger student/athletes)</i>	Symptom limited physical and cognitive rest.	Recovery
2	Light aerobic exercise <i>If symptoms re-emerge with this level of exertion, then return to the previous stage. If the student remains symptom free for 24 hours after this level of exertion, then proceed to the next stage.</i>	Walking, swimming or stationary cycling keeping intensity <70% maximum permitted heart rate. No resistance training.	Increase heart rate
3	Sport-specific exercise <i>If symptoms re-emerge with this level of exertion then return to the previous stage. If the student remains symptom free for 24 hours after this level of exertion then proceed to the next stage.</i>	Skating drills in ice hockey, running drills in soccer. No head-impact activities.	Add movement
4	Non-contact training drills <i>If symptoms re-emerge with this level of exertion then return to the previous stage. If the student remains symptom free for 24 hours after this level of exertion then proceed to the next stage.</i>	Progression to more complex training drills, e.g., passing drills in football and ice hockey. May start progressive resistance training.	Exercise, coordination and cognitive load
5	Full-contact practice <i>If symptoms re-emerge with this level of exertion then return to the previous stage. If the student remains symptom free for 24 hours after this level of exertion then proceed to the next stage.</i>	Following medical clearance, participate in normal training activities.	Restore confidence and assess functional skills by coaching staff
6	Return to play	Normal game play.	No restrictions.

The healthcare professional should give the responsibility of the graduated RTP steps over only to a trained professional such as an ATC, PT or should teach the parents. A coach, school nurse or PE teacher does NOT need to be responsible for taking concussed student/athletes through these steps.

Research Note: Earlier introduction of physical activity is being researched and may become best practice. However, at this time, any early introduction of physical exertion should only be conducted in a supervised and safe environment by trained professionals.

PACE

Special Considerations

As we know, 80 to 90% of concussions will resolve within 3 to 4 weeks.

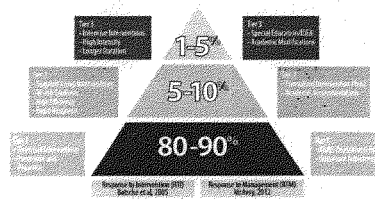
However, there remains the 10 to 20% of student/athletes who have on-going physical, cognitive, emotional or sleep/energy symptoms well beyond the 3 to 4 week mark. In those cases, the parent and medical professionals are advised to look to the school system for existing supports. The 2004 Re-authorization of IDEA (Individuals with Disability Education Act) introduced an educational initiative called "Response to Intervention (RTI)." RTI contends that good teaching and reasonable academic "adjustments" in the general education classroom can help to support 80 to 90% of students with mild/temporary learning or behavioral issues. The same concept holds true for concussions. We have called this "Response to Management (RTM)."

In RTI and RTM, we maximize the student/athlete's recovery by focusing on good academic "adjustments" in the general education classroom.

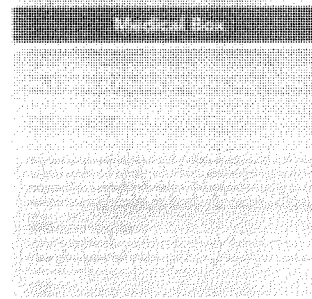
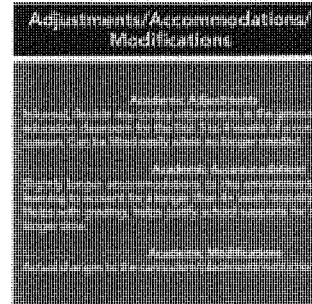
The 10 to 20% of students who struggle beyond the general education classroom may need a small amount of "targeted intervention" called academic "accommodation." Academic "accommodations" may be provided via a Health Plan, a Learning Plan, a 504 Plan⁶ or an RTI Plan. It is still hoped that the accommodations for learning, behavior or concussions are temporary and amenable to intervention but may take months (instead of weeks) for progress to show. Lastly, with RTI and RTM, in the rare event that a permanent "disability" is responsible for the educational struggle, the student may be assessed and staffed into special education services (IDEA) and provided an IEP (Individualized Education Plan). This would constitute an extremely small number of students with a concussion.

The multi-disciplinary teams need to continue to work together with the student/athlete with protracted

Concussion Management Guidelines⁸



recovery. Parents and medical professionals need to seek medical explanation and treatment for slowed recovery; educators need to continue to provide the appropriate supports and the school physical team needs to continue to keep the student/athlete out of physical play.



Resources		
Centers for Disease Control (CDC)	CDC.gov	1-800-CDC-INFO
Colorado Brain Injury Program	tbicolorado.org	303-866-4779
CO Child/Adolescent Brain Injury	COKidwithbraininjury.com	
Brain Injury Alliance of Colorado (BIAC)	biacolorado.org	303-355-9969
Brain Injury Association of America (BIAA)	biausa.org	1-800-444-6443
Colorado High School Activities Association (CHSAA)	chsaa.org	303-344-5050
Colorado Department of Education (CDE)	cde.state.co.us	303-866-2879
National Association of Athletic Trainers (NATA)	nata.org journalofathletictraining.org	
National Federation of State High School Associations	nfhs.org	317-972-4900
Coaches Training: (free, online coach-training sessions)	National Federation of State High School Associations	nfhslearn.org

Disclaimer:
This publication is not a substitute for seeking medical care.
REAP is available for customization in your state.

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 - Ciera Lund and the Lund family

This manual is available in Spanish upon request.
This program is part of HealthONE's Rocky Mountain Hospital for Children.

 Symptom Checklist

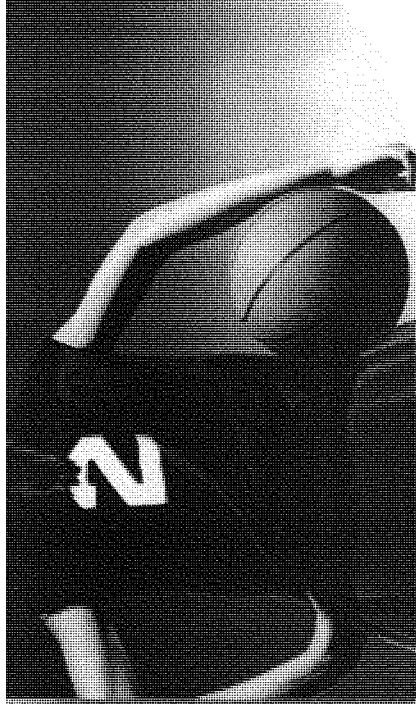
Name: _____ Assessment Date: _____

Date of Injury: _____ Time of Injury _____ 2-3 Hrs _____ 24 Hrs _____ 48 Hrs _____ 72 Hrs _____ Daily _____ Weekly _____

SYMPTOMS		SEVERITY RATING						
Pathways	Symptoms	0	Mild	Moderate	Moderate	Severe	Severe	
A	I feel like I'm going to faint	0	1	2	3	4	5	6
V	I'm having trouble balancing	0	1	2	3	4	5	6
	I feel dizzy	0	1	2	3	4	5	6
	It feels like the room is spinning	0	1	2	3	4	5	6
O	Things look blurry	0	1	2	3	4	5	6
	I see double	0	1	2	3	4	5	6
H	I have headaches	0	1	2	3	4	5	6
	I feel sick to my stomach (nauseated)	0	1	2	3	4	5	6
	Noise/sound bothers me	0	1	2	3	4	5	6
	The light bothers my eyes	0	1	2	3	4	5	6
C	I have pressure in my head	0	1	2	3	4	5	6
	I feel numbness and tingling	0	1	2	3	4	5	6
N	I have neck pain	0	1	2	3	4	5	6
S/E	I have trouble falling asleep	0	1	2	3	4	5	6
	I feel like sleeping too much	0	1	2	3	4	5	6
	I feel like I am not getting enough sleep	0	1	2	3	4	5	6
	I have low energy (fatigue)	0	1	2	3	4	5	6
	I feel tired a lot (drowsiness)	0	1	2	3	4	5	6
Cog	I have trouble paying attention	0	1	2	3	4	5	6
	I am easily distracted	0	1	2	3	4	5	6
	I have trouble concentrating	0	1	2	3	4	5	6
	I have trouble remembering things	0	1	2	3	4	5	6
	I have trouble following directions	0	1	2	3	4	5	6
	I feel like my thinking is "foggy"	0	1	2	3	4	5	6
	I feel like I am moving at a slower speed	0	1	2	3	4	5	6
	I don't feel "right"	0	1	2	3	4	5	6
	I feel confused	0	1	2	3	4	5	6
	I have trouble learning new things	0	1	2	3	4	5	6
E	I feel more emotional	0	1	2	3	4	5	6
	I feel sad	0	1	2	3	4	5	6
	I feel nervous	0	1	2	3	4	5	6
	I feel irritable or grouchy	0	1	2	3	4	5	6

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 Pathways of concern: A=Autonomic V=Vestibular O=Oculomotor H=Headache (Migraine & Non-Migraine) C=Cervicogenic N=Neck Strain S/E=Sleep/Energy Cog=Cognitive E=Emotional

APPENDIX



**ROCKY MOUNTAIN
HOSPITAL FOR CHILDREN**
At Children's Hospital Colorado

1100 East 17th Avenue, Suite 1000
Denver, CO 80202
303.733.0000

**Center for Connections
at Children's Medical Press**
1400 East 19th Avenue, Building 1, Suite 800
Denver, CO 80202
303.733.0000

At Red Rocks Medical Center
1400 14th Avenue, Suite 800
Golden, CO 80401
303.441.1000

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www.rockymountainhospitalforchildren.com



Jake Snakenberg Fund

Dedicated to the Memory of Jake Snakenberg
April 19, 1990 - September 19, 2004

In the fall of 2004, Jake Snakenberg passed away from "Second Impact Syndrome." As a result of Jake's death, with the support of Jake's family and a team of dedicated health professionals, REAP and the Center for Concussion exist today.

The Jake Snakenberg Fund is a program of Rocky Mountain Children's Health Foundation, whose mission is to *enhance the quality of life for pediatric patients in the Rocky Mountain region.*

To ensure the ongoing efforts to educate coaches and parents on concussion recognition, please consider a gift to the Jake Snakenberg Fund.

Online: www.rmchildren.org/donation

Mail to:
Rocky Mountain Children's Health Foundation
2055 High Street Suite 240, Denver, CO 80205

Contact: Luanne Williams, Executive Director
303.839.6873

Visit us at: www.rmchildren.org
Find us on [facebook.com/rmchf](https://www.facebook.com/rmchf)

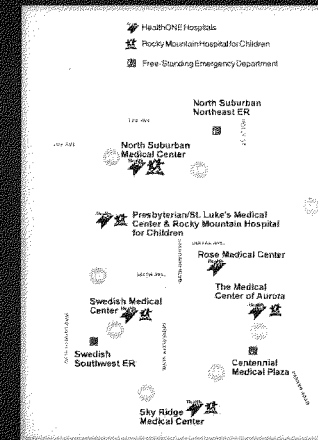
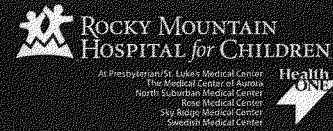


Printing of this brochure was paid for by the Jake Snakenberg Fund of the Rocky Mountain Children's Health Foundation.

When your child is sick or hurt, you want the best for them. Rocky Mountain Hospital for Children has the quality care your child deserves. Here's why:

- ② All board-certified doctors who communicate closely with your child's doctor for personalized care
- ③ Most experienced pediatric nurses whose sole focus is children's emergencies
- ④ Best pain relief measures for children — pain-free IV starts and blood draws
- ⑤ Safest drug dosing system for children, using computerized drug dosing calculations
- ⑥ All pediatric specialists available onsite, if specialty care is required
- ⑦ Pediatric X-ray services
- ⑧ Short wait times
- ⑨ Convenient, free parking

Learn more at RockyMountainHospitalForChildren.com.



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Let's talk about the most serious football injury.

Children's brains do not have as much of a protein called myelin, which helps protect the brain. Kids have larger heads and smaller necks and throats, so if they fall they are much more likely to have their heads snap backward and hit the ground. Transporters need to have the correct equipment, but unprotected children need the medical personnel at the scene. Children should not play tackle football before the age of 14.

— Dr. Robert C. Cantu, Professor, Department of Neurosurgery, Boston University School of Medicine

You only get one brain. The thing you want your kids to do most is sustained at the end of the playing they are in. Football may surprise you that, my kid that.

— Dr. John Adams, Neurosurgeon, Boston University

Younger children take longer to recover from head trauma.

— Zachman, Surgery, Neurology, Neurosurgical

Want More Information about Chronic Traumatic Encephalopathy, CTE?

Too many of our sons are lost to football... PLEASE DON'T LOSE YOURS!

Please visit and join our important cause at StopCTE.org

Or write to: CTE@stopcte.org
 215-342-6308

A warning for youth leagues: tackle football is nothing compared to a child's right to a good quality life and a healthy brain.

CTE AWARENESS FOUNDATION

FLAG UNTIL 14

When you are choosing healthy options for your children, ask your pediatrician about the dangers of CTE

What's CTE?

CTE (Chronic Traumatic Encephalopathy) is a brain disease caused by repeated hits to the head. It is often undetectable until it's too late. It's a progressive neurodegenerative disease that causes memory loss, mood swings, and personality changes. It's often found in athletes and military veterans exposed to head trauma and is often associated with repeated head impacts and concussions. Many athletes need to be protected from head trauma and brain injury, which help contribute to the disease for debilitating CTE.

Why FLAG 14?

7 and 8 year old football players receive an average of 80 head hits per season. While players 9 to 13 received 240 hits. Some research showed a loss of 10% of brain volume at high risk of concussion.

— *Physician, Rush Medical College, University of Pennsylvania*

Football players who begin playing middle school football at the age of 12 years old had a higher risk of developing memory and thinking problems later in life.

— *Dr. Robert Stern, Director, University of Pennsylvania*

For children between the ages of 10-14, there is evidence of links to memory impairment for head trauma's but increased from 2,400 in 1987 to over 15,000 in 2013 despite the decrease in participation in contact football for that age group.

— *HealthChronicle, AHA/ASA*

We need to stop doing activities before their brain is fully developed. Brain trauma is the cause of the disease. A brain 100 lbs at age 9, 110, 13 years old will up to 200 lbs.

— *Ohio Neurosci. Consultant, Cognitive Psychology*

Make a Great Call!



Don't let brain trauma be the cause. Call today for help to help your child's brain. Reported brain injury during contact football play is linked to CTE.

RPE of middle school CTE cases rose in athletes who began their contact between the ages of 11 and 13.

— *Sports Injury Institute*

The co-founder of Boston University's CTE Center says that football participation is increasing among teenagers.

"The more you start and the more often you play, the greater your risk. So we really do have to be concerned about the risk of brain injury's allowed to increase. And I think that's the reason that we have to take with football from a pure public health perspective and support our participants."

But my kid has the best helmet...

Helmets do not prevent CTE and may even contribute to its development by causing a false sense of security.



Risk are getting bigger and bigger. In 1996 researchers say kids ages 8 to 17 without the emergency room with football related injuries. 274,264 times. In 2007 that number increased 27 percent to 346,272 times.

— *The Center for Injury Research and Policy, Nationwide Children's Hospital*

Children ages 7 to 13 suffered 17% of sports related concussions over in emergency departments.

— *Sally Katz, WebMD*

Know Their Risk. Learn More at:

CTE AWARENESS FOUNDATION
www.ctefoundation.org