

# Transcript of Little Brains – Big Future: The Impact of Traumatic Brain Injury in Young Children

Moderator: Good morning. I am [Allison Bolton 00:00:02], Family Support Coordinator with the Pennsylvania Family Support Team, based at the Center for Schools and Communities. I will be your moderator for today. It is my pleasure to welcome you to today's webinar session "Little Brains - Big Future: The Impact of Traumatic Brain Injury in Young Children". It is now my pleasure to introduce our presenter for today.

Ashley Graves serves as the Project Development Specialist for the Center for Schools and Communities. In this role, she provides technical assistance for Safe Kids Pennsylvania. Specifically for Safe Kids Pennsylvania, Ashley works to bring awareness to the issue of childhood injury. She serves as the State Coordinator for Pennsylvania and interacts closely with Safe Kids worldwide. She is a Certified Instructor in Lifeline Suicide Prevention, Pennsylvania Student Assistance Program, and National Child Passenger Safety Technician. Ashley earned a BS in Physical Education from the State University of New York at Cortland College and a Masters of Education in Health Education from Penn State University. She is a certified teacher in both New York and Pennsylvania.

It is my pleasure to welcome Ashley this morning. Please be patient while I pass the presenter privileges to her. Ashley, thank you for joining us, the microphone is now yours.

Ashley Graves: Thank you, Alison, and welcome everyone, to the webinar. I appreciate those who have taken the time to join us today.

As Alison mentioned, I did get my Bachelor's Degree in Physical Education, so in doing that, I then proceeded to get my Masters in Health Education. Through that, I really took a liking to concussions and traumatic brain injury and how that impacts teenagers and young children.

As we get started here, we'll view the mission statement, which was: "Traumatic Brain Injury impacts cognitive, physical and affective domains." The purpose of this is to understand how it impacts each kid different and how those kiddos may then recover from them.

The objectives for today are understanding the mechanism of injury, recognizing the signs and symptoms associated with TBI, and learning how the young brain is more susceptible to TBI.

Some of the statistics that we have, we found through the CDC. It's estimated that 1.7 million people sustain a TBI every year. That's across the United States. Of that, we have about almost 500,000 emergency department visits, almost 3,000 deaths, and 37,000 hospitalizations for children zero to 14 with the TBI. On average, that's about 62,000 children that sustain brain injuries that require

hospitalization. Most of those are a result of the motor vehicle crash, falls, or sports injuries. Then of course, we have some child abuse and other causes that may contribute to those.

Traumatic brain injury is caused by a bump, blow, jolt, or penetrating head injury, and that disrupts the normal function of the brain. The majority of TBIs that occur are concussions or other forms of mild traumatic brain injury. So, as we go back and forth and discuss TBI, it could be a mild, or I might say, concussion and that could be used vice versa. Your brain is a soft organ that is surrounded by spinal fluid that protects your hard skull. Then normally, the fluid around the brain acts as a cushion that keeps your brain from banging into your skull. If your head or body is hit hard, your brain will then crash into the skull, and that's what would then cause the injury.

We'll start our first polling question: At what age have all the brain sutures closed? When a child is born, they have that soft skull. We're looking to see at what point that the skull has started to [ossify 00:04:06]. I'll give you a moment. Go ahead and take that poll. All right, and the results are in. The majority of folks thought that 22 to 39 months of age is when the skull has completely [ossified 00:04:22], and that is true. That is the point in one's life that their brain has started to close the sutures.

Here's some of the basic anatomy, just to give you an idea as we move forward, when the brain is injured, so you have an idea of how different injuries to the brain impacts some of the lifelong recovery. The anatomical characteristic of a child's brain render it more susceptible than an adult brain to certain types of injury following head trauma. The head is larger in proportion to the body surface area. This ability is dependent on the bony structure. Due to the small stature, pediatric pedestrians are at significant risk of a direct brain injury in automobile crashes, as their heads might be at the site of initial impact and will absorb a high percentage of the forces applied. Because of that proportion of their head being so much larger than their body, their head's gonna absorb more of that blow. Although infants and young children can tolerate intercranial pressure increases because of the open sutures that we just discussed, the presence of those open sutures does not preclude the prevalence of an elevated intercranial pressure, so they can still get that pressure in between the skull and the brain in any type of TBI. So monitoring this population is still just as important as we would with teenagers or adults.

The purpose of the bony skull is to protect the brain from injury. It is formed from eight different bones that will eventually fuse together as we discussed, at that 22 to 39 months of age. The frontal, the parietal, the temporal, the occipital, and the ethmoid bone are all formed of that skull. Keep in mind that that temporal and where the mandible are joining is called the TMJ joint, and that's another site that sometimes a kid could hit their chin, and that could push up into their temporal, and the temporal's the weakest bone of the brain, so that could then also cause a small concussion. That's why you might see that more student athletes are

wearing mouthpieces these days, again, because that's gonna help absorb some of that blow in that TMJ joint.

Next, we're gonna just review some of the brain anatomy. The cerebrum, which is the frontal lobe, the parietal lobe, and temporal lobe, and occipital lobe, all of that is called the cerebrum. It's the largest part of the brain. It's composed of left and right hemispheres. It performs higher functions like interpreting, touch, vision, hearing, as well as speech, reasoning, emotions, learning, and fine control movement.

The cerebellum is located underneath the cerebrum and it's functioning as to coordinate muscle movement, maintain posture and balance. So, keep that in mind as if somebody was to get an injury towards the back of their brain, they might have more issues with balance and posture and things like that.

And then the brainstem, which includes the midbrain and the medulla, it acts as a relay center, connecting the cerebrum and cerebellum to the spinal cord. It performs many automatic functions, which we also call involuntary functions such as breathing, heart rate, body temperature, sleeping cycles, digestion, things like that, that you don't have to think about to control.

We're gonna go on to our next polling question. That's gonna be related to the brain: At what age has your brain fully developed? I'll give you a minute to take that survey, and then we'll come back. All right, great. So we have a wide range of responses, but the majority again fell in that D, 25 years of age, and that would be correct.

It is found recently, research has found that an adult and child brain works differently. Adults think with the prefrontal cortex, and that's the brain's rational part, this part of the brain that responds to situations with good judgment and understanding, have awareness of long-term consequences, whereas children and teenagers process information with the amygdala, which is found in the temporal lobe area. So, this is then the reason that children have more emotional responses, and the reason that a child's brain is connecting between the emotional part of the brain and the decision-making center's still developing. So, that's why children have a hard time understanding long-term consequences and things like that, and they get easily overwhelmed by emotional input. Again, because they're thinking with a different part of their brain, and so even considering as you're getting into young adulthood, how we have a hard time understanding how, maybe, 21-year-olds are not making the same decisions as you would at 25. Again, they're still developing that prefrontal cortex and that good judgment.

Moving on, we briefly discussed the brain lobes, but we're gonna go into just explaining which each lobe does. That frontal lobe is, we just were discussion about good judgment. It also controls some of your personality, your behavior, your planning, your problem-solving skills, also incorporates your speech and

your writing. As we talk about recovery, the frontal lobe, you would see different recovery options with that, if that lobe was to be damaged.

The parietal lobe, which is the high neck, interprets language and words, sense of touch, interprets your vision, hearing, motor, sensory, and memory. It also is controlling your spatial and visual perception and awareness.

The occipital lobe, which is in the very back of the brain, interprets vision. So, sometimes, if somebody falls on the back of their head, that might be why they feel more dizzy or they have those floating spots. It might be because they hit the back of their head.

Then the temporal lobe, which is again that where the softer bone is, understands language, some more memory, hearing and then sequencing, and organizing of things.

Memory, there's three different types of memory. We break them down into short-term memory, long-term, and skill memory. The short-term memory occurs in the prefrontal cortex. Again, it stores the information for about a minute and then its capacity is limited to about seven items. So, if you think about a telephone number, that's usually seven numbers and that's again the capacity. Then we move into long-term memory, which is an unlimited content, and duration, and capacity. It contains personal memories as well as facts. New memories are encoded in the hippocampus and then transferred into the frontal lobe for the long-term memory. Then that skill memory, it stored automatically learned memories, so it's like tying your shoe, playing an instrument, and writing, and again that's stored in your prefrontal cortex.

The mechanism of injury is really important to know among small children because a lot of these can then be prevented. Mechanism injury is most common to be falls from any type of distance. Whether they're standing on something, they fall backwards, or things like that, and then falls from just standing and walking and running into things. Collisions with a stationary objects is another one, which would, depending on how you look at falls being concluded, motor vehicle accidents or crashes account for about 27% to 37% of all pediatric head injuries. A large proportion of injuries that are caused by motor vehicle or bicycle crashes occur when the child is not properly restrained or wearing a helmet, so keep those in mind when we talk about prevention. A child abuse has sadly been identified to cause brain injury, and about 24% of pediatric patients younger than two. It is suspected in another 32%. Again, that's a hard one to understand if some of these results are from abuse or if they're just from a child being a little child and falling.

As part of that mechanism injury, we have to discuss coup and contrecoup. These are the types of injuries that are associated with cerebral brain contusions, a type of TBI in which the brain is bruised. Coup and contrecoup injuries can occur individually or can concur together. The coup injury can result from a fall or when a moving object impacts the stationary head. In contrecoup, injuries are

common in motor vehicle crashes as the head impacts the airbag, and then rebounds backwards, and then hits the back of the seat. In coup injuries, it's usually either the prefrontal cortex or the occipital part of the lobes that are getting impacted, just one. But then in contrecoup, it's gonna be both of those. So the brain's gonna be shifting back and forth, and it's gonna be contacting both parts of the skull, in the front and back, or side to side.

Of course, we have to bring up rear-facing and forward-facing. As a car seat technician, this is one of the reasons that we always discuss with keeping kiddos rear-facing longer. By supporting the interior, posterior torso, neck, head and pelvis, a rear-facing car seat distributes the crash forces over the entire body rather than focusing them only at the belt of contact when forward-facing. So again, it's supporting the head much better. The American Academy of Pediatrics and the National Highway Traffic Safety Administration have developed guidelines saying that a child should be rear-facing at least to one year of age and 20 pounds before transitioning to forward-facing. The age of a child, in particular, is an important factor, which correlates with the maturity of a child's anatomy, such as muscular development and ossification of the cervical spine. Even though the American Academy of Pediatrics says, "at least one year of age and 20 pounds," they also say for optimal protection, "that a child should remain rear-facing until they reach the maximum weight or height limit for the car seat."

Now, we're gonna watch a brief video. We'll play it a couple of times, then you can see the difference between rear-facing and forward-facing. Great. That shows you how the difference between a child rear-facing and child forward-facing will absorb that blow, and the importance of keeping the kiddos rear-facing longer.

We're gonna move on to another polling question. This one's just as, something a little different: How many states have a law that pertains to rear-facing car seats? I'll give you a minute to go ahead and do that. It's either four, 15, 32, or all 50 plus all the areas. Take a moment to take that. Great, everyone's responded. It looks like the majority thought all 50 states plus the areas have a law pertaining to rear-facing car seats. That is actually not the case. It's only 15 states that have a law that's requiring children. Most of them are requiring children under the age of one and 20 pounds to be rear-facing. Of that 15 states, only four of them have a law requiring children under the age of 2 to remain rear-facing. Of those four states, Pennsylvania is one of them. The other states include California, New Jersey, and Oklahoma. So, good job, Pennsylvania.

Moving on, we briefly discuss how concussion is a mild traumatic brain injury. Again, it's just disrupting that normal brain function. The trauma includes the alteration in mental status. Again it's from that acceleration, deceleration of the brain inside the skull. Loss of consciousness is relatively very uncommon, let alone in children but also in adults when we're talking just a mild traumatic brain injury. So that's typically not a sign that you're gonna see.

Of the severe TBI types, there's closed and penetrating. A closed one would include those falls, motor vehicle crashes, or being struck with an object. That's the majority of most concussions and most TBIs that we see. A penetrating one would usually include something entering the skull, whether it's a firearm or being struck with a sharp object.

Severe TBIs contribute for about 31% of all injury-related deaths. Of those, it can cause permanent disability. Non-fatal severe TBI may result in extended period of unconsciousness, which would be a coma or amnesia after injury. Hospitalization after a severe TBI, it's about 43%, still have a related disability one year after.

Moving on to physical symptoms, I kinda broke these down so that you could see that the ones in the left column are a little bit more easier to notice in a small child as opposed to the ones in the right column are kinda difficult for small children to identify. Very young children frequently sustain bumps and bruises to their head from a host of mechanisms as we discussed such as falls and direct impacts, motor vehicle crashes, and bicycle accidents, or even child abuse. Sometimes, these events can be significant enough to result in a concussion or a traumatic brain injury.

In deciding whether a child has hit his or her head, it needs immediate concussion assessment, can be very difficult. Young children have the same symptoms as an older child or an adult but they do not express in the same way, thinking the same as when a child has his tummy ache. They can't express it in a way that an adult or young teen may do. For example, a kid might not be feeling good, but they might not understand that that's nausea or that that's a headache. So, parents, and caregivers, and physicians should keep this in mind when considering the presence of any type of concussion symptom. When in doubt, a child should be referred for immediate evaluation. A primary care physician should ask the caregiver's about all bumps and blows to the head into considering referring a child to the emergency department if one is suspected. Crying is gonna be a big one, restlessness, things like that, especially if the caregivers that are around the child on a day-to-day basis, they should be able to tell when their child probably needs to be seen.

Cognitive symptoms, again, are gonna be really difficult to identify in small children because they're not gonna understand feeling mentally foggy, but as a caregiver, you can recognize when they're having difficulty concentrating. Even the lack of interest in their favorite toys or activities, they might have problems just with explaining themselves. So, just keep looking for things like that.

The emotional symptoms will probably be a big indicator for small children as that's irritability and increased tantrums, sadness or becoming upset easily. Again, knowing your child and knowing when there definitely is something that needs to be addressed. Depression, and anxiety, and nervousness, all those probably get a little bit harder to identify in a small child.

Sleeping symptoms is another one that we consider when we're talking about a traumatic brain injury, drowsiness, sleeping more or less than usual, insomnia, and then trouble sleeping or falling asleep. Again, looking for these different symptoms in small children can help you assess whether or not they need to be assessed in the emergency department or they need to see their primary care physician.

Post-TBI difficulties can include concentration and attention span, headaches is one that's usually seen at about 90% of an [inaudible 00:21:27] that sustains a concussion. Headache is usually a symptom that's usually last to resolve itself. A visual scanning, that would be playing on an iPad or any kind of device, watching television, reading books, things like that can be really difficult post-concussion because it's just requiring too much. Then the irritability, and the change in attitude can also be present.

As discussed, some of those other symptoms, some red flag ones that would need immediate attention would be the excessive crying, the change in sleep patterns, the child will not nurse or eat, the loss of consciousness is one that should certainly be addressed, and of course, seizures, cannot be woken, increased vomiting, the increased irritability. The ones again in the left side are a little bit more easier to address in small children, whereas the right side might be a little bit more difficult to determine in small children.

When the child is recovering from TBI, the management team would get together and they would determine the appropriate therapy and recovery options. Ongoing communication is always important. Caregivers and anybody that works with a child on a day-to-day basis should be involved in the team. Team members can include caregivers, daycare providers, the pediatrician, a neurologist, a speech pathologist, occupational therapist, and a physical therapist. A speech pathologist is gonna probably work with the oral communications and even feeding. So, just some of those basic things that they may have had before injury that they may lose. An OT is gonna work on more of the fine motor skills such as tying the shoes, buttoning clothes, handwriting. Then the physical therapist is gonna work on gait, independent moving, and the environment's balance, and hand-eye coordination. Again, it's gonna depend where the injury occurred and what part of the brain was impacted, and then you're gonna see whether or not they need speech OT, PT, or maybe a combination of those.

Treatment's always one of the biggest ones. There is no cure for concussions or TBI. Some kiddos may need to stay home or be removed from activities for days or weeks, because again, overall rest is the best treatment post-injury. Recently, the University of Pittsburgh has started prescribing some concussed athletes with the low dose of [pregabalin 00:24:00] three weeks post-injury, again, that's gonna be because of that concentration issues that they're seeing. These medications are typically used to treat ADHD, again it's just a very low dose. They're trying to see the results from that. Some children might again need some kind of medication that treat either migraine or headaches, but keeping in mind that you

wouldn't wanna take anything that could impact your blood flow. So, we typically recommend Tylenol as opposed to an Advil or anything like that.

Recovery is gonna depend on your history. It's really important to keep in mind that everyone's gonna be different. Recovery usually from a concussion can be cleared in two to three weeks, but that's not gonna be necessarily for everyone because if this child, this might be their second or third concussion within a year, they could really have some prolonged recovery, again, because of their history of already having some concussions. Short-term and long-term consequences can be a variety of things. It was always assumed that a child with a brain injury would recover better than an adult because there is more plasticity in the brain but recent research has shown that this is not the case. Many may not consider the physical, motor, cognitive, and behavioral deficits that a child might face following a TBI.

In the area of motor skill development, timing of the injury is really important to the process and can be critical. If the brain injury occurs concurrently with the development of the neuro-skeletal system, in which motor skills are emerging such as walking, then current and future motor functions can be compromised. Again, if a two-year-old child suffers a severe TBI in a motor vehicle crash, they may have been just learning how to walk and feed one's self, but they might have to relearn those skills all over again. In toddlers, with moderate to severe brain injury problems with gross motor coordination and balance are very common, again, because they're just developing those skills.

Cognitive impairments of children may not be immediately obvious after an injury because they're young but maybe more apparent as the child gets older and faces increased cognitive and social expectations from new learning and more complex on social appropriate behaviors. Again, these delays can affect lifetime challenges for living and learning of a child, for their family, their schools, and the communities. Some children may have lifelong physical challenges. Again, it's gonna depend on how severe the brain injury was and what part of the brain was impacted.

However, the greatest challenge many children have with brain injury, face the inability to think and learn and develop socially appropriate behaviors. Common deficits after brain injury include difficulty of processing information, impaired judgment and reasoning. When an adult is injured, these deficits can be apparent within a few months of injury. However, again, with a child, it may take years to see these deficits from the injury because they were younger and they weren't developing their cognitive skills as much as they may be when they head into their school years. So, again, it could be very devastating for a child to have a TBI.

On adult versus a child, again, some of the biggest differences is that muscle mass, that's why we try to keep kiddos rear-facing again because they have less muscle mass, so they're more vulnerable because of that head proportion to body, thus take a longer recovery time. Again, that might be because kids have a



hard time explaining what their symptoms are, and it's just the brain is just not able to absorb the blow as well as an adult brain might be able to.

Then of course the last one is unconsciousness. It's very uncommon in small children. It is more common in adults. But again, it's pretty uncommon either way, especially if we're just talking about just a concussion. It only appears in about 7% of cases of concussion. In a severe traumatic brain injury, it's gonna be a lot more common.

As we briefly discussed earlier, some of the prevention of TBI, of course, wearing seatbelt or using a properly fitted and installed child passenger safety seat, this is gonna be really important to prevention. Wearing properly fitted protective equipment, whether that be a helmet, whether that be some kind of other equipment that they're using, that they're playing, again it should be properly fitted. Again, going back to maybe using a mouth guard. Again, this is why we have started to see soccer and football start to consider taking out hitting things like that when we talk about young children because of the long impact that it can have.

Playground surfaces, there is usually no regulation for playground surfaces. So keeping in mind that if you're taking your child to a playground surface that there should be some type of a shock-absorbing materials. Playground surfaces are laid out in mind of where the area is, maybe not keeping in mind some of the safety factors. Making sure that the swings are within the outsides of the playground surface. It's really important and just keeping in mind that again there is no regulation for them.

Making living areas safer, so some of the things that we would recommend to caregivers is installing window guards to keep young children from falling out of windows. Even if they're on the first floor, it's still a good thing to install. Using safety gates, not pressure gates, but hardware-installed gates at the top and bottom of the stairs. The pressure gates can be easily knocked over by a child. So, we don't recommend putting those in stairways. Keep your stairs clean and free of clutter. Securing rugs and using rubber mats in bath tubs and then lastly, one that's frequently overlooked is securing all large furniture and televisions. TV and furniture tip-overs do account for numerous deaths each year, so keeping in mind that those should be secured.

As we discussed earlier, the people with a history of concussions are gonna be more susceptible to one. Once the brain has been injured once, it's gonna take longer to recover per each concussion, but also, they're just gonna be more susceptible because the brain has kinda had some of that tearing with inside it. Repeated TBI's have been found to have an increased risk of developing dementia, CTE, Parkinson's, and depression later in life.

Next, we're gonna do another polling question. This is in regards to Second Impact Syndrome. That occurs when an individual experiences a second blow within the same day, true or false? I'll give you a moment to take that question.

Great. Many of you, 73% thought that was false, and that is true. It is false. Second Impact Syndrome, although can occur in the same day, typically does not.

Second Impact Syndrome is suffered when a second collision has occurred before the healing process. It can result in death, severe TBI, or prolonged recovery from the initial injury. Then again, it's impacting that cerebral auto regulation of vascular control. Second Impact Syndrome, although it's really rare, it tends to be those cases that you hear of a kiddo that has then been playing football, and has had some type of concussion, may have set out for two to three weeks, and then return, and then somehow sustained what might be a very minor blow, and then has either had a severe TBI, or has maybe even passed away from that. Again, because the brain is so vulnerable when it is still recovering. There's just no magic of knowing what is enough time to allow that brain to heal.

Another thing that they have found is what we call CTE and this is a progressive degenerative brain disease. It is very common in people with a history of repetitive brain trauma. Researchers aren't exactly sure what makes somebody more susceptible to this disease and others, not. Factors such as genetics and age of first impact may play a role, but it's not clear for many researchers as to what too many repeated head trauma, but either way, this head trauma then results in the buildup of what's called an abnormal protein called tau. The tangles of tau can overtake parts of the brain that control the memory, mood, and then aggression. The symptoms are similar to Alzheimer's but have become much earlier on in life. Usually, the onset is seen anywhere from 40, 50, but certainly 60 years of age, it's clear. There are four different stages to this disease. The most severe case can result in suicidal thoughts. Again, thinking back to this NFL players that have unfortunately died by suicide, that could be a lot of those have been found to have CTE.

Next, we're gonna watch a video that will explain CTE a little bit better.

Sanjay Gupta: But first, as you probably know by now, I've reported a lot on concussions in football, particularly in the NFL. But recently, I turned my attention to high school players and what concussions can do to their young brains. During my investigation, I met a family who lost their son, playing this game that he loved, and they made this remarkable decision to donate his brain. And what scientists are learning from his brain is stunning.

Number 44, senior Nathan Stiles is the Spring Hill Broncos star running back.

Ron Stiles: If you would watch him run, he had a flow, a [inaudible 00:34:37] there was just beautiful. I mean, it looks so graceful.

Sanjay Gupta: Nathan's also a starter on the varsity basketball team, a singer.

Speaker 5: The 2010 homecoming king is Nathan Stiles.

Sanjay Gupta: He's the toast of Spring Hill Kansas.

The Broncos lost that game. The next day, Nathan had headaches. No big deal, until five days later when his mom, Connie, received a phone call.

Connie Stiles: I got a call from the trainer at school saying, "Nathan's telling me he's still having headaches. You need to go, take him to the emergency room." So I did, had a CAT Scan, nothing.

Sanjay Gupta: The doctor kept Nathan out of play for three weeks. When he was ready to return, his mom was worried.

Connie Stiles: I remember him looking at me and he goes just, "Now, Mom, are you okay with this?" I'm like ... no, with him going back for football. I'm like, "No, but it's his choice." "Nathan, you wanna play?" "Yeah, I'm all right. Yeah. I only got, you know, two games left."

Sanjay Gupta: But in the last game of the season, right after half time, Nathan went down.

Connie Stiles: He had collapsed on the sideline and the coaches were telling me to try to wake him up, and he didn't. Then I heard them say he's seizing and then, that was it. They took him in the ambulance, we waited for life light, and everything went bad from there-

Ron Stiles: Yeah.

Connie Stiles: From bad to worse.

Sanjay Gupta: After hours of surgery, doctors stopped the bleeding in Nathan's brain. But by then, his lungs and heart were too weak to keep him alive. Nathan died. The cause, Second Impact Syndrome, a condition that occurs when a player is hit too soon after a concussion. It primarily impacts younger athletes.

Chris Nowinski: We have called hundreds of families within 48 hours of their loved ones dying, and it's never easy. I just spoke ...

Sanjay Gupta: Chris Nowinski is the co-director of the VA-CSTE Brain Bank. It's a joint project between the Veterans Administration and Boston University. To better understand concussions, they are looking inside the brain. After reading about Nathan's death, he called the Stiles.

Ron Stiles: Deep down, I felt like it was right thing to do.

Sanjay Gupta: And so Nathan's doctor sent his brain to Boston to be examined by Dr. Ann McKee. She's examined nearly a hundred athletes' brains, and in a frightening number of cases, she has found unnatural tau protein deposits. Those are the same types of proteins found in Alzheimer's patients.

What we're seeing here, is this definitely caused by blows to the head?

Dr Ann McKee: It's never been seen in any reported case except in the case of repeated blows to the head. The youngest case to date is a 17-year-old-

Sanjay Gupta: Wasn't it the brain of Nathan Stiles?

Dr Ann McKee: ... which is Nathan Stiles, right.

Chris Nowinski: Hi.

Connie Stiles: Hello.

Chris Nowinski: Welcome. Chris Nowinski.

Connie Stiles: Connie Stiles.

Dr Ann McKee: Hi. Ann McKee. How do you do? It's all familiar, beside the window.

Sanjay Gupta: This is the Stiles' first visit to the Brain Bank.

Dr Ann McKee: What we've learned in the last three years is that it's a progressive disease. And then, as the individual ages, if they're susceptible to this disease, it becomes a widespread disease affecting larger regions of the brain.

Connie Stiles: So, all of this was because the kid had a concussion?

Dr Ann McKee: Probably more than one concussion and probably some sub-concussive hits too.

Chris Nowinski: No one believed there was a problem until we were able to show-

Connie Stiles: Well, it's too late, huh?

Chris Nowinski: Yeah.

Connie Stiles: For Nathan, yeah.

Chris Nowinski: At least-

Sanjay Gupta: The Stiles met with me afterwards.

What was that like, to sit there and talk to Dr. McKee, Connie? What was ...

Connie Stiles: You know it's my son, and to see the pictures of his brain, that's-

Sanjay Gupta: That's a lot.

Connie Stiles: Yeah. Yeah, that is a lot, something you don't wish on your worst enemy.

Ron Stiles: But I think the good thing is, you can see every effort's being made to learn from it. Then, I think, Nathan is helping to come up with a plan to ... maybe what to do with concussions.

Sanjay Gupta: We can see more about this in the documentary that I put together. It's about in North Carolina trying to turn tragedy into triumph. Question keeps coming up: Can you play a safer game and still win? It's called Big Hits Broken Dreams, Sunday, January 29th, right here on CNN.

Ashley Graves: As they mentioned, in CTE and the things that the Second Impact Syndrome, again, are more common in athletes, but again, nobody quite knows the reason of how many blows one can take that's gonna develop that CTE or even Second Impact Syndrome. A child could suffer some kind of concussion or brain injury in a motor vehicle accident and then weeks later, be playing and not think of anything and hit their head. So, it's just something to keep in mind. CT Scans aren't gonna typically show anything of concern, as it did in Nathan Stiles, it didn't show any concern, so they sat him out for three weeks, but clearly, it wasn't enough to help his brain completely heal.

Post-concussion Syndrome, it's more common in children and young teens than in adults. Again, it's more common in people that suffer multiple concussions. The symptoms do not resolve for weeks, months, or years. There's no specific protocol to help with this condition. It could take months for anything to start to subside. We have learned that through people resting, that that is the best tool to help heal. Even if they start doing some activity, that can start make them asymptomatic again. Truly, having kiddos refrain from any type of activity and even visual scanning, whether it's watching TV or being at some kind of electronic device, it's all stuff that they recommend staying away from in those first couple of weeks following any type of traumatic brain injury.

I've kept this in here. This is in regards to neuropsychological testing. ImPACT testing is typically the most common one that we see. ImPACT stands for Immediate Post-concussion Assessment and Cognitive Testing. This test consists of six assessment modules that are combined mathematical to produce four different composite scores for verbal memory, visual memory, visual, motor speed and reaction time. This test, over time and time again, has proven to be the most accurate and reliable and valid test to determine if a concussion has occurred.

This is an example of some of the results that you would see in an ImPACT testing. Again, this particular student had a baseline test. But if there was not a baseline test, they could go off the percentages. Each percentage, which is those smaller percentages that you'll see like the 88 and the 91, those percentages are what's particular to that gender and age group. That student scored a 96 and that's in the 88th percentile for that age group. Then they went and scored a 55%, which is less than 1% of that age group. So, even if that student didn't have a baseline, we'd still be able to get that. I think we're gonna see that more and more with younger kids. The difficult part about providing any type of ImPACT

test is it requires children to focus, and it just might be a little too difficult for some of the younger kiddos. But again, the tool that is being used more often, so do keep that in mind.

Lastly, here are some of the references I used. If you want to look any of them up, they'd be great. Also, that video was from that documentary that was Big Hits Broken Dreams. It's just a wonderful documentary on concussion.

Then lastly, my contact information, if you needed that.

Moderator:

Excellent. Thank you so much, Ashley. I'd like it this time to open it up for questions. If you do have a question for Ashley, please go ahead and type that in at this moment into the question box.

Mic has gone ahead and placed to the handout of the slides, right here in the go to webinar control panel on your right-hand side. So, if you have registered late and did not receive the slides, but would like this to be a reference, then please know that you may print them right here from today's sessions. Then again, as always it will be placed with the archived version of the recording.

Go ahead, and let's see if any questions come across. I think there was one that had come across throughout the presentation. I'm just going to unclick my microphone and share that with Ashley, and we'll come right back to see what other questions we may have.

We did that one question that came in when Ashley was discussing the injury that might occur from a motor vehicle crash, and the benefits of keeping a child rear-facing rather than moving them too quickly to forward-facing. A question had come in if that would be the same if the car was hit from behind or from the side. From behind, yes, because that's going to have that same movement. It may go in different direction that the head is moved forward first, then back, but you're still gonna have that kind of bouncing effect. From the side, it would be a different type of impact to the brain, but the side impacts are much less frequent in terms of motor vehicle crashes than are frontal. Frontal collisions are the greatest. So, yes, the brain at any time that there's an impact, that's gonna shake, but again, that impact may be different if it is from a side or from the front.

Okay, I don't see any other questions coming in right now. I did want to follow up but there is ... actually, one just came in.

I'm gonna save my comment first, and that was, just as a reminder, for everyone who is a parent educator or home visitor or whatever your profession may be in terms of supporting families, I think a lot of Ashley's message in terms of these younger children are they can't verbalize what they're experiencing, that they're feeling fuzzy or they can't see things correctly or they can't focus. So I think it's really important for the role of the parent educator or home visitor to listen to the parent when they're expressing concerns that one just doesn't seem to be able to do, stay focused, or do what he could do last month. And really, talking through

that with the parent or caregiver, just see, might had there be something that had occurred? You know, a run in the yard that resulted in a fall, because remember, these can be falls for very small children, infants.

A lot of times, it's a fall from a changing table, a fall from someone setting the infant up on the couch and they roll off. This doesn't have to be a fall from a great distance. For an infant, a fall from the changing table is a significant fall. So, being able to talk with the family about, well, "Has there been anything that has occurred? Have there been any falls, maybe any impact?" And you would have to phrase it in a way that a family understands this isn't a completely huge event. Again, a fall off of a couch, a roll off of a bed can be that major event. So, helping the family understand when a small fall in their minds occurs, that seeking medical care may be necessary especially if they're noticing some of those signs or symptoms that Ashley had brought up. Again, for very young children would be hard for a child to verbalize.

It looks like we had a question come in that said, "What can we as parent educators say to parents of children regarding sports? There seems to not be an age that is necessarily safe for sports."

Ashley Graves: In regards to trying to find that perfect age to recommend sports, you'll see that's why a lot of the soccer leagues and the [inaudible 00:47:26] or football leagues have been removing, whether it be tackling or head balls. In that first, I was a little concerned that we're removing head balls because I said, "At what point are they gonna learn it?" But if the brain and the neck is not developed, that type of impact and impacting, if all wrong, could be really substantial for a small child. So, that's another reason they've removed tackle football for small children. I think, even as we move forward, I think that will be pushed further and further out for kiddos with tackle football. Again, it's just as more research comes in, we learn more and more.

There's really no recommendation, again, at what age is the safest, but keeping in mind that the protective equipment is really important. Certainly recommending to parents that if a kid's gonna play soccer, that maybe using a mouthpiece would be important. Again, it's just gonna help absorb some of that shock. Luckily, for small kiddos that are playing sports, when they do collide, they're just not as fast as maybe teenagers, so the collision might not be as big of an impact but certainly them colliding with a stationary object or another player would be of concern. Certainly, seeking medical attention is important especially if the kid is having any type of signs or symptoms of a concussion. Again, there is no "What is the safest age?" But it's just what is in the best interest of the child and what the caregivers feel is the best for their kiddo.

Moderator: And I would follow up that I feel that we're encouraging kids to be active and to play. So, we just have to figure out the balance of what might be appropriate. As a mom of elementary-aged children, that recess time when they're on playgrounds is ever so important for the school-aged kids. For those younger kids going to the community park to play on a playground, it's very important I

think as our role is family support professionals working with families, it really comes down to helping families understand that there is certain playground equipment that is appropriate for younger children and a playground equipment that is appropriate for older children. Even though a lot of times, we ... I'd be guilty of it too, think our kids are ready for something, develop mentally, we need to wait and have them do the activities that are appropriate for them. So, getting on playground equipment that is appropriate for third-grade and up is not what's appropriate for a three-year-old. So, helping families recognize that this small-scale playground equipment is appropriate for your toddler at this time and when they get older, then there's some other equipment that's appropriate because again, as Ashley said, that falls are where the head injuries are occurring for those really young children. So, a fall from a playground equipment can be the cause of that injury, so just helping families understand that balance.

Once that they get into the age of sports, it really comes down to those leads and those taking the measures that are necessary. Again, as Ashley said about removing the opportunity to head balls in soccer, that was a change made this year. For my son's age, they could not head a ball anymore. I know a lot of parents were pretty upset about it but I think because of the research coming out, these leagues are understanding we've got to take some measures to prevent the injuries to children. Encouraging parents to be active in their child's physical activity is very important but also for them understanding what is correct and what is acceptable and what's okay for them to do at this time. I think as a home visitor, a parent educator, really helping families understand what are the risks within their homes, what are the risks outside of their homes, and how can we help these children be safe.

With that, again, I wanna thank Ashley so much for her participation today in helping us lead this webinar. This was one that she came on the spot for us because we had a cancellation for what was supposed to be our November webinar, so we are so fortunate, she was able to step up. Thank you very much to Ashley, and to all of you for your participation. Thank you for joining us today. Again, the archived session will be up on the parents and teachers website within the week. You will be receiving an electronic evaluation via email. That will probably be here shortly. Please take a couple of minutes to complete that because your feedback is so important to us to be able to deliver these webinars of the highest quality. Registration information for next month's webinar, which you can see on the screen is Communication Development in Young Children will be coming up momentarily, probably this week. So, please watch for that, and we encourage you to share that with any of your colleagues to register for, again, Communication Development in Young Children.

Always, as a reminding, you can join these family support webinars in multiple ways including mobile devices such as phone and tablets. Thank you again for joining us and this concludes today's webinar.