

HOW THE RECENT ILLUMINATION ON PUBLISHED  
RESEARCH OF CHRONIC TRAUMATIC  
ENCEPHALOPATHY IS CHANGING VIEWERS, ATHLETES  
AND PARENTS PERCEPTION OF AMERICAN FOOTBALL

by

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A THESIS

Presented to the Department of Journalism  
and the Robert D. Clark Honors College  
in partial fulfillment of the requirements for the degree of  
Bachelor of Arts

June 2018

## **An Abstract of the Thesis of**

Emma Childs for the degree of Bachelor of Arts  
in the Department of School of Journalism and Communication to be taken June 2018

Title: Concussions and CTE: How They Are Changing the Perception of  
American Football

Approved: \_\_\_\_\_

Rebecca Force

This research explores how the modern publication about the evidence arising from primary research on Chronic Traumatic Encephalopathy is affecting the perception of football, specifically at the high school level. The investigative news package suggests that the sport is being coached with a lot more caution and that parents of youth involved in this sport are beginning to be a lot more cautious in their approach to their children's participation in American Football.

## **Acknowledgements**

I would like to thank my professors, colleagues, peers, Duck TV family, and my Student Recreation Center job for holding me accountable and inspiring me to work in a field I am passionate about. Thank you to my Association for Women in Sports Media Executive Board for being a group of strong women that has pushed me the last two years to be the best version of myself. I am forever grateful for the opportunities the School of Journalism and Communication has provided me with. I extend my biggest appreciations to Rebecca Force, my thesis advisor, professor and mentor. You have supported, coached me and inspired me to work hard, ask questions and to take critiques gracefully. Thank you for checking in on me and making sure I stay on track. Thank you to Lori Shontz for inspiring me to pursue a sports journalism career. Your J299 Sports Media and Society class I took from you helped me look at all sides of sports stories and approach the field with an analytical lens. I also want to thank my two other thesis advisors that serve on my committee, Professors Jesse Abdenour and Elizabeth Raisanen. Thank you for being willing to take the time to participate in this project. I also would like to thank Matt Palma for being willing to help with some technological elements of this project. Lastly, I would like to thank my parents and friends for being my support system over, the past four years; your encouragement, late night phone calls, shoulders to cry on and love have helped me to succeed.

## Table of Contents

Introduction	1
Literature Review	4
<b>Physiology of concussions: What are concussions?</b>	4
<b>Physiology of CTE: What is Chronic Traumatic Encephalopathy?</b>	6
<b>Subconcussive Hits</b>	11
<b>Recent Findings- Age You Start Playing Matters</b>	12
Method	16
Subjects in Story:	19
Parent	20
Questions for Viewer	22
Findings	23
Youth Perspective	23
Parents	23
Viewership	24
Expert	26
Programs	27
Laws	27
Discussion	29
NFL Response to Medical Evidence of Connection Between Football and CTE	32
Laws and Legislation	37
Heads Up Program	41
OSAA's Concussion Guidelines and Most Recent Version	43
Youth Sports and Effects of Concussions	48
Conclusion	52
Appendices	55

## **List of Accompanying Materials**

1. DVD with my news package
2. My YouTube Channel: Emma Childs, video named “Thesis”

## **List of Figures**

Figure 1: Aaron Hernandez's Brain Scans

Figure 2: Brain Comparison

Figure 3: CTE by player position, The New York Times

Figure 4: CTE Stages

Figure 5: USA Football American Development Program, Rookie Tackle Program

Figure 6: NFL Concussion Numbers, Courtesy of the National Football League

Figure 7: Timeline

Figure 8: Timeline

Figure 9: Timeline

Figure 10: Timeline

Figure 11: Timeline

Figure 12: OSAA Concussion Protocol Guidelines, Page 1

Figure 13: OSAA Concussion Protocol Guidelines, Page 2

Figure 14: OSAA Concussion Protocol Guidelines, Page 3

## Introduction

Brett Favre, a 48-year-old, who played 20 seasons as a quarterback in the National Football League and retired in 2010. He told NBC TODAY in an interview on April 12th, 2018, “The brain and just the skull itself, for (eight to 15-year-olds), and maybe even older, is not developed enough and they should not be playing tackle football.”

Chronic Traumatic Encephalopathy, also, known by its acronym, CTE is a neurodegenerative brain disease that is characterized by a buildup of “abnormal tau protein in the brain” (Daniella Emanuel, CNN, 2017). It can be diagnosed most commonly through scans of the brain after an individual has died. Scientists are able to observe the location of the protein buildup. They are also able to correlate symptoms with amounts of protein buildup in players’ brains as well. The clinical symptoms of CTE include impulsive behavior, depression or apathy, short-term memory loss, difficulty planning and carrying out tasks, emotional instability, substance abuse, and suicidal thoughts or behavior. Doctors can test for these symptoms by testing the patient's speech, language and cognition, their reflexes, their muscle tone and strength, their ability to get up from a chair and walk across the room, their sense of sight and hearing and by testing their coordination and balance. Players can notice the clinical symptoms of CTE while they are living, but the disease cannot be 100 percent positively diagnosed with CTE until they are deceased.

In 2016, 202 brains of deceased former football players were donated to Dr. Ann McKee in the Boston University CTE Center. Of these 202 brains, 111 brains of former players in the National Football League were donated to Dr. McKee. 110 of those 111

brains were found to have developed CTE. 177 out of the 202 total football players that were autopsied were found to have developed CTE (Boston CTE Center, 2017).

Favre is one of many former NFL players concerned about chronic traumatic encephalopathy. Carolina Panthers linebacker Thomas Davis said, "I would be lying if I said I didn't get nervous about that stat. But this game, I just love it so much." Davis is not the only NFL player to have spoken out on this topic. 29-year-old Eugene Monroe was released from the Baltimore, Ravens in June 2016. He retired from the NFL in July 2016 as an offensive tackle. The Baltimore Ravens, released Monroe. He wrote in *The Player's Tribune*, "The last 18 years have been full of traumatic injuries to both my head and my body. I'm not complaining, just stating a fact. Has the damage to my brain already been done? Do I have CTE? I hope I don't, but over 90% of the brains of former NFL players that have been examined showed signs of the disease. I am terrified."

Monroe is one of many players to be terrified. All of these players in the National Football League started playing at a young age. Football is a gateway sport that allows us to analyze the risk of athletic competition where an individual is playing a sport where blows, hits or tackles to the head are common. Children start playing football at a very young age; tackle football specifically.

Young people playing football are scared, parents allowing them to play football are scared, and people who love the sport are scared. The best way to look at this fear is to concentrate in on the high-school level. Kids, ages 14-18, have the growing brains and are competing for their future.



There are estimated to be over 300,000 concussions that occur in high school sports annually. In research done during the 2005-2006 school year “the weighted national estimate for concussions” that occurred in all high school sports was 135,901 (Gessel & Fields, 2006). Football had the majority of these total concussions with 40 percent (55,007). These concussions were found to most commonly occur during tackling and being tackled during game play.

Adolescent brains begin maturing at the age of 10, and their physical, cognitive and social-emotional development continue this maturation through the age of 25. This development can be negatively affected when taking blows to the head during football games. Parents have been cited to pull their kids from the sport, high schools have significantly lower levels of participation and some people have stopped watching. Concerns for playing football has risen. Programs, drugs and decrease in play for the sport have been highlighted in the news. These interviews of high school athletes, athletic directors, doctors and parents will be compiled into a news package to illuminate the change in the perception of American football.

## Literature Review

It is vital to analyze and understand the research that has been published regarding concussions in football and chronic traumatic encephalopathy. These studies are leading to a change in the way American football is regarded. The National Football League is worth \$1.4 billion; the 32 teams in the have a combined a market value of \$45 billion. The NFL's connection to CTE may be put in all that value at risk. High school-level American football is the chosen focus to articulate and understand perceptions of the sport since the NFL professional level many young adults aspire to be a part of. These perceptions have been changing as understanding of concussions along with CTE broadens through hard scientific research.

### *Physiology of concussions: What are concussions?*

One large blow, or multiple blows to the head can result in a concussion. A concussion, according to the Center for Disease Control and Prevention, is caused from a hit, bump, jolt or blow to the head, from which, "the head and brain to move rapidly back and forth. This sudden movement can cause the brain to bounce around or twist in the skull, creating chemical changes in the brain and sometimes stretching and damaging brain cells" (Center For Disease Control and Prevention, 2018). When one experiences a concussion, there is a "neurometabolic" cascade. According to Dr. Micky Collins, Director UPMC Sports Medicine Concussion Program, an event that causes an external force to the head "can cause the brain to accelerate and decelerate with translational, rotational and/or angular forces," (Collins, 2017). A concussion is an extreme blow to the head causing the brain to bounce off the walls of one's skull and causes "bruising" to the brain. This is believed to lead to a wave of energy passing

through the brain and brain tissue “triggering neuronal dysfunction” characterized as a metabolic, ionic, physiologic cascade. This involves stretching and tearing of cells and cell membranes. Neurons in the brain and brainstem become damaged. Once these cells become damaged the normal function and movement of glutamate, potassium, calcium and other nutrients/minerals are impeded. When a concussion occurs the normal blood flow to the brain is significantly decreased. Blood is the only fuel for glucose in the brain. The cells that are damaged will try to repair themselves by increasing the blood supply, but since the blood supply after one is concussed is tapered, there is a limited supply. The lack of blood where it is needed causes further damage in the cells (Barkhoudarian, 2011). After someone experiences a concussion they are a lot more susceptible to a second injury to the brain within a couple of weeks after experiencing an initial concussion.

Medical professionals emphasize the fact that brain cell loss is a huge part of every single concussion. An individual who is concussed experiences headaches, nausea or vomiting, balance or coordination difficulties, blurred vision, sensitivity to light or noise, feeling lethargic, hard time concentrating and trouble with memory. The observed symptoms of a concussion are lack of memory of the initial hit or blow to the head. The individual seems dazed, forgets instruction or assignment position in the game, responds slowly to questions and moves clumsily, brief loss of consciousness or sudden mood change. Most recorded concussions occur without losing consciousness.

The short-term consequences and need for convalescence from concussion can interfere dramatically with a student’s life. Technology is often required in the classroom and for daily academic tasks, as when someone has experienced a concussion

they are guided to stay away from screens. This makes it difficult in this day and age to follow through and complete academic tasks. Not only are screens to be avoided, but work that involves concentration is as well. This is justified to causing the concussive symptoms to appear or worsen. The long-term consequences impair brain functioning and can even shorten life.

### ***Physiology of CTE: What is Chronic Traumatic Encephalopathy?***

Chronic Traumatic Encephalopathy is believed by scientists to be brought on by repeated head trauma. Chronic Traumatic Encephalopathy or formally known as CTE is a detrimental neurodegenerative brain disease.

The clinical symptoms of CTE include impulsive behavior, depression or apathy, short-term memory loss, difficulty planning and carrying out tasks, emotional instability, substance abuse, and suicidal thoughts or behavior. Doctors can test for these symptoms by testing the patient's speech, language and cognition, their reflexes, their muscle tone and strength, their ability to get up from a chair and walk across the room, their sense of sight and hearing and by testing their coordination and balance. Players can notice the clinical symptoms while they are living but cannot be 100 percent positively diagnosed with CTE until they are deceased.

CTE can lead to excessive amounts of aggression in an individual and a lack of impulse control. Symptoms of CTE can begin at the age of 40 and there is currently no cure. CTE is broken up into four stages.

The first stage includes confusion, disorientation, inability to focus and headaches. The individual with CTE may experience depression, severe mood swings, suicidal thoughts and short-term memory loss in the second stage. The third stage can

include aggression, depression, mood swings, more memory loss and trouble focusing. The symptoms of the last stage are marked by dementia, speech difficulties, depression, paranoia, visuospatial difficulties and mobility issues (McKee, 2009).

In 2015 former New England Patriots (2010-2012) tight end, Aaron Hernandez, ended his own life by hanging himself with a bed sheet in April 2017 in prison after he was convicted of murdering Odin Lloyd in 2013. Hernandez's brain is being studied at Boston University CTE Center. He was diagnosed with stage three Chronic Traumatic Encephalopathy. Neuropathologist Dr. Ann McKee, who is also the head of Boston University CTE Center, studied Hernandez's brain. She reported that there were dark spots where the tau protein had built up and a lot of damage to his frontal lobe. The Washington Post reported that McKee said that areas of Hernandez's brain "that were supposed to be firm were thin and gelatinous." She also commented that there were abnormally "large holes in his brain." Not only did Dr. McKee find the built-up of tau protein but she also said CTE was evident in dilated ventricles that included chambers of the brain storing spinal fluid which is evidence that the brain had shrunk. They also found an atrophied fornix (nerves associated with memory) (McKee, 2017).

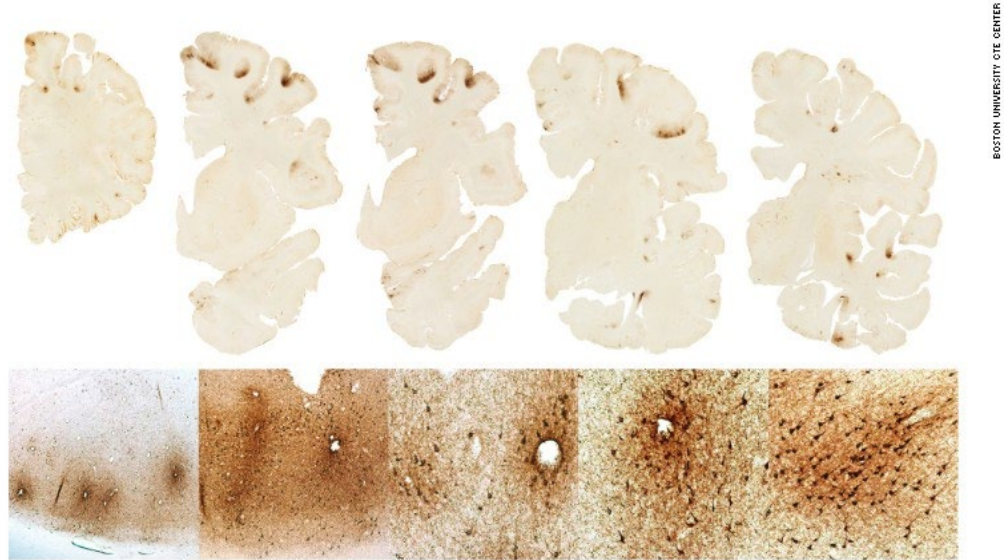


Figure 1: Aaron Hernandez's brain from Boston University

Dr. McKee told a news conference at the Metcalf Trustee Center on November 9th, 2017 that, “we’ve never seen...in our 468 brains, except for individuals very much older.” Hernandez's case is proved to be shockingly severe for such a young individual.

An important note is that Hernandez's estate sued the NFL and the New England Patriots for 20 million dollars for being aware of the correlation between repeated blows to the head in football and how it can cause CTE. They claim that the league failed to do anything about it. The lawsuit has been filed and is currently ongoing.

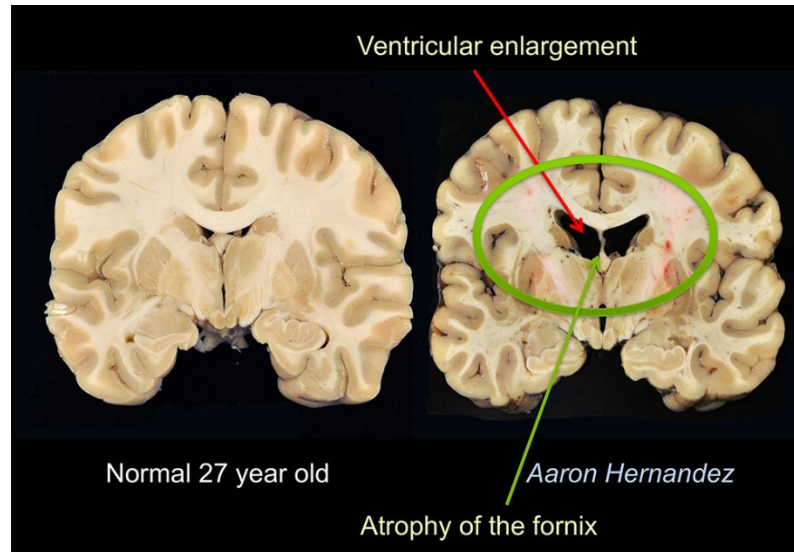


Figure 2: Brain Comparison, Courtesy of BU Today- Science & Health

Hernandez was not the only case Dr. McKee and her CTE research center examined. They dissected and observed over 468 different brains. McKee’s research became popular after she co-published on July 25th, 2017 in the *Journal of American Medical Association Network*, the investigative scholarly article, “Clinicopathological Evaluation of Chronic Traumatic Encephalopathy in Players of American Football.” McKee’s findings of 111 brains of former NFL players that were from the A-BU-CLF Brain Bank supported this investigation (Mez, 2017). The team performed tau protein tests to confirm their observation that 99 percent (110) of those NFL donated brains were found to have CTE. Below is a chart provided by The New York Times showing the separation in positions of the former players.

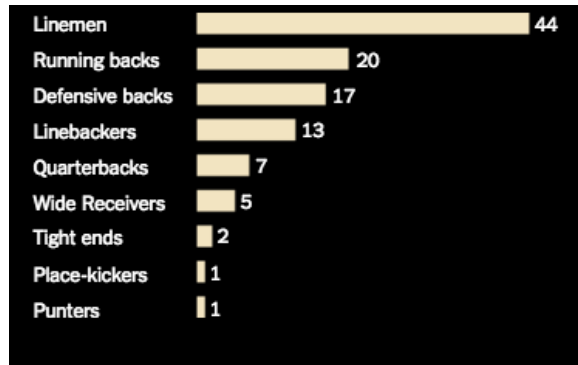


Figure 3: CTE by position, *The New York Time*

Dr. McKee told *The Boston Globe* that she feels like “Dr. Death” and that she can’t even watch football anymore after growing up and cherishing the great American sport. She didn’t watch the Super Bowl for the first time in January 2017. She also told *The Boston Globe* the reason she quit watching football was after examining a young child:

I’ll tell you the reason I stopped. It was September of this [past] year. We got the brain of this kid, 13 years old. He was playing football and he just had this massive traumatic brain injury...He had the kind of injury you would have if you got into a motor vehicle accident. If a truck hit you. It just sort of speaks to the severity of the injury. It looks like they are shielded from it. They’ve got these helmets and these pads and look larger than life — even these little kids — but the brain is fragile. You get hit the wrong way and it can end your life. (Grossfeld, 2017)

It is also important to note that Dr. McKee says that even the physical blows alone are not just the things that can contribute to a player’s development of CTE. She said that even quarterbacks are getting sacked and tackled which means they experience a lot of acceleration and deceleration to their head. These subconcussive hits, if experienced repeatedly over time, also lead to CTE. Dr. McKee spoke at the CTE conference and said, “It’s an intrinsic component of football...Every time you have a tackle or a collision, you’re



going to have these rapid forces affecting the brain...that's one of the difficulties of keeping football safe." ("CTE Conference," 2017)

### **Subconcussive Hits**

CTE is associated with repetitive head impacts (RPH). "It's the hits to the head, not concussion, that trigger CTE," said Dr. Lee Goldstein an associate of the Boston's CTE Center this past March in a published a study, "Concussion, microvascular injury, and early tauopathy in young athletes after impact head injury and an impact concussion mouse model," in the academic journal of neurology called, *Brain Journal*. The heightened awareness of head injuries and CTE has led to more studies and more evidence of the connection between the two. He has made a strong case that subconcussive hits (no loss of consciousness, no dizziness or other usual concussion symptoms) have more of a connection with CTE than full-on diagnosed concussions.

Subconcussive hits do not show any neurological signs or symptoms. In football, the sport consists of primarily tackling and people are constantly going down. Dr. Goldstein told NPR that 20 percent of CTE cases have no "records or report of concussions." His research was done on young adult brains of people who had died from other causes but had sustained mild head injuries prior to their death. His team found evidence that it's not the concussion itself that can cause CTE; it is all the hits (from athletic events) to the head that added up and can lead to the buildup of this tau protein. The study implied that head injuries and traumatic hits to the head could cause blood vessels to leak and then leak protein into nearby blood vessels (Goldstein, 2018).

Goldstein also discovered evidence of some adolescents who were already starting to develop early stages of this neurodegenerative disease. He was able to find

this by examining eight postmortem brains of male teenagers who had recent concussions (from sports) head injuries but died from other causes. Goldstein looked at their brains and saw post-mortem brain pathologies. One of the students, a weight lifter and football player, killed himself. All of the adolescent brains that were examined by Goldstein and his team had played American football in high school before they died.

They tested their theory on mice that these subconcussive hits can cause CTE in young adults in order to test for head motion, traumatic micro vascular injury from hits, that aren't diagnosed as technical "concussions." Goldstein used this to assist his proof of the young human brains where one case had early stages of the neurodegenerative disease. CTE, two of four brains showed phosphorylated tauopathy. The study cites that "Clinic pathological correlation suggested mechanistically causal linkage between early CTE brain pathologies, including phosphorylated tauopathy, and antecedent closed-head impact injury" (Goldstein, 2018).

Goldstein's findings are important because not only is this research being developed, but also youth are going to be advised to not play tackle football before the age of twelve. This research can enlighten parents and viewers on the precautions of playing football. It may also deter parents, viewers and athletes from playing or supporting American football at the high school level.

### **Recent Findings- Age You Start Playing Matters**

Boston University's School of Medicine teamed up with the VA Boston Healthcare System in conjunction with Boston University CTE Center and published a study on April 30th, 2018 in the *Annals of Neurology*- "Age of First Exposure to Tackle Football and Chronic Traumatic Encephalopathy."

Dr. Ann McKee as mentioned earlier, has been working in this field- studying CTE and brains and continues to do so. In relation, to the topic at hand- *youth and football*, McKee among others now have studied over 246 brains of football players. 211 those brains were diagnosed with CTE. They found that athletes who played tackle football before the age of 12 suffered “cognitive, behavioral and mood symptoms” of CTE earlier than those who started after the age of 12. (McKee, 2017)

Many males who take to playing football in high school have been exposed to the game at younger ages- including but not limited to pick-up football, pop-warner football or playing for a team in middle school. They call this “age of first exposure” (AFE).

Dr. Michael L. Alosco and Dr. McKee from the Boston University CTE Center among 21 other doctors in this study included former National Football League players and amateur football players of donated brains to the Veterans Affairs- Boston University- Concussion Legacy Foundation. This new study is part of the National Institutes of Health- funded U01 project called, “Understanding Neurologic Injury and Traumatic encephalopathy.” (UNITE) The study documented demographics, education, athletic participation, AFE, traumatic brain history and military history of each individual that was included in the study. The team evaluated these for each brain by reaching out to people with direct relationships to the now-deceased players that had donated their brains. It is important to note that 99 of the “informant interviewers” were immediate family, 65 were significant others, 22 were their children, 30 were a combination of family members, 20 were parents, 6 were siblings and 1 was a friend.

Through examining each brain in connection with the information gathered in the interviews above they were able to conclude that the symptoms and effects of CTE when paired with biological examination conducted by neuropathologists who examined the brain tissue of every participant.

They used the criteria provided by the National Institutes of Neurological Disease and Stroke and the National Institute of Brain Imaging and Behavior “consensus panel.”

#### The stages they evaluated:

Stage I: 1 or 2 focal perivascular CTE lesions in cerebral cortex at the depths of the sulci.

Stage II:  $\geq 3$  CTE lesions in multiple cortical regions and superficial NFTs along the sulcal wall and gyral crests.

Stage III: Multiple CTE lesions, widespread cortical NFTs, and NFTs in the medial temporal lobes.

9

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Annals of Neurology

Stage IV: Multiple CTE lesions, widespread cortical NFTs, NFTs in the medial temporal lobes, widespread astrocytic p-tau pathology, neuronal loss, and gliosis.

This classification of CTE pathological severity has been supported through several

Figure 4: CTE Stages, (Image Courtesy of Annals of Neurology)

The study concluded, “AFE to tackle football was not associated with the CTE neuropathology severity,” but that younger exposure (before the age of 12) to tackle football was connected to players to having an earlier onset of neurobehavioral problems (emotions, behavior, mood and cognitive problems (Alosco, 2018). Every player studied who played football before the age of 12 had an earlier onset of these

neurological and cognitive problems by an average of 13 years. All these problems are directly associated with developing CTE later in life for athletes who play football. Dr. McKee told ESPN's television show "Outside the Lines" that she advises from this study that all youth to play football after the age of 12 or even push it later to the age of 18, when, athlete's bodies and brains are more mature. She advises this because their study shows that developing brains were permanently changed from playing tackle football before the age of 12, and they will be "less resilient" to brain disease later in their lives.

In "Parents have key role in reducing concussions," by Dr. Michael Koester, the Slocum Sports Concussion Program director in Eugene Oregon, claims that parents can lower their children's risk of receiving a concussion if they weigh the pros and cons of the sport along with its risks. "At the youth level, parents looking to help lessen injury risks should inquire with league officials about putting educational requirements in place for coaches. That can mean requiring certification or incorporating league wide concussion management protocols" (Koester, 2014). With all these factors combined, there are safer approaches to the sport at the youth level.

## Method

### *Video Project/Method of Articulation:*

#### **NEWS PACKAGE**

Total Run Time: 2:37

### **Script:**

#### *(Voice Over)*

*IN ORGANIZED HIGH SCHOOL SPORTS... FOOTBALL ACCOUNTS FOR MORE THAN SIXTY PERCENT OF THE CONCUSSIONS REPORTED IN THE UNITED STATES.*

*CONCUSSIONS HAVE BEEN LINKED TO THE PROLONGED EFFECTS OF TRAUMATIC BRAIN INJURIES ALSO KNOWN AS CHRONIC TRAUMATIC ENCEPHALOPATHY OR CTE.*

*AND THE FREQUENCY OF FOOTBALL CONCUSSIONS HAS MANY PARENTS CONCERNED.*

*FOR ONE HIGH SCHOOL STUDENT...KEENAN PURKEY...THE NUMBER OF CONCUSSIONS HE HAS SUSTAINED IS CONTROLLING WHETHER HE WILL CONTINUE TO PLAY THE GAME.*

*AS A FRESHMAN AT GRANT HIGH SCHOOL IN PORTLAND OREGON PURKEY PLAYED ONE SEASON OF FOOTBALL FOR THE GENERALS...BUT BEFORE HE STEPPED ON THE FIELD FOR THE FIRST TIME... HE HAD ALREADY RECEIVED THREE CONCUSSIONS.*

*AFTER HE STARTED PLAYING FOOTBALL HE SUSTAINED HIS FOURTH.*

*(SOT Keenan Purkey/ "I was playing offensive tackle and it was a JV  
verse varsity practice scrimmage and I just got completely blindsided by the defensive  
tackle...that was like running right behind me to protect the quarterback and he just  
took me out...like just clipped me right around here.")*

*PURKEY SAID HE INITIALLY WAS DIZZY AND WENT TO THE  
LOCKER ROOM WITH A HEADACHE....BUT THE HEADACHES CONTINUED THE  
NEXT DAY... ALONG WITH NAUSEA.*

*HE WENT TO THE DOCTOR WHERE HE WAS DIAGNOSED WITH A  
CONCUSSION.. AND KEPT OUT OF SCHOOL FOR THE REST OF THE WEEK.*

*FOR HIS FATHER THE NEWS WAS INITIALLY DISAPPOINTING.*

*(SOT Andrew Purkey/ "For him to get concussed like early in the season  
when he was having a good time too...he was enjoying it was really disappointing at  
multiple levels.")*

*SYMPTOMS OF CONCUSSIONS CAN INCLUDE  
HEADACHES..EMOTIONAL INSTABILITY...BLURRED VISION...SENSITIVITY TO  
NOISE AND LIGHT AND DISTURBANCE OF SLEEPING PATTERNS.*

*DR. MICHAEL KOESTER IS AN EXPERT ON THE DEVESTATING EFFECTS  
OF CONCUSSIONS.*

*(SOT Michael Koester/ "so your brain moves back and forth so if you  
think about it your brain is sitting in your skull like a yolk inside an egg...gets shaken  
back and forth...you shake that yolk (take graphic) back and forth it's going to get a  
little damaged...same thing your brain bounces back and forth so it doesn't have to be a*

*blow to your head...you get hit in the body your head whip lashes...same effect and it affects the way your brain works.")*

*KOESTER SAYS SIGNIFICANT DAMAGE CAN BE CAUSED EVEN BY SMALL REPEATED HITS TO THE HEAD.*

*(SOT Michael Koester / "It does appear that there's an effect upon the brain and its function and the long term damage with these multiple hits...what we describe as subconcussive blows...e")*

*PURKEY'S MOTHER.. JULIE HAD BEEN HESITANT TO LET KEENAN PLAY FOOTBALL IN THE FIRST PLACE...*

*(SOT Julie Brennan Purkey / Title: "And so I thought well I'll let him play but I said if he gets a concussion that's it and so he did play and he got a concussion...") (:7)*

*AND KEENAN'S DOCTORS GAVE HER STRONG ADVICE.*

*(SOT Julie Brennan Purkey / Title: "and they said stop him now. Stop him now...do not let him play again...as I talk to you and tell you this it kind of makes me think ok we should stick with that and not let him play again..because it is...you know it could be really severe.")*

*BECAUSE OF THE PURKEY'S GROWING CONCERN AROUND CONCUSSIONS...HIS PARENTS SAID HE WILL ONLY BE ALLOWED TO PLAY IF HE BECOMES A KICKER AND IS NO LONGER ON THE FRONT LINE.*

*(SOT Keenan Purkey / "I think I'm going to play kicker next season...which would be fun I really enjoyed that.")*



*THE OREGON STATE ACTIVITIES ASSOCIATION HAS MODIFIED PRACTICES AND RULES IN THE PAST FEW YEARS TO LIMIT TACKLE EXPOSURE..WHILE CONCUSSIONS CONTINUE TO BE A GROWING CONCERN DR KOESTER SEES THE DECREASE IN ACTIVITY LEVELS OF YOUTH AS MORE OF A CONCERN.*

*(SOT Michael Koester/ "we are seeing cultural shifts in activity levels...so obesity levels going up. So it's easier to sit in front of a computer or in front of a TV or sit on your phone then to go to football practice or go to wrestling practice so I think concussion is kind of easy to blame but I don't think it's the single solution to it. I think there's other factors.")*

*REPORTING FOR OREGON NEWS I'M EMMA CHILDS.*

**Subjects in Story:**

**Expert-** Dr. Michael Koester, Director of Slocum Sports Concussion Program

**Face-** Keenan Purkey, Freshman at Grant High School, Football Player

**Parents-** Andrew Purkey and Julie Brennan Purkey, Keenan Purkey's Parents

**Expert:**

**Michael C. Koester MD-** *Pediatric & Adolescent Sports Medicine, Musculoskeletal Injuries in Active Adults, Sports Concussion Management- Director of the Slocum Sports Concussion Program*

**INTERVIEW QUESTIONS:**

1. What is your role here at Slocum Orthopedics?
2. Depending on the time of year...what is the difference, the sport seasons?

3. As an expert...what is your definition of a concussion?
4. I know there's been a couple of articles and studies that recently that have been published about subconcussive hits.so people are going to go down...still hitting their head but not getting a blow to their head. Can you speak on that?
5. Is there a certain age that young athletes should be playing football or soccer like starting tackle young athletes should be playing football or like starting to play tackle football?
6. What advice would you give me as a parent- in terms of watching them play football, or making sure they're okay when playing football and what if I'm worried?
7. I fell like a couple weeks ago and I was worried like "oh no like I just tripped because I'm clumsy and I hit my head and I was worried about having a concussion. What are the symptoms?
8. You touched on this but that you talked about in 2008 and 2009... All of this research that is being done with parents worrying and things like that do you think that it's changing the way....will football still be a popular sport in 10 years? Specifically I mean obviously NFL is king, college football is still huge, but I know at the high school level numbers are dropping. For example South Eugene is having trouble getting kids to come out for their football program.
9. I've been talking to some parents who have children who play football. I most recently talked to a mom of a kid who played football at Franklin High School in Portland, Oregon. She said she was more scared when her boys would leave the house to go bike than when they would go to football practice...and that she feels that the coaches have taught and been teaching safer blocking techniques, how to tackle and better ways to protect the quarterback... I trust the coaches more than I trust my son on a bike. What OSAA changes have they made?

**Parent**

*Andrew Purkey/ Julie Brennan Purkey-Son, Keenan Purkey, Athlete at Grant High*

*School*

1. How did Keenan receive his concussions?
2. How many concussions has he had?

3. Does that worry you?
4. Will you let him play football again? If so why?
5. All of this recent research surrounding CTE and concussions and youth playing football- what do you think about it?
6. What concerns do you have regarding Keenan playing football?
7. Does it deter you from supporting the sport at all?
8. What hopes do you have for your child involved with football in the future and or the sport?

***Lisa Zuniga- Son, Clifford Carlsen Played Football at Franklin High School 2014-***

*2018 at the Quarterback position. She has four sons.....and all four have played football at some point.*

1. Do you have any children who currently play football, if so for how long?
2. Have they gotten any concussions?
3. Does your child playing football right now, with risk of getting concussions scare you? What worries you about them playing?
4. Are you worried about concussions long term? What about subconcussive hits....reports coming out saying those are more detrimental than an occasional concussion?
5. From your perspective, NFL viewership ratings have been down along with participation in USA high school football, as a parent involved in football culture would you attribute this to the growing concern around concussions?

I elected to interview viewers and spectators of the sport in order to add to my thesis topic and conclusions. The viewers were not added to the visual piece, but assist my findings.

### **Questions for Viewer**

1. Do you watch football?
2. If so, why?
3. Did you watch football?
4. Did you play football? Would you let your kid play football?
5. Has your perception of the sport changed after all of this research surrounding CTE and concussions has been developing in the recent years?
6. What age would you let your kid play football? How many concussions would you allow your kid to have before stopping playing football?
7. What concerns you about all this research? Does it stop you from watching it at all?

## **Findings**

Through a news package encompassing an investigative approach (which I produced, edited, shot and wrote) I have found that this news story serves as a catalyst for a bigger discussion concerning CTE and high school football.

### **Youth Perspective**

Keenan Purkey, said that football was fun until he got a concussion. Purkey also said he's ninety percent sure that he will return to the game, but as a kicker. That is the only position his parents will allow him to play after he received four concussions. Purkey is also worried if he gets another concussion about the implications it can have on his mind.

I also talked with Caleb Peck, a student who attends South Eugene High School. Peck chose to stop playing football when it transitioned from flag football to tackle football. He opted out of high school football and chose basketball instead because he was nervous about the tackle aspect of football.

### **Parents**

When Andrew Purkey watched his son Keenan sustain four concussions and then reading the research and news on CTE he was very concerned and disappointed that Keenan Purkey would have to be limited to playing kicker after his first season.

Lisa Zuniga is a parent of four boys who have played football and one, Clifford Carlsen who just left the high school sport. Carlsen played in the quarterback position. Zuniga says that she will always support the sport, as she grew up with it and says she knew the program he was in was safe:

If something happens to him when he's playing football of course I will be devastated...he will have been doing what he loves but you can't put your kid in a bubble. He always had good coaches...Franklin coaches were extremely cautious. They taught the kids you never lead with your head. Teach the kids to tackle. I never forced my kids to play...they loved it so much. But I feel almost physically sick when they leave on a bicycle...there are so many bike accidents in Portland. When you come up against a car you are going to die. My children are also big...if I had a little kid I would probably try to talk them out of it. I've felt a lot of judgment over the years from the parents. They have their kids go play soccer but honestly that's the worst sport. I get really frustrated with this idea that football is so dangerous (Zuniga, Personal Communication, May 2018).

Zuniga is adamant that football is safer than a lot of other hobbies and things her kids do and she brings up the point that soccer is dangerous as well.

### **Viewership**

Social media apps such as Boomerang, Snapchat, Facebook Live, Twitter Live, streaming through Xfinity ON Demand, network streaming's, Twitter posts, Periscope, and instant messaging make the publicity of football very easy. Everyone can connect to it at any point. Accessibility is at an all-time high. While viewership is notably down, the publicity of the sport has increased. For Example, 16.2 million people on average tuned in to watch the NFL during the 2016 season. The 2017 season had an average of 15 million people, watching through week 6 according to Nielsen ratings (Nielsen, 2018). Nielsen is a company that rates television and radio program ratings. But ESPN's Monday Night Football is up eight percent, averaging over 11 million viewers per game shown. It seems as if people are starting to realize how much damage the sport is causing to humans. Ratings are down nine and a half percent. Because of the large amounts of glorification and monetary investment that the United States has in the

sport many people still choose to ignore the fact that repeated blows to the head are connected to a deadly and detrimental disease.

Ultimately, I believe the money, camaraderie, community and fame that football brings to America continues and will continue to capture people's attention despite them knowing the consequences the sport can bring, but the sport will see a decline in viewership over the years, but not enough to discontinue it all together.

From interviews I conducted with fifteen individuals I have gathered that ultimately people still want to encourage the sport, but with more caution. The research that has been published makes them warier of the sport. For one student, Brian Doerr, a senior at the University of Oregon, "all of the recent research surrounding CTE has definitely affected the way I see football. Doerr says he sees it as an opportunity to revise the brutal sport and mitigate dangerous plays. He said that it's the choice of the athletes and parents and it does not deter him from watching the sport. He did say he would make his child stop playing football if they have had more than two concussions. He is going to require his child to start after the age of ten. A lifetime Oakland Raiders fan said that he is never going to stop watching or supporting the sport of football. "I will always have and I will continue to support it" (Doerr, Personal Communication, May 2018).

Andrew Purkey (Keenan's father), University of Oregon alumni, said that he doesn't watch football nearly as much as he did after reading all of the headlines associating football with CTE. He says, "Football is such a violent sport and I find myself turning the television off a lot more because of this concussion issue." One student, Carley Belin received so many concussions from other sports when she was

younger that she has chronic headaches and every time she goes home to San Diego she gets onabotulinum toxin type A (**Botox**) injections to manage the painful headaches. Belin says the pain that she has had to go through does not deter her from ultimately supporting football as watching it is something she will always do with her family. Although she does say, “Whenever anyone gets hit hard on the head I immediately turn off the TV because it’s really hard for me to watch.” There are many different viewpoints on the topic and from my research, it is apparent that awareness of the risk of concussions is the biggest factor.

### **Expert**

Dr. Michael Koester recommends that children wait until they are 12 or 13 to start playing tackle football:

I personally having a son who graduated last year from high school and played football for four years of high school he didn't start playing until he was in seventh grade. Well so he played seventh grade eighth grade. He had a concussion while playing football as an eighth grader we let him continue to play and he went on enjoyed his high school football career immensely. So I think it's a good sport I think it can be done safely I think that it's not a great sport necessarily for kids when they are in second, third or fourth grade when they should be really going through what we call a “sampling phase. (Dr. Koester, Personal Communication, May 2018)

Dr. Koester recommends that children should try different sports to see what they like. He says it will benefit their bodies and with a variety of options and play they won’t be at as high of an exposure to sport-specific injuries.

I think the key message is first we want the kids to be active and second then kind of worrying about the risks of the sport because I'm far more worried about the kids who are sitting on the couch or sitting in front of their computer not doing anything than I am a kid the kids who are participating in any type of physical activity. (Koester, Personal Communication, May 2018)



## **Programs**

As mentioned previously youth and high school programs are adapting to the concussion research that has been published. At the youth level people are playing tackle later. USA Football is encouraging youth to even wait until high school to participate in tackle football programs.

U.S. Participation in high school football is down 3.5 percent over the past five years, reported in the annual survey by the National Association of State High School Federations.

## **Laws**

As a result of all the research coming out around CTE and concussions the revision and addition of laws and regulations surrounding concussions have affected the NFL, football at the collegiate level (NCAA), and high school programs. Laws and legislation surrounding high school and football seem to be constantly revised. Delegate from Maryland, Teri Hill and Senator William Smith proposed a bill in February 2018 that would not allow the states board of education from sanctioning any football programs for youth in the state of Maryland. They hope to not allow children to play tackle football before the age of 14. This bill is modeled after other proposed bills in Illinois and New York in January of 2018.

Targeting rules at the professional level have changed and adapted. The NFL passed in March of 2018 a “helmet-hit” rule. Players will be penalized 15 yards and have the possibility of being disqualified from the game if they lead with the crown of

their helmets during games. As written on NFL.com the rule states, “Playing Rule Article 8: It is a foul if a player lowers his head to initiate and make contact with his helmet against an opponent. The player may be disqualified. Applies to any player anywhere on the field. The player may be disqualified.” (“Official Site of the National Football League,” 2018)

Targeting was approved as a separate foul in NCAA football. In the past few years, the e Football Rules Committee has continued to advance these rules in order to avoid dangerous play. In 2013, players who target and as the NCAA puts it, “contact defenseless opponents above the shoulders” are required to be immediately ejected from the game.

At the high school level programs are guided and coaches are taught to teach youth to not block, tackle or hit with their heads.

## Discussion

American football is a sport that has been played since 1869. In 2017 there are 32 teams in the National Football League (“National Football League,” 2017), over 130 teams in Division 1 Football Bowl Subdivision (FBS) and 125 Football Championship Football Subdivision. There are over 770 collegiate programs and thousands of high schools that have football teams (“National College Athletic Association,” 2017).

CTE was not correlated with football until about 10-15 years ago. It also has been identified in soccer, ice hockey, baseball, rugby, and military service. In 2010, the NFL finally agreed to donate \$1 billion to McKee’s research. Stanford University researchers found that on average a college lineman took 62 hits in a single game (Carey, 2012).

One former linebacker who played for the New York Giants in the 1990s believes he has been experiencing signs that he has CTE. Corey Widmer denied the honor to be placed in Montana State’s (where he played college ball) Hall of Fame 2018 class. He told *The Bozeman Daily Chronicle* that “concussions” were the reason as to why he was not accepting this honor. Widmer is now 49 years old but played in the NFL for eight years until 1999. He has reported to the *Bozeman Daily Chronicle* that he has been experiencing depression, violent mood swings and a lot of memory loss. Don’t let your kids play tackle football at least until high school, he urges, and even then, perhaps wait until they’re seniors. If they have the speed and the strength to play college football and beyond, they’ll be discovered. Once they’re adults, he says, “If he wants to put himself out there and destroy his brain, as long as he’s fully informed ... that’s

America. Until then? Flag football.” (Corey Widmer, *Bozeman Daily Chronicle*, March 2018)

As NFL athletes are beginning to come forward about the impact the game has had on their brains, the sport itself is taking a hit. The number of television viewers is declining. Flag football is increasing by 66 percent in the NFL Flag football program run by USA Football from 2013-2016. There have been many changes put in place by the umbrella organization of youth football, USA Football. Dr. Michael Koester, sports concussion doctor at Slocum Orthopedics in Eugene, Oregon, backs up the changes USA Football has instilled in getting youth accustomed to the sport:

They're not learning a lot. They can get pigeonholed in one position. A kid can be an offensive lineman for the rest of his life so there's not necessarily a lot of skill building involved. The one or two kids who are the biggest and fastest and who are maturing faster than everybody else dominate it. So introducing kids to the sport of football can probably be done in a lot better, more successful and more enjoyable ways for everybody. It can be by making it safer and making it more of something that they're going to enjoy and want to continue to do. USA football has put together this developmental model of football and some others like Pop Warner, have been looking as well to where there's a progression through flag football and then they would be teaching the skills of blocking and tackling and then all of that would be culminating into participating in tackle football starting around the age of twelve or thirteen. (Dr. Koester, Personal Communication, May 2018)

**Start a Rookie Tackle Program**

If you are interested in starting a Rookie Tackle program in your league, simply log-in or create an account to access your starter's kit.

Start Here



**About Rookie Tackle**

Rookie Tackle was created with input from youth football leaders throughout the United States to improve the playing experience for young athletes.

Get inside the background of Rookie Tackle.



## FIELD LAYOUT

A small sided game to maximize player skill development and enjoyment at younger levels.

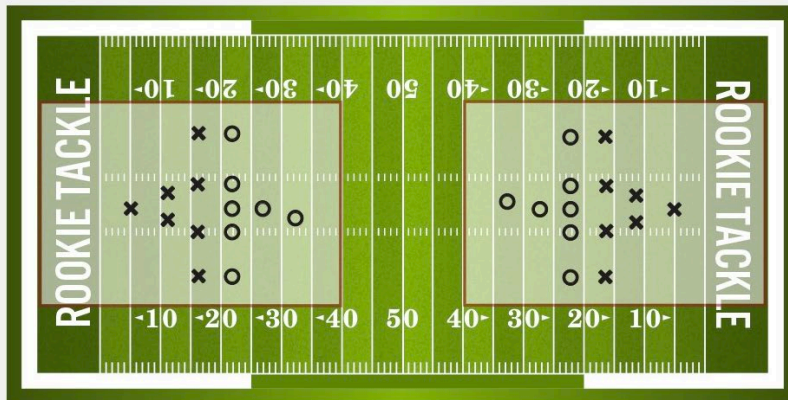


Figure 5: USA Football American Development Program, Rookie Tackle Program

Robert Stern, Ph.D., Neuropsychologist at Boston University, said in *League of*

*Denial:*

In football, one has to expect that almost every play of every game and every practice, they're going to be hitting their heads against each other. That's the nature of the game. Those things seem to happen around 1,000 to 1,500 times a year. Each time that happens, it's around 20G or more. That's the equivalent of driving a car at 35 miles per hour into a brick wall 1,000 to 1,500 times per year.

## Incidence of Concussion – 2012-2016

Year	Preseason			Regular Season			Preseason + Regular Season		
	Practice	Game	Total	Practice	Game	Total	Practice	Game	Total
2012	42	43	85	3	173	176	45	216	261
2013	39	38	77	4	148	152	43	186	229
2014	42	41	83	8	115	123	50	156	206
2015	29	54	83	9	183	192	38	237	275
2016	26	45	71	6	167	173	32	212	244



Figure 6: NFL Concussion Numbers, courtesy of the National Football League

### **NFL Response to Medical Evidence of Connection Between Football and CTE**

On March 14th, 2016 the National Football League’s senior vice president of health and safety policy, Jeff Miller, represented the league at a meeting with the U.S. House on Committee and Energy. He answered, “Yes” to Representative Jan Schakowsky’s question, “Mr. Miller, do you think there is a link between football and degenerative brain disorders like CTE?”

The National Football League fully backed Miller’s definitive answer and finally acknowledged that there is a connection between CTE and the game of football. The NFL for years neglected the claims that repeated concussions caused by repeated blows, tackles and hits over time lead to the development of CTE in NFL players. They had previously said that there was not enough evidence to justify this claim. The

overwhelming amount of evidence of connection of CTE and football has cause the NFL to begin to acknowledge the link. The developments of the NFL's acknowledgement are below.

## Timeline from CNN:

- October 28, 2009** - Part I of the [House Judiciary Committee hearing](#) on Legal Issues Relating to Football Head Injuries. NFL Commissioner Goodell defends the League's policy regarding concussions.
- January 4, 2010** - Part II of the House Judiciary Committee hearing on Legal Issues Relating to Football Head Injuries. Dr. Ira Casson, one of the co-chairs of the Mild Traumatic Brain Injury Committee, denies a link between repeat head impacts and long-term brain damage.
- March 2010** - The NFL's Mild Traumatic Brain Injury Committee is renamed the Head, Neck and Spine Committee. Two new co-chairs are selected, and Dr. Pellman is no longer a member of the panel.
- October 20, 2010** - NFL Commissioner Goodell issues a memo to all 32 teams that warns of possible suspensions for offenders that violate the "playing rules that unreasonably put the safety of another player in jeopardy have no place in the game, and that is especially true in the case of hits to the head and neck."
- February 17, 2011** - Former Chicago Bears defensive back Dave Duerson, 50, commits suicide with a gunshot wound to the chest rather than his head so his brain can be researched for CTE. Boston University researchers find CTE in Duerson's brain, the same disease found in other deceased NFL players.

Figure 7: Timeline

- August 29, 2013** - The NFL and ex-players reach a deal in the class action lawsuit that calls for the NFL to pay \$765 million to fund medical exams, concussion-related compensation, medical research for retired NFL players and their families, and litigation expenses, according to a court document filed in US District Court in Philadelphia. The agreement still needs to be approved by the judge assigned to the case, which has grown to include more than 4,500 plaintiffs.
- December 13, 2013** - The body of former NFL linebacker Jovan Belcher is exhumed in order to perform tests on his brain, a lawyer for the player's family tells the [Kansas City Star](#). On December 1, 2012, Belcher, 25, shot his longtime girlfriend to death and then killed himself.
- January 14, 2014** - A federal judge declines to approve a proposed \$760 million settlement of claims arising from concussions suffered by NFL players, saying she didn't think it was enough money.
- May 28, 2014** - Former Miami Dolphins quarterback [Dan Marino](#) and 14 other former NFL players sue the NFL over concussions. Their lawsuit claims the NFL knew for years of the link between concussions and long-term health problems.
- June 3, 2014** - It is reported that Marino has [withdrawn his name from the concussion lawsuit](#).
- July 7, 2014** - The US District Court in Philadelphia grants preliminary approval to a settlement between retired NFL players and the National Football League.
- July 17, 2014** - Former NFL players Christian Ballard and Gregory Westbrook file suit against the NFL Players Association, alleging the union withheld information about head injuries.

Figure 8: Timeline



**September 30, 2014** - Dr. Piotr Kozlowski releases a report on former NFL linebacker Jovan Belcher, stating that he likely had CTE when he killed his girlfriend and himself in 2012.

**April 22, 2015** - A federal judge gives final approval to a class-action lawsuit settlement between the National Football League and thousands of former players. The agreement provides up to \$5 million per retired player for serious medical conditions associated with repeated head trauma.

**November 25, 2015** - Frank Gifford's family says he suffered from CTE. Gifford's diagnosis comes amid a growing focus on the risks athletes face from suffering repeated concussions, and just hours after the NFL admitted its concussion protocols had failed when St. Louis Rams quarterback Case Keenum kept playing Sunday even after his head injury on the field.

**February 3, 2016** - Former Oakland Raiders quarterback Ken Stabler, who died in July 2015 of colon cancer, is diagnosed posthumously with CTE by researchers at Boston University.

**March 14, 2016** - For the first time, a senior NFL official publicly acknowledges a connection between football and CTE. At a round-table discussion with the US House Committee on Energy and Commerce, when asked if "there is a link between football and degenerative brain disorders like CTE," Jeff Miller, the NFL's senior vice president of health and safety policy, answers "the answer to that question is certainly, yes."



Figure 9: Timeline

**September 14, 2016** - Commissioner Goodell announces an initiative intended to increase the safety of the game, specifically by preventing, diagnosing and treating head injuries. As part of the initiative, the league and its 32 club owners will provide \$100 million in support of engineering advancements and medical research -- in addition to the \$100 million previously pledged by the league to medical and neuroscience research.

**July 25, 2017** - A study published in the medical journal JAMA identifies CTE in 99% of deceased NFL players' brains that were donated to scientific research -- 110 out of 111 former NFL players.

**September 21, 2017** - Attorney Jose Baez tells reporters that results from tests performed on the brain of Aaron Hernandez, the former New England Patriots tight end who was convicted in 2015 of murder, showed a "severe case" of CTE. (The conviction was vacated after his death in April 2017.)

Figure 10: Timeline

**September 30, 2014** - Dr. Piotr Kozlowski releases a report on former NFL linebacker Jovan Belcher, stating that he likely had CTE when he killed his girlfriend and himself in 2012.



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Figure 11: Timeline  
(Photos of Timeline, written and published by CNN.com)

Late in the second quarter of a week eight NFL game in the 2017-2018 season, a Miami Dolphin's linebacker Kiko Alonso (former Oregon Duck) hit the Baltimore Ravens quarterback, Joe Flacco, knocking him down. He was on the ten yard-line and his helmet flew off. Flacco rolled over on the ground supporting himself with his forearms and came up clearly dazed, confused and grabbing at his head. Around 45 seconds of distress and disorganization occurred before Flacco went to the sideline and was helped to follow concussion protocol. Flacco was the only player to leave the game, even though Alonso initiated that rather unwarranted hit, and then Alonso was tackled to the ground by the Raven's Ryan Jensen, a 350-pound offensive lineman. Concussion protocol is not always carefully followed in the league.

The structure of concussion protocol, as it travels down through the tiers of American Football, is vital to understanding how the sport is viewed. The NFL is king in America. The NCAA is an oversight organization for collegiate athletics. Many high school athletes aspire to play at the collegiate level. Both organizations serve as an influence and model for younger kids who play football. By addressing the NFL and the

NCAA's methods of managing concussions on and off the field, high school-level concussion protocols can be appropriately examined.

### **Laws and Legislation**

What is concussion protocol? Concussion protocol is a set of rules and guidelines that may differ among professional, college, high school and pop-warner football. The NFL did not introduce their concussion guidelines until 2013 after the growing concern and research exposing the risk of concussions (Flynn, 2016). The NFL concussion guidelines were put together in partnership with their Head, Neck and Spine committee. For the pre-season, every team in the league is supposed to make sure that their players are educated about the risk of concussions. A baseline exam is taken before the professional football players start their season as well.

Every team is required to have an "Unaffiliated Neurotrauma Consultant" who evaluates players who after a hard hit, have been suspected of receiving a concussion. There is also someone with the role called "Booth ATC" who sits in the booths in stadiums and they have power to review game film and have the authority to call medical timeouts. The Booth ATC in the NFL added a second spotter in this position during games in 2016. Supposedly, if a player reports or shows concussive symptoms they are not allowed to go back into the game. "The Madden Rule" is enforced when the players have been diagnosed with a concussion and has to be escorted back to the locker room. An independent neurological consultant has to clear the player to be able to return to practice and games (NFL.com, 2011).

These rules are clearly not followed, however. For example, Seahawks quarterback Russell Wilson during week nine of the NFL season on "Thursday Night

Football” against the Arizona Cardinals evidently had a concussion. He took a helmet-to-helmet hit late in their game with Carlos Dansby and only missed one play. The quarterback was required to go through the mandated concussion protocol and he didn’t. The commentators on ESPN were baffled that he was let back in the game after Wilson denied feeling as dazed as he looked. The concussion protocols are evidently not always followed or enforced, although, Adam Schefter NFL reporter for ESPN reported that the Seahawks were fined for not following protocol (Schefter, 2017).

Now that NFL concussion protocol has been addressed, the National Collegiate Athletic Association’s (NCAA) concussion protocol needs to be examined. The NCAA’s “Concussion Safety Protocol Management” installed a review process in 2015. The 2018’s current review process finished this past May. Each school with this review process is required to submit “concussion safety protocol” to the Concussion Safety Protocol Committee. Their protocols include checklists, a certificate of compliance and diagnosis and management practice. Each institution and program in the NCAA is required and has their own concussion protocol that they submit for approval. Every college is required to align with the “Interassociation Consensus: Diagnosis and Management of Sport-Related Concussion Best Practices.” (“National Collegiate Athletic Association, 2018)

Concussion protocol laws for high school and Pop Warner football vary from state-to- state. I have examined the state of Oregon’s current concussion protocol because I have interviewed athletes, coaches, athletic directors, viewers and parents who are connected to high school football within this particular state. The Oregon State’s Activities Association requires all coaches to have ten different certifications in

relation to managing concussions. High schools that are members of “OSAA” are bound by law to the “Member’s Schools Responsibilities.” For example, in Oregon there is “Jenna’s Law.” Jenna’s law also known as Senate Bill 721 was created after Jenna Sneva from Sisters, Oregon, had ten concussions from skiing. She was a national medalist at the age of 19 but stopped and attended Oregon State University where she had difficulties studying from all the concussions she had sustained. Jenna’s Law is an addition to “Max’s Law.” It requires that parents, referees, coaches and youth over the age of 12 have to be educated in concussion signs and symptoms. It also requires parents and athlete’s ages 12 or older to sign a concussion information history and an understanding document in order to participate (Kracke, 2010).

Max’s Law derived from Max Conradt experience with football. He was a quarterback at Waldport High School in Waldport, Oregon. He received a blow to his head in 2008 and returned to play. Conradt received multiple concussions within two weeks after the initial blow. He also was allowed to return to the next game immediately and received another hard hit where he collapsed and had large amounts of brain bleeding. Conradt had received two large hits and concussions within two games resulting in “Second-Hit Syndrome.” Conradt is still alive but has been told he will only be able to ever have the mental capacity of a nine-year-old and live with assistance for the rest of his life. His father Ralph Conradt lobbied for Max’s law to be passed in 2009. It requires athletes to be cleared by medical professionals after experiencing a concussion before they can return to play. There is a specific process high schools in the state of Oregon have to follow when an athlete is suspected of experiencing a concussion (Oregon State Activities Association, 2018). Any athlete suspected or

diagnosed with a concussion may not return to the athletic contest or practice within the same day. Athletic trainers have to consult health professionals before the athlete can ever return to the activity. Before returning to the sport, the athlete can no longer be exhibiting signs and symptoms of a concussion. They also have to have a release form signed by a Doctor, Doctor of Osteopathic Medicine, a Physician's Assistant or Psychologist that is certified by the Oregon State Board of Medicine, or the Oregon State Board of Nursing or Oregon Board of Psychologist Examiners. Private schools within the OSAA require the student and a parent or legal guardian to sign a consent form. It acknowledges that they understand the risks of getting a concussion when participating in a sport and that they have received information on symptoms and warning signs of a concussion.

The referees and officials involved in every game are also required to remove a player that is showing signs of a concussion if they have seen a specific blow or tackle that may cause those symptoms, right away. After the player is removed, the responsibility of proper care of the athlete falls on the school and health care officials. This rule states that they are only required to remove the player if they specifically see a bad blow or tackle that may have caused a concussion, not just the occasional bad tackle ("Oregon State Activities Association, 2018). This does not prevent any consequences from sub concussive hits. As mentioned earlier in this body of work, sub concussive hits are now associated with developing CTE and long-term brain damage. While a referee's recognition of a hard hit may prevent the player from worsening concussion symptoms, it may still not enough of a proper safety net for youth.

Like the NFL and the NCAA, high school and middle school teams have baseline testing in place required for every athlete to take prior to the start of their seasons. Portland Public Schools require ImPACT (Immediate Post Concussion Assessment) Testing (Portland Public Schools, 2017). Baseline testing is a test that takes 20-25 minutes for participants to take that. The test scores an athletes brain function prior to the season. As written in Portland Public School’s letter to parents of athletes about the testing it is “a pre-season physical of the brain.” The child’s test results can be seen by health professionals along with the parents in the incidences of a suspected concussion. Portland Public Schools requires athletes, if suspected to have a concussion, consult their physicians and they may be required to take the “post injury ImPACT test.” An issue with baseline testing, however, is that kids have been cited to tweak their original testing so that when they do receive a concussion they can continue to play if they pass their post-injury test.

### **Heads Up Program**

The Heads Up Football program was developed by the Center for Disease Control and Prevention (CDC). It is a national initiative and training program that hopes to increase concussion awareness. It includes but is not limited to providing information on the signs and symptoms, recognizing and responding to concussions. It is a training and guideline that is offered at the national level, but states are encouraged to adopt. The Heads Up Football Player Safety Program is offered as a training course throughout the state but currently doesn’t satisfy Oregon’s “state statute for training course” (“State of Oregon: Oregon.gov,” 2018). It does not satisfy it as stated under the State of Oregon’s official references on the government website.

An ongoing investigation into concussions within the state of Oregon is also taking place conducted by Pamplin Media, InvestigateWest and the University of Oregon's Agora Journalism Center called "Rattled: Oregon's Concussion Discussion." It proves that only 109 out of 291 Oregon High Schools provide access to an athletic trainer. This investigation is proving that lack of resources for many small and rural high schools in Oregon are detrimental to treating athlete's concussions and their recoveries. This investigation is ongoing and has filed more than 200 public records requests with high schools across Oregon.



## OSAA's Concussion Guidelines and Most Recent Version

### OSAA Concussion Information Sheet

#### What is a concussion?

A concussion is a brain injury in which trauma to the head results in a temporary disruption of normal brain function. The injury occurs when the brain is violently rocked back and forth or twisted inside the skull as a result of a direct or indirect force.

#### Concussion Facts

- It is estimated that over 800 high school athletes in our state suffer a concussion each year.
- Concussions occur most frequently in Football, but Girls' Soccer, Boys' Soccer, and Girls' Basketball follow closely behind. All athletes are at risk.
- An athlete does not have to lose consciousness ("knocked-out") to suffer a concussion.
- A concussion is a traumatic injury to the brain.
- Concussion symptoms may last for several days to months.
- Concussions can cause symptoms which interfere with school, work, and social life.
- An athlete should not return to sports when still having symptoms from a concussion as they are at risk for prolonging symptoms and further injury.
- A concussion may cause multiple symptoms. Many symptoms appear immediately after the injury, while others may develop over the next several days or weeks. The symptoms may be subtle and are often difficult to fully recognize.

#### What are the signs and symptoms of a concussion?

SIGNS OBSERVED BY COACHING STAFF	SYMPTOMS REPORTED BY ATHLETE
Appears dazed or stunned	Headache
Is confused about assignment	Nausea
Forgets plays	Balance problems or dizziness
Is unsure of game, score, or opponent	Double or fuzzy vision
Moves clumsily	Sensitivity to light or noise
Answers questions slowly	Feeling sluggish
Loses consciousness	Feeling foggy or groggy

Figure 12: OSAA Concussion Sideline Guide Page 1

## OSAA Sideline Concussion Guide

### Signs and Symptoms of a Concussion

One or more of these signs and symptoms may indicate that an athlete has a concussion. Any of the symptoms listed in this table should be taken seriously. Athletes who experience these signs or symptoms after a bump, blow, or jolt to the head should be kept from play until cleared by a health care professional.

SIGNS OBSERVED BY COACHING STAFF
Appears dazed or stunned
Is confused about assignment
Forgets plays
Is unsure of game, score, or opponent
Moves clumsily
Answers questions slowly
Loses consciousness
Shows behavior or personality changes
Can't recall events prior to hit
Can't recall events after hit

SYMPTOMS REPORTED BY ATHLETE
Headache
Nausea
Balance problems or dizziness
Double or fuzzy vision
Sensitivity to light or noise
Feeling sluggish
Feeling foggy or groggy
Concentration or memory problems
Confusion

### When a Concussion Occurs

If you suspect that an athlete has a concussion, take the following steps:

1. **Immediately remove the athlete from play.** Athletes who experience signs or symptoms of concussion should not be allowed to return to play.  
"When in doubt, keep them out!"
2. **Ensure that the athlete is evaluated by an appropriate health care professional.** Do not try to judge the severity of the injury yourself.
3. **Inform the athlete's parents or guardians about the known or possible concussion.** Make sure they know that the athlete should be seen by a health care professional.
4. **Allow the athlete to return to play only with permission from an appropriate health care professional.** Any athlete who continues to have signs or symptoms upon return to activity must be removed from play and re-evaluated by their health care provider.

This information has been adapted from the CDC's "Heads Up: Concussion in High School Sports" materials by the OSAA's Medical Aspects of Sports Committee. Please go to [www.cdc.gov/ncipc/tbi/Coaches\\_Tool\\_kit.htm](http://www.cdc.gov/ncipc/tbi/Coaches_Tool_kit.htm) for more information.

**\*\*We recommend that you attach this paper to a clipboard or binder to have at all times.\*\***

Figure 13: OSAA Concussion Guidelines Page 2

### **When can an athlete return to play?**

After suffering a concussion, **no athlete should return to play or practice on that same day.** Previously, athletes were allowed to return to play if their symptoms resolved within 15 minutes of the injury. Studies have shown us that the young brain does not recover that quickly, thus the **OSAA has established a rule that no player shall return to play following a concussion on that same day** and the athlete must be cleared by an appropriate health care professional before they are allowed to return to play or practice.

Once an athlete is cleared to return to play they should proceed with activity in a step-wise fashion to allow their brain to re-adjust to exertion. The athlete may complete a new step each day. The return to play schedule should proceed as below following medical clearance:

**Step 1:** Light exercise, including walking or riding an exercise bike. No weight-lifting.

**Step 2:** Running in the gym or on the field. No helmet or other equipment.

**Step 3:** Non-contact training drills in full equipment. Weight-training can begin.

**Step 4:** Full contact practice or training.

**Step 5:** Game play.

**\*\*If symptoms occur at any step, the athlete should cease activity and be reevaluated by their health care provider.**

### **How can a concussion affect schoolwork?**

Following a concussion, many athletes will have difficulty in school. These problems may last from days to months and often involve difficulties with short and long-term memory, concentration, and organization.

In many cases it is best to lessen the athlete's class load early on after the injury. This may include no classes for a few days, or a lightened schedule for a longer period of time. Decreasing the stress on the brain early on after a concussion may lessen symptoms and shorten the recovery time.

### **What can you do?**

- Learn to recognize the Signs and Symptoms of concussion
- Emphasize to players, staff, and parents your concerns and expectations about concussion and safe play.
- Remind athletes to tell coaching staff if they suspect that a teammate has a concussion.
- Monitor sports equipment for safety, fit, and maintenance.
- Enlist teachers to monitor any decrease in grades or changes in behavior that could indicate concussion.
- Report concussions that occurred during the school year to appropriate school staff. This will help in monitoring injured athletes as they move to the next season's sports.

This information has been adapted from the CDC's "Heads Up: Concussion in High School Sports" materials by the OSAA's Medical Aspects of Sports Committee. Please go to [www.cdc.gov/nclpc/tbi/Coaches\\_Tool\\_kit.htm](http://www.cdc.gov/nclpc/tbi/Coaches_Tool_kit.htm) for more information.

If you have any further questions, regarding concussions in high school athletes, the use of computerized neurologic testing like *ImPACT*, or want to know how to find a concussion specialist please contact Michael C. Koester, MD, ATC at [Michael.koester@slocumcenter.com](mailto:Michael.koester@slocumcenter.com)

Figure 14: OSAA Concussion Guidelines Page 3

The constant revision of concussion protocols proves that as evidence surrounding CTE and concussions develops, the worry of anyone involved with the sport increases. Football is thoroughly loved and proves to continue to be dominant in America. Through the constant revision of these protocols organizations are desperately trying to maintain the popularity of this sport. These protocols and management rules provide justification as to why people continue to support the sport. The advertisement and stating of these protocols may convince coaches, viewers and athletes that tackle football will be less harmful. These protocols comfort people playing and viewing the sport. These concussion protocol revisions are instigated due to the perspectives of

parents, athletes, and viewers of American football changing as published evidence that neurological conditions (CTE) are connected with the sports.

The Oregon State Activities Association has revised concussion protocol and revised practice rules in recent years. They have moved to not allowing any daily double practices for any sports during the summer and have greatly limited tackle exposure. Dr. Michael Koester, the chair for the OSAA Sports Medicine Advisory Committee comments on the effect of these rule changes:

[S]o one of the things that we've done in Oregon over the last few years is that we've put in where the teams they can participate in eight practices, eight contact practices during the summer... we've eliminated daily doubles and back-to-back daily doubles. You can't have contact two times a day with a sport. They've eliminated or we eliminated this open time when there could be a lot of contact in football. We've taken it down into a small amount of days that they can do contact or and/or wear equipment because of the risk. (Dr. Koester, Personal Communication, May 2018)

The revision and changing of rules and guidelines in the state of Oregon is evidence that the research surrounding concussions is affecting the sport. These changes are intended to keep youth safe. Many other high school programs around the country have installed a highly revised concussion protocol for the sport. Revisions are ongoing. Parents, athletes and coaches are all clearly aware of the risk of the sport, and many don't want to discontinue the sport; rather, they want to install things to manage and prevent concussions.

Among many products established to combat concussions, one to note is that there's a new drug under clinical trial called Prevasol. This drug is administered as a nasal spray and is marketed as a drug that will help immediate brain swelling after a traumatic brain injury. Brett Favre (a former NFL star), Abby Wambach (on the

National Women's soccer team), David Ross (a former professional baseball catcher for the Chicago Cubs), and Kurt Warner (former NFL quarterback), are all backing this drug (Ryman, 2018). My first thought is can a drug marketed to help reduce long-term effects of concussions be the right move by these famous athletes? Does it make the human body into a specimen that pharmaceutical companies can exploit and make money off of? If this drug is proven to be effective, could it then eliminate a young athlete whose families cannot afford this drug?

People are clearly making changes to rules, habits of the sport and methods of prevention in order to avoid what has been deemed a "concussion epidemic." I have used football going into and at the high school level as a gateway sport to identify the changes in awareness and within the sport. It is evident that there is a broader spectrum of sports that can be detrimental to the brains of youth. There are high concussion rates in soccer, hockey and among military personnel. This conversation in football is important, but Dr. Koester says that everyone is too concussion focused, "It's obviously a big deal people are really worried about it...I was just talking to somebody earlier on one of my jokes is that I've been here at this Slocum Center for twelve years taking care of concussions and I spent about the first four years convincing parents that their child did indeed have a concussion and I've spent the last eight years convincing parents that their child doesn't have a concussion (Dr. Koester, Personal Communication, May 2018).

## **Youth Sports and Effects of Concussions**

Football participation at the high school and youth level continues on downward trend, and state athletic organizations are making significant changes to their athletic and football programs. The Boston CTE center just came out with a study concluding that you enhance your chance by 13 years of having CTE or neurological disorder if you play football before the age of 12 (Boston CTE Center, 2018). Now people don't start playing football at the professional level, they start young. Elementary, middle or high school is the most probable, which means that they have been playing tackle football and taking blows since they were in elementary school. Adolescence, as defined by the National Center for Biotechnology and cited on the United States Government's website, is the time of one's life between the ages of 10 and 19. Adolescence is a phase in one's life that is a large development period for the brain. This development includes a second surge of synaptogenesis, which is the formation of neurons in the nervous system. In the Central Nervous System hormones, dopamine, serotonin and melatonin, are responsible in a large part of brain maturation. All of these hormones affect one's behavior.

Adolescents have an ample amount of brain plasticity. This means that their brains can adapt and "re-wire" their neurocircuitry in the face of learning new skills and talents, but trauma to the brain during this time can also be detrimental.

Brain maturation is influenced by multiple factors during adolescence including: sex hormones, pre-natal and postnatal care, drug abuse, physical, environment, sleep patterns, nutrition, mental and psychological stress. You now can add in another factor, concussions.

The sport of football is violent. In the PBS Frontline film, *League of Denial*, Jim Otto a former Oakland Raiders player from 1960-1974 said, “I know that I went to war and came out of the battle with what I got.” He has had over 74 surgeries for his injuries and wrote a novel called *The Pain of Glory*. The ideology that football mimics war is very much alive and present. It is apparent that this violent battle-like sport fuels aggressive desires, hopes and dreams. The similarity between the spectators “hungry for blood” during Gladiator battles and excited football fans watching their beloved sport heroes do permanent damage to one another is hard to miss.

Pac-12 Network Football Analyst, Yogi Roth, told me that the violent nature of the game is the “reality of the game.” He played football for the University of Pittsburgh and assisted alongside then Head Coach Pete Carroll at the University of Southern California. Roth is deeply involved in the American football culture and believes that everyone knows what they are getting into. “You sign up for a violent sport and fans want to see it,” he commented. Roth says that the game is changing in light of the recent study mentioned previously released in partnership with Dr. Ann McKee in July 2017 (Roth, Personal Communication, October 2017).

It is a violent sport. It captivates and draws audiences, and the league grossed roughly 14 billion dollars because of it in 2017. According to The National Collegiate Athletic Association, the University of Oregon is among the top NCAA Division 1 programs in terms of revenue. In 2017 the football program made 21,523,656 million dollars from ticket sales alone (GoDucks.com, 2018). No other sport at the university made anywhere near a million dollars in ticket sales. Football is clearly still dominant at the professional and collegiate level. While it is evident the sport will not go away, it is

possible some viewership and youth participation will decrease. This cannot be pinpointed to concussions and CTE research in the news directly. Dr. Michael Koester explains:

We are seeing some other sports increase, while we're seeing some sports just kind of flat line. So football has its own culture, but certainly physical activity has its own culture too. Sports like wrestling and football are not always fun. They take a lot of hard work and we're seeing cultural shifts again and obesity levels are going up. It's easier to sit in front of the computer or sit in front of the TV or sit on your phone than to go to football practice or go to wrestling practice. I think concussions are kind of easy to blame, but I don't think it's the single solution to it. I think there's other factors involved in that decrease in some of those sports. (Dr. Koester, Personal Communication, May 2018).

The concussion doctor is saying that the rapidly rising obesity rates are more of a concern than concussions in football. According to the Center for Disease Control and Prevention obesity rates in children have tripled since the 1970s (CDC, 2018). This is important because while concussions are clearly being managed and a lot of efforts are going into protecting youth from getting one during football play, it isn't the main concern of doctors.

There is decline in play, cited by USA Football. 25,901 players dropped out of the sport in high school as reported by the National Federation of State High School Associations. South Eugene High School in recent years is having much lower participation rates. They had one freshman that participated in the entire program (Hansen, 2018). South Eugene has also won seven games in the last four seasons. Dr. Michael Koester is a resident of Eugene and has worked in the area for the past twelve years:



South Eugene is a very special. [The lack of participation] is a little bit of a cultural thing...the question is kind of... does football need to be saved? Should football be saved? Clearly football is a very American sport. It's still a national sport and it's never going to disappear. You're never going to lose football in certain regional areas, but it's certainly at risk for decreasing participation numbers, which we are already seeing. We're seeing at the high school level and we're more importantly seeing at the youth level. Now the question is why is it? Because of concussions? I think that part of it is that parents do have that worry that their kid's going to get a concussion, but are there other cultural factors that decrease that participation because we're also seeing fairly significant decreases in wrestling - so is that because of concussions? Does saying my mom won't let me play because she doesn't want me to get a concussion easier than saying I just don't want to put out the effort to participate. (Dr. Koester, Personal Communication, May 2018)

Many factors are involved as discovered through this project, one being the fear of youth with developing brains receiving too many concussions. Keenan Purkey, 15-year-old from Grant High School in Portland, Oregon says he is afraid of getting another concussion because from what he has seen in the news and “it can harm” his brain.

People aren't playing, as much in high school, but it's hard to pinpoint one factor because cultural values and sport popularity around the United States varies. In Oregon, people commonly support soccer and football is not as big of a deal here. But in the South people memorialize the game. Lisa Zuniga, parent of four teens and two football players, is from Texas and, provides evidence that the football culture in the South is much different, “I would attribute ratings down to culture...but maybe concussions. In the South it is still pretty big a big deal. When I went to my first Franklin game I was shocked you know...it's just different here in Oregon” (Zuniga, L, Personal Interview, May 2018).

## Conclusion

Through this research and methodology of news report I have found that football is adapting. I examined perspectives with research and used an athlete's story to tell the fundamentals. The sport involves a lot of money. Young kids train and practice so they eventually can make it to the National Football League. While some individuals have stopped supporting the sport, I do not foresee it being eliminated. People view football as a violent sport. They are more aware of the implications of the sport and its rules and regulations. The age young athletes actually start playing tackle football will change and have changed due to this fear. From my research and news package I have gathered that the topic and worry of concussions are more commonly on the forefront of people's minds when trying to decide whether allowing their children to play football. The athletes are worried about playing football and some have a hard time watching football. Therefore, people will play and view the sport with more caution, but it is not stopping the majority of people from supporting the sport. The perception of the sport is ever changing, but the sport will not completely change. Dr. Koester is clear that the sport will not disappear:

Coaches across the country in many states have to take a course on heat and hydration and the climatization. We are a lot farther than were 10 years ago, even 15 years ago. Now there are things that just aren't going to change. Football is always going to be a collision sport. The safer you teach it to be, the better it will be, but there's always going to be some risk. One of the things that's changed is just trying to change the perception of the sport. I'm as guilty as anybody.....when we are trying to explain rules changes to other sports medicine physicians, to football coaches and to officials.... part of it is a marketing issue. (Dr. Koester, Personal Communication, May 2018)

Not only have people begun to recognize the detrimental implications of the sport and the long-term brain damage that can occur with CTE but also people are not supporting the nasty violent blows like they used to. Dr. Koester also supports this argument, “so that crack back block that everybody twenty years ago used to stand up and cheer when some guy got knocked off his feet because what a hard block it was...well no one stands up and cheers when that happens anymore.”

Rule changes in football have been evidently driven by concussion data and risk. The most dangerous elements of the game have been eliminated or altered to provide safety. People are not blocking from the “blind side” anymore. Football and concussions are evaluated by “athletic exposures” and that is the risk of concussions through games and practices. Those are being reduced with practice and tackle rule changes. The sports has been crafted and will continue to be redrafted due to safety demand but Dr. Koester claims that young people will be less safe if the organized form ends completely:

My big fear on concussions is that they drive kids from being active...like a mom saying that she knows her son is safer if we ban football tomorrow. We're not going stop football because there's going be a club version. If we stopped having it at the high school level... well it's just going to trickle down. It's just going be a club sport and then there's going to be absolutely no oversight of it like there is right now for club soccer and volleyball and softball. All of those club sports have absolutely no safety standards that they play by, whereas if your kids are in high school there's often an athletic trainer there, they're only practicing for so long and certainly playing in so many games and there's emergency action plans in place. (Dr. Koester, Personal Communications, May 2018)

It can be valuable to parents to prevent their children from concussion exposure through different programs. They might be introducing their child to the sport in a progression manner starting with flag football.

Parents might not allow their children to play football and youth (as individuals) will be less inclined to play football unless proper concussion protocol is incorporated throughout every single high school program in the United States. Rules such as targeting and concussion protocol will continue to bend and change in the sport as discovered through conversations with young athletes, parents, athletic directors, coaches and doctors. Limitations on tackle football for youth have already begun and as numbers have shown, youth are shying away from tackle before the age of 12 and some even up until the high school level. The research and awareness of subconcussive hits are both advancing rapidly. There is still a lot that scientists and experts do not know about these hits and their long-term effective on the brain in terms of causation. It can be concluded that there is a correlation.

Chronic Traumatic Encephalopathy and the breaking research by the Boston CTE Center and Dr. Ann McKee's team has sparked a national conversation about the concussion epidemic and turned heads of parents, athletes and viewers to the issue. It is recommended that this conversation continue as more research develops and the media along with athletes and doctors have a responsibility in this.

The decline in participation and viewership can't be solely attributed to the developments in concussion research, but it is apparent that it is a factor.

## Appendices

### Extra Expert Interviews:

**Li-Shan Chou, *Orthopedics Biomechanics, University of Oregon*:**

1. What is your position here at the University? How long have you been here?
2. What research are you currently doing around concussions?
3. Basics of concussions?
4. How did you start researching on the subject of concussions and “dual-task gait balance” recovery?
5. You found out that concussion symptoms- ability and focusing are still affecting individuals two months after they’ve received their concussion....what methods did you use to find that out?
6. Tell me about your trial/research?
7. I am interviewing some athletes and parents about the effects of subconcussive hits and how they feel about concussions and playing the sport of football- do you have any recommendations or advice or warnings for parents and kids who are worried about playing football?
8. Do you think kids should play football before the age of 12?
9. What do you think about subconcussive hits leading to CTE?
10. What effects do they have leading up to CTE?
11. What do you advise for high school athletes?
12. How detrimental are concussions in relation to CTE at the high school level?
13. Do you agree that youth should not play tackle football before the age of 12?
14. What do you think about the work they are doing at the Boston CTE Center?
15. Do you see the demise of football after all this concussion research going out?

## Bibliography

- "Concussions and Football." *Gale Student Resources in Context*, Gale, 2016. *Student Resources in Context*, [link.galegroup.com/apps/doc/DKBGTO709848036/SUIC?u=port&xid=5c1f7218](http://link.galegroup.com/apps/doc/DKBGTO709848036/SUIC?u=port&xid=5c1f7218). Accessed 14 Nov. 2017.
- "Repetitive hits, concussions, and a mother's long goodbye to youth football." *Washingtonpost.com*, 12 Sept. 2017. *Student Resources in Context*, [link.galegroup.com/apps/doc/A504325290/SUIC?u=port&xid=34262938](http://link.galegroup.com/apps/doc/A504325290/SUIC?u=port&xid=34262938). Accessed 14 Nov. 2017.
- < Mez J, Daneshvar DH, Kiernan PT, Abdolmohammadi B, Alvarez VE, Huber BR, Alosco ML, Solomon TM, Nowinski CJ, McHale L, Cormier KA, Kubilus CA, Martin BM, Murphy L, Baugh CM, Montenegro PH, Chaisson CE, Tripodis Y, Kowall NW, Weuve J, McClean MD, Cantu RC, Goldstein LE, Katz DI, Stern RA, Stein TD, McKee AC. Clinicopathological Evaluation of Chronic Traumatic Encephalopathy in Players of American Football. *JAMA*. 2017;318(4):360–370. doi:10.1001/jama.2017.8334
- Age limits and adolescents. (2003). *Pediatrics & Child Health*, 8(9), 577.
- Arain M, Haque M, Johal L, et al. Maturation of the adolescent brain. *Neuropsychiatric Disease and Treatment*. 2013;9:449-461. doi:10.2147/NDT.S39776.
- Arain, M., Haque, M., Johal, L., Mathur, P., Nel, W., Rais, A., ... Sharma, S. (2013). Maturation of the adolescent brain. *Neuropsychiatric Disease and Treatment*, 9, 449–461. <http://doi.org/10.2147/NDT.S39776>
- Axson, S. (2017 , October 18). NFL TV Ratings Down 7.5 Percent. *Sports Illustrated*, Retrieved from <https://www.si.com/nfl/2017/10/18/nfl-television-ratings-decline>
- Begley, Josh."Here's Every Concussion in the NFL This Year Pic.twitter.com/ZywciboSi." Twitter, Twitter, 1 Feb. 2018, [https://twitter.com/joshbegley/status/959018523098890240?ref\\_src=twsrc%5Etfw&ref\\_url=https%3A%2F%2Fwww.vox.com%2Fscience-and-health%2F2018%2F%2F%2F16956440%2Fsuper-bowl-2018-concussion-cte-nfl-brain-damage&tfw\\_site=voxdotcom](https://twitter.com/joshbegley/status/959018523098890240?ref_src=twsrc%5Etfw&ref_url=https%3A%2F%2Fwww.vox.com%2Fscience-and-health%2F2018%2F%2F%2F16956440%2Fsuper-bowl-2018-concussion-cte-nfl-brain-damage&tfw_site=voxdotcom)
- Brennan Purkey, J. (2018, May 23). Interview by E. Childs [Video recoding].
- CDC Physicians Toolkit; Collins, Gioia et al 2006. *Concussion Definition and Pathophysiology*. (n.d.). Retrieved from <http://dhhs.ne.gov/publichealth/ConcussionManage/Documents/ConcussionDefnPathophysiology.pdf>

Chad A Tagge Andrew M Fisher Olga V Minaeva Amanda Gaudreau-Balderrama  
Juliet A Moncaster Xiao-Lei Zhang Mark W Wojnarowicz Noel Casey Haiyan  
Lu Olga N Kokiko-Cochran *Brain*, Volume 141, Issue 2, 1 February 2018,  
Pages 422–458, <https://doi.org/10.1093/brain/awx350>

Chou, L. (n.d.). Interview by E. Childs [Video recording].

*CONCUSSION SAFETY PROTOCOL CHECKLIST*. (2017, March). Retrieved  
November 7, 2017, from NCAA website:  
[http://www.ncaa.org/sites/default/files/SSI\\_ConcussionProtocolCheckList\\_2018  
2018.pdf](http://www.ncaa.org/sites/default/files/SSI_ConcussionProtocolCheckList_20182018.pdf)

*Concussions and Sports: What You Need To Know*. . (n.d.). Retrieved from  
"Concussions and Football." Gale Student Resources in Context, Gale, 2016.  
Student Resources in Context,  
[link.galegroup.com/apps/doc/DKBGTO709848036/SUIC?u=port&xid=5c1f721  
8](http://link.galegroup.com/apps/doc/DKBGTO709848036/SUIC?u=port&xid=5c1f7218). Accessed 14 Nov. 2017.

Emanuel, D. (2017, July). CTE found in 99% of studied brains from deceased NFL  
players. *CNN*. Retrieved from [http://www.cnn.com/2017/07/25/health/cte-nfl-  
players-brains-study/index.html](http://www.cnn.com/2017/07/25/health/cte-nfl-players-brains-study/index.html)

Ex-NFL LB turns down Montana Football Hall of Fame nod because of concussions.  
(18, March 27). Retrieved April 10, 2018 from [https://sports.yahoo.com/ex-nfl-  
lb-turns-montana-football-hall-fame-nod-concussions-173047746.html](https://sports.yahoo.com/ex-nfl-lb-turns-montana-football-hall-fame-nod-concussions-173047746.html)

Gavett, B., Stern, R., & McKee, A. (2011, January). Chronic Traumatic  
Encephalopathy: A Potential Late Effect of Sport-Related Concussive and  
Subconcussive Head Trauma. *Clinics in Sports Medicine*, 30(1), 179-188.  
doi:<https://doi.org/10.1016/j.csm.2010.09.007>

Gessel, L. M., Fields, S. K., Collins, C. L., Dick, R. W., & Comstock, R. D. (2007).  
Concussions Among United States High School and Collegiate  
Athletes. *Journal of Athletic Training*, 42(4), 495–503.

Grossfeld, S. (2017, July 28). I feel like Dr. Death,' says doctor on leading edge of CTE  
research. *The Boston Globe* . Retrieved from  
[https://www.bostonglobe.com/sports/patriots/2017/07/28/mckee/rZIOacuVTPjz  
eQol312IWN/story.html](https://www.bostonglobe.com/sports/patriots/2017/07/28/mckee/rZIOacuVTPjzeQol312IWN/story.html)

*Heads Up* . (2017, January). Retrieved from Centers For Disease Control and  
Prevention website:  
[https://www.cdc.gov/headsup/basics/concussion\\_what.html](https://www.cdc.gov/headsup/basics/concussion_what.html)

Heller , D. (18, April 18). *Wisconsin*. Retrieved May 18, 4, from Fox Sports website:  
[https://www.foxsports.com/wisconsin/story/wisconsin-badgers-chris-borland-  
pay-college-players-nfl-cte-coach-football-041918](https://www.foxsports.com/wisconsin/story/wisconsin-badgers-chris-borland-pay-college-players-nfl-cte-coach-football-041918)

- Kilgore, A. (2017, November 9). s Aaron Hernandez suffered from most severe CTE ever found in a person his age. *The Washington Post*. Retrieved from [https://www.washingtonpost.com/sports/aaron-hernandez-suffered-from-most-severe-cte-ever-found-in-a-person-his-age/2017/11/09/fa7cd204-c57b-11e7-afe9-4f60b5a6c4a0\\_story.html?utm\\_term=.5f3a95d9344b](https://www.washingtonpost.com/sports/aaron-hernandez-suffered-from-most-severe-cte-ever-found-in-a-person-his-age/2017/11/09/fa7cd204-c57b-11e7-afe9-4f60b5a6c4a0_story.html?utm_term=.5f3a95d9344b)
- Koester, M. (5, May 5). Interview by E. S. Childs [Video recording].
- Levdon, Stephanie. “When A High School Football Player Meets A Brain Injury Researcher.” NPR, NPR, 15 Mar. 2018, [www.npr.org/sections/health-shots/2018/03/15/593812809/when-a-high-school-football-player-meets-a-brain-injury-researcher](http://www.npr.org/sections/health-shots/2018/03/15/593812809/when-a-high-school-football-player-meets-a-brain-injury-researcher).
- Mez J, Daneshvar DH, Kiernan PT, et al. Clinicopathological Evaluation of Chronic Traumatic Encephalopathy in Players of American Football. *JAMA*. 2017;318(4):360–370. doi:10.1001/jama.2017.8334
- NBC News*. (n.d.). Retrieved February 4, 2018, from NBC website: <https://www.nbcnews.com/storyline/super-bowl/concussions-protests-football-s-popularity-drops-n844506>
- Nukols, B. (2017, October 6). Football's decline has some high schools disbanding teams . *Ap News*. Retrieved from <https://www.apnews.com/66e699491a3b478293620c1e5069dc9e>
- Oregon Activities Association*. (n.d.). Retrieved October 2018, from <http://www.osaa.org/>
- Purkey, A. (2018, May 23). Interview by E. Childs [Video recording].
- Purkey, J. (2018, May 23). Interview by E. Childs [Video recording].
- Purkey, K. (2018, May 23). Interview by E. Childs [Video recording].
- Resnick , B. (2016, April 30). *VOX*. Retrieved May 4, 2018, from <https://www.vox.com/science-and-health/2018/2/2/16956440/super-bowl-2018-concussion-cte-nfl-brain-damage>
- Ryman , R. (2018, April 12). *Green Bay Press Gazette* . Retrieved from <https://www.greenbaypressgazette.com/story/sports/nfl/packers/2018/04/12/brett-favre-ive-had-hundreds-probably-thousands-concussions/510699002/>
- Safety in School Sports - Concussions*. (n.d.). Retrieved from State of Oregon website: <http://www.oregon.gov/ode/educator-resources/standards/physicaleducation/Pages/Concussions.aspx>
- Santangelo, S. (2018, April). Interview by E. Childs [Video recording].



Sherden, D. (2018, April). Interview by E. Childs [Video recording].

*The Aspen Institute*. (n.d.). Retrieved April 16, 2018, from  
<https://www.aspeninstitute.org/events/future-football-reimagining-games-pipeline/>

Ward, J., Williams, J., & Manchester, S. (2017, July 25). *The New York Times* .  
Retrieved from

Zuniga, L. (2018, May 15). *Phone Interview*. Interview by E. Childs.,