



## Flag Football Under 14: An Education Campaign for Parents

White Paper by Chris Nowinski, Ph.D., and Robert Cantu, M.D.

If you are a parent considering enrolling your child in football, the Concussion Legacy Foundation strongly recommends you delay enrolling your child in *tackle* football until the age of 14. Tackle football has been played for nearly 150 years, but only in the last 10 years has the scientific community begun investigating its long-term effects on the brain. The initial research is so concerning that we are launching the Flag Football Under 14 campaign (FFu14) to educate parents so you can make an informed decision. This campaign builds on the recommendation made by Dr. Robert Cantu, who first advocated this policy in 2012 in his book [Concussions and Our Kids](#). Until tackle football is proven safe for the developing brain, we urgently recommend parents only enroll their children in flag and other non-tackle versions of football before age 14.

### YOUTH TACKLE FOOTBALL IS A MODERN EXPERIMENT

Delaying the introduction of tackle football until 14 is not as radical as it may seem. While tackle football has existed for 150 years, modern youth tackle football has only existed for 50 years. When Pop Warner “youth” tackle football began, the youngest players were 15.<sup>1</sup> It was not until after legendary coach Pop Warner’s death in 1954 that Pop Warner Little Scholars, Inc., became a corporation that began nationally promoting 5-year-olds playing tackle football. Adoption was slow, but by 1970, there were a few thousand Pop Warner youth tackle football teams across the country. Players from that era have begun dying, and their families are donating their brains to science because of concerns of how football affected their brain and behavior.

### NEW RESEARCH ON CTE HAS CHANGED OUR RECOMMENDATION

When CLF began researching CTE in 2007, we did not make any recommendations on participation in youth tackle football because there was not yet enough science. That has changed.

[Chronic traumatic encephalopathy \(CTE\)](#) is a progressive degenerative brain disease. All available evidence supports CTE is caused by repeated head impacts like one suffers in boxing or tackle football. It was originally called *Punch Drunk* because it was first observed in boxers in the 1920s. CTE starts as small lesions around blood vessels in the brain, but it progresses even after football players retire and stop receiving head impacts. As players age and the disease spreads, it attacks parts of the brain responsible for memory, judgment, mood, and control of behavior. The end stage of the disease can look like Alzheimer’s disease and

usually requires nursing home care because the patient can no longer function independently and eventually loses ability to speak, stand, or feed themselves.

## CTE IS CAUSED BY BRAIN TRAUMA

While you may be told there is a debate in the medical community on whether causation is proven, remember that every doctor has an opinion, but not every doctor is an expert at interpreting research and understanding what qualifies as proof of causation. It is rarely reported that the independent experts in the United States government, including the lead experts for the National Institutes of Health, Department of Defense, and Centers for Disease Control and Prevention are on record saying they believe causation has been proven.

“CTE is only seen in the setting of repeated head trauma. At the end of the day, this is produced by head trauma. I'm sorry, that's what all the research says.”<sup>2</sup>

- *Daniel Perl, M.D. Director of CTE Research, Dept. of Defense, Uniformed Services University*

†

“I don't think there's any wiggle room. It's pretty clear this is due to head injury. Whether there are other things involved, and when it starts, that's hard to know, but I don't think there's any question that it's related to head injury.”<sup>3</sup>

- *Walter J. Koroshetz, M.D., Director, National Institute of Neurological Disorders and Stroke, a division of the National Institutes of Health*

†

“CTE is a brain disease that results from changes in the brain. These changes can affect how a person thinks, feels, acts, and moves. Traumatic brain injuries, including concussions, and repeated hits to the head, called subconcussive head impacts, may lead to CTE.”<sup>4</sup>

- *US Centers for Disease Control and Prevention. Answering Questions about CTE.*

CTE can only be confirmed through the post-mortem examination of the brain, and because it was never looked for, it was not found in a football player until 2005. Since then, it was diagnosed in 110 of the first 111 NFL players studied at Boston University, people like Ken Stabler, Dave Duerson, John Mackey, and Aaron Hernandez. Unfortunately, CTE has also been found in college and high school football players, including players as young as 17. It is not seen in the normal population that has not been exposed to repeated head impacts.<sup>5</sup>

### Clinicopathological Evaluation of CTE in Players of American Football <sup>6</sup>

Highest Level Played	Share with CTE
Pre-High School	0 of 2 (0%)
High School	3 of 14 (21%)
College	48 of 53 (91%)
Semiprofessional	9 of 14 (64%)
Canadian Football League (CFL)	7 of 8 (88%)
National Football League (NFL)	110 of 111 (99%)

\*Published in the Journal of the American Medical Association, July 2017

CTE is not just a football problem. In addition to boxing, CTE has been diagnosed in athletes who participated in ice hockey, soccer, rugby, baseball, bull riding, professional wrestling and mixed-martial arts. However, football is where the most evidence exists, as two-thirds of CTE cases diagnosed globally are American football players.

Existing data suggests CTE risk is determined by a dose-response relationship. If CTE is the response, the dose is number of years played or thousands of hits to the head received. As of 2018, the best evidence suggests a football player's risk of CTE is primarily determined by the number of years they play football.<sup>7</sup> If an athlete reduces the number of years they participate in tackle football, they should significantly reduce their risk of developing CTE.

## FFu14 IS NOT ABOUT CONCUSSIONS, BUT SUBCONCUSSIVE HEAD IMPACTS

Concussions are not unique to football, and as the NFL commissioner has pointed out, "Concussions can happen in a variety of activities."<sup>8</sup> But this campaign is not focused on concussions. Literature reviews support that a single concussion, in the absence of repetitive brain trauma, *does not* consistently appear to be a major risk factor for CTE or related neurodegenerative diseases.<sup>9</sup>

Tackle football requires both tackling and blocking, and both activities cause regular head impacts, even when proper form is used. Very few football players have been recorded taking fewer than 100 head impacts per season, and most take many hundreds of head impacts each year. Studies show tackle football causes more repetitive head impacts than any other youth team sport.

This campaign is focused on those subconcussive head impacts – defined as head impacts that don't cause concussion symptoms – because they *are* correlated with CTE risk. A recent Boston University study proved that hard head impacts, in the absence of any signs of concussion, can produce CTE in mice. The brain changes in mice mirrored what is seen in deceased young athletes who recently suffered head impacts, providing the strongest evidence yet that repetitive head impacts actually *cause* CTE.<sup>10</sup>

A [study](#) of former high school and college football players showed that players with more subconcussive head impacts had significantly elevated levels of self-reported cognitive and behavioral problems later in life.<sup>11</sup> Those with the most estimated head impacts, with some exceeding 12,000 head impacts during their career, were most likely to report neurological problems as adults.

## CHILDREN HAVE BIOLOGICAL DISADVANTAGES

Head impacts are more dangerous for children than they are for adults. Children are at a disadvantage playing tackle football for two main reasons:

1. Brain development
2. The Bobblehead Effect

**Brain development.** In the pre-adolescent and adolescent years (age 8 to age 13), the brain undergoes dramatic changes and maturation that are responsible for the transition from child to adult brain function.<sup>12</sup> Among the neurodevelopmental milestones that have been identified in this population, three stand out for football players:

1. White matter development: Myelin is a fatty substance that surrounds axons (the long connections from one nerve cell to another), giving the white appearance of the white matter. Myelin acts like the insulation around wires in electrical systems, protecting the cells and increasing the speed of communication between cells. The peak rate of nerve cells becoming myelinated occurs at ages 11 and 12. Without adequate myelin, axons can be more easily injured or destroyed and the speed of brain processing is slowed down.
2. Grey matter development: Important brain structures, including those controlling memory and emotion, reach their peak in size between ages 8 and 12, as they build trillions of connections to improve functioning.
3. Peak cerebral blood flow: Blood flow to the cerebrum (the largest and most important part of the brain) supplies the nerve cells with the nutrition and energy needed for healthy functioning. This blood flow peaks between ages 10 and 12, reflecting the tremendous growth and maturation of many regions of the brain.

### **Growing Evidence That Younger Exposure to Tackle Football is Bad for the Brain**

Head impacts during critical developmental windows appear to impair normal brain development and function throughout the rest of life. Just like public health experts focus on lead poisoning prevention among children, rather than adults, more evidence is becoming available that indicates our focus should be on preventing youth head impact exposure.

Studies on both living and deceased football players have shown that tackle football before 12 leads to worse outcomes.

1. A 2018 study by VA and Boston University scientists reviewed 246 brains of deceased football players, 211 of whom had CTE. Those who began tackle football before age 12 had an earlier onset of cognitive, behavior, and mood symptoms by an average of 13 years. Every one-year younger participants began to play tackle football led to earlier reported cognitive symptom onset by 2.4 years and behavioral/mood symptoms by 2.5 years.<sup>13</sup>
2. Studies of hundreds of living football players have found that high school, college and professional football players who began tackle football before age 12 are 2 times more likely to have cognitive impairment and behavior disturbances as adults, and 3 times more likely to suffer depression than players who began at age 12.<sup>14 15</sup>
3. Former NFL players who started tackle football before age 12 have been shown to have [altered white matter microstructure](#) in the corpus callosum, a critical area of the brain responsible for communication between the left and right sides of the brain.<sup>16</sup> A [different study](#) found NFL players that started before 12 had smaller thalamic volumes. The thalamus, among its many roles, regulates sleep, a common complaint of former football players.<sup>17</sup>

**The Bobblehead Effect.** Youth football players are slower and smaller than adults, which can make it appear that head impacts in youth tackle football are inconsequential, like a pillow fight.

However, using helmet sensors, researchers unexpectedly discovered that a youth player experiences head impacts that rival those of [college football players](#).<sup>18 19 20</sup>

Experts in human development and biomechanics have suggested that the head hits are similar for three reasons:

1. Children have [dramatically larger heads](#) relative to the rest of their body than adults.
2. A child's football helmet may be 10 percent of their bodyweight. (That would be the equivalent of an NFL lineman wearing a 30-pound helmet!)
3. Children have smaller, weaker necks relative to adults.<sup>21</sup>

When combined, those three elements create a perfect storm. The reason our eyes deceive us is that it's not the speed a youth football player brings to the tackle that causes the severity of the head impacts; it's the fact that they cannot slow their proportionally giant, heavy head down after it's been impacted, creating a Bobblehead Effect.<sup>22</sup>

## OTHER YOUTH CONTACT SPORTS ARE RESPONDING TO CTE RESEARCH

Football is not the only sport which should change to eliminate repetitive head impacts for children prior to 14. The Concussion Legacy Foundation advocates that all sports should have a modified youth version that does not involve preventable, repeated head impacts. Many sports have already changed:

- US Youth Soccer has eliminated heading for players under age 11, and limits heading in practices for 11 to 13-year-olds. (Learn about our [Safer Soccer](#) campaign.)
- USA Hockey has eliminated checking for 11 and 12-year-old players, introducing intentional contact at age 13.
- US Lacrosse has changed the rules for U14 so that any check involving the head and any stick-to-head contact is now a penalty.

Youth Football is the largest contact sport to fail to implement a policy protecting young athletes from repetitive head impacts. Therefore each year, about two million youth tackle football players are estimated to suffer nearly *a billion* combined head impacts during games and practices.

## THE PERCEIVED BENEFITS OF TACKLE INSTEAD OF FLAG DO NOT OUTWEIGH THE RISKS

It is undeniable that there are risks to hitting a child in the head 500 times each season in youth tackle football. Are there benefits?

First, the discussion must be appropriately framed. There are clear health benefits to exercise, and there are character-building benefits to team sports. No one questions that. However, there is no data to support that tackle provides better exercise than flag, or greater soft benefits of team sports, as both are team sports.

In a debate of tackle versus flag, there is no role for a discussion of obesity or other health risks that come with inactivity, as both sports offer exercise.

Through that framework we believe we cannot overlook the absurdity of hitting a child in the head hundreds of times simply because they happen to be getting exercise at the time.

Scientists are not alone in advocating for flag football under age 14. There is a growing contingent of football legends, both players and coaches, who advocate for delaying tackle

until 14. They argue that the formula to become the best tackle football player at the high school, college, and professional level means passing on youth tackle football.

“They don’t need a helmet. They can play flag football. And with flag football you can get all the techniques. Why do we have to start with a 6-year-old who was just potty trained a year ago and put a helmet on him and tackle? . . . We’ll eventually get to tackling.”

–*John Madden, Pro Football Hall of Fame Coach and Broadcaster*

†

“I don’t think there’s a need to play tackle football until at least high school... I don’t think there’s a real need for the tackling, the tackling drills, the high-impact on these young kids when their brains are getting developed at such a young age and early stage in their lives.”

– *Zach Ertz, Pro Bowl TE, Philadelphia Eagles*

†

“I don’t think football needs to be played until you’re in ninth grade. That’s my personal opinion with kids growing up.”

– *Dana Holgorsen, Head Coach, West Virginia University*

†

“I always encourage youngsters in America to play soccer. I think every American boy should play soccer till the eighth grade, then they should play football – American football”

– *Jim Harbaugh, Head Coach, University of Michigan*

Waiting until high school to play tackle football has not held back some of the greatest players in NFL history. In fact, the top five NFL players all-time waited until 14 to play tackle football: **Jerry Rice, Jim Brown, Lawrence Taylor, Walter Payton, and Tom Brady**. We assembled the Flag Football Under 14 All-Time Greatest Team, composed entirely of players who did not start tackle football until high school, to illustrate that it is better to wait.

## SUMMARY

In addition to NFL players and football coaching icons supporting the merits of Flag Football Under 14, public opinion is clear. A [recent poll](#) showed that 4 out of 5 adults believe that tackle football is not appropriate for children under age 14.<sup>23</sup> The emerging consensus among football legends, American adults, and a growing number of leading neuroscientists reflects the impact of recent CTE research. Eliminating tackling in youth football, opting instead for flag or other non-tackle versions under age 14, will allow our children to enjoy and continue to develop their athletic and academic skills without putting their brains, and futures, at risk.

The loudest voices advocating for 5-year-olds to continue to play tackle football are the National Football League and the youth football governing body they launched, USA Football. The Concussion Legacy Foundation is concerned this policy decision is motivated by business interests, not what is in the best interest of children. We encourage parents and families to become educated on CTE and continue to follow advancements in our understanding so that they can make an informed choice, as the wrong choice can have life-long consequences.

## Works Cited

---

- <sup>1</sup> History of Pop Warner Little Scholars, Inc. <http://www.popwarner.com/Default.aspx?tabid=1579750>. Accessed November 28, 2017.
- <sup>2</sup> Fainaru, Steve & Mark Fainaru Wada. Union, NFL split over research funds. ESPN.com. March 6, 2014.
- <sup>3</sup> Fainaru, Steve & Mark Fainaru Wada. Union, NFL split over research funds. ESPN.com. March 6, 2014.
- <sup>4</sup> US Centers for Disease Control and Prevention. Answering Questions about CTE. Released April, 2018.
- <sup>5</sup> Bieniek KF, Ross OA, Dickson DW. Chronic Traumatic Encephalopathy Pathology in a Neurodegenerative Disorders Brain Bank. *Acta Neuropathol.* 2015 Dec; 130(6): 877–889.
- <sup>6</sup> Jesse Mez, Daniel H. Daneshvar, Patrick T. Kiernan, Bobak Abdolmohammadi, Victor E. Alvarez, Bertrand R. Huber, Michael L. Alosco, Todd M. Solomon, Christopher J. Nowinski, Lisa McHale, Kerry A. Cormier, Caroline A. Kubilus, Brett M. Martin, Lauren Murphy, Christine M. Baugh, Phillip H. Montenegro, Christine E. Chaisson, Yorghos Tripodis, Neil W. Kowall, Jennifer Weuve, Michael D. McClean, Robert C. Cantu, Lee E. Goldstein, Douglas I. Katz, Robert A. Stern, Thor D. Stein, Ann C. McKee. Clinicopathological Evaluation of Chronic Traumatic Encephalopathy in Players of American Football. *JAMA.* 2017;318(4):360–370.
- <sup>7</sup> McKee AC, Stern RA, Nowinski CJ, Stein TD, Alvarez VE, Daneshvar DH, Lee HS, Wojtowicz SM, Hall G, Baugh CM, Riley DO, Kubilus CA, Cormier KA, Jacobs MA, Martin BR, Abraham CR, Ikezu T, Reichard RR, Wolozin BL, Budson AE, Goldstein LE, Kowall NW, Cantu RC. The Spectrum of Disease in Chronic Traumatic Encephalopathy. *Brain.* 2013 Jan; 136(Pt 1):43–64.
- <sup>8</sup> Schwarz, Alan. N.F.L.'s Moves Signal a Truce on Concussions. New York Times. November 25, 2009. Accessed January 1, 2018. <http://www.nytimes.com/2009/11/26/sports/football/26concussions.html>
- <sup>9</sup> DeKosky ST & Asken BM. Injury cascades in TBI-related neurodegeneration. *Brain Injury* Vol. 31, Iss. 9, 2017. <http://www.tandfonline.com/doi/full/10.1080/02699052.2017.1312528>
- <sup>10</sup> Goldstein, L et al. Concussion, Microvascular Injury, and Early Tauopathy in Young Athletes after Impact Head Injury and an Impact Concussion Mouse Model *Brain.* 2018.
- <sup>11</sup> Montenegro PH, Alosco ML, Martin BM, et al. Cumulative Head Impact Exposure Predicts Later-Life Depression, Apathy, Executive Dysfunction, and Cognitive Impairment in Former High School and College Football Players. *J Neurotrauma.* 2016; PubMed PMID: 27029716
- <sup>12</sup> Stamm JM, Koerte IK, Muehlmann M, et al. Age at First Exposure to Football Is Associated with Altered Corpus Callosum White Matter Microstructure in Former Professional Football Players. *J Neurotrauma.* 2015;32(22):1768–76.
- <sup>13</sup> Alosco, ML, Mez, J, Tripodis, Y, Kiernan, PT, Abdolmohammadi, B, Murphy, L, Kowall, NW., Stein, TD, Huber, BR, Goldstein, LE, Cantu, RC, Katz, DI, Chaisson, CE, Martin, B, Solomon, TM, McClean, MD, Daneshvar, DH, Nowinski, CJ, Stern, RA and McKee, AC (2018), Age of First Exposure to Tackle Football and Chronic Traumatic Encephalopathy. *Ann Neurol.* Published online April 30, 2018. doi:10.1002/ana.25245
- <sup>14</sup> Stamm JM, Bourlas AP, Baugh CM, et al. Age of first exposure to football and later-life cognitive impairment in former NFL players. *Neurology.* 2015;84(11):1114–20. PubMed PMID: 25632088 †
- <sup>15</sup> Alosco ML, Kasimis AB, Stamm JM, et al. Age of first exposure to American football and long-term neuropsychiatric and cognitive outcomes. *Transl Psychiatry.* 2017;7(9):e1236.
- <sup>16</sup> Stamm JM, Koerte IK, Muehlmann M, et al. Age at First Exposure to Football Is Associated with Altered Corpus Callosum White Matter Microstructure in Former Professional Football Players. *J Neurotrauma.* 2015;32(22):1768–76.
- <sup>17</sup> Schultz V, Stern RA, Tripodis Y, et al. Age at First Exposure to Repetitive Head Impacts Is Associated with Smaller Thalamic Volumes in Former Professional American Football Players. *J Neurotrauma.* 2017;
- <sup>18</sup> Daniel RW, Rowson S, Duma SM. Head acceleration measurements in middle school football. *Biomed Sci Instrum.* 2014;50:291–6. PubMed PMID: 25405436
- <sup>19</sup> Daniel RW, Rowson S, Duma SM. Head impact exposure in youth football: middle school ages 12–14 years. *J Biomech Eng.* 2014;136(9):094501. PubMed PMID: 24950298
- <sup>20</sup> Munce TA, Dorman JC, Thompson PA, Valentine VD, Bergeron MF. Head Impact Exposure and Neurologic Function of Youth Football Players. *Med Sci Sports Exerc.* 2015;47(8):1567–76. PubMed PMID: 25437194
- <sup>21</sup> Ekner JT, Oh YK, Joshi MS, Richardson JK, Ashton-Miller JA. Effect of neck muscle strength and anticipatory cervical muscle activation on the kinematic response of the head to impulsive loads. *American Journal of Sports Medicine.* 2014 Mar; 42(3):566–76
- <sup>22</sup> Cantu, R. C., & Hyman, M. Concussions and our kids: America's leading expert on how to protect young athletes and keep sports safe. Boston: Houghton Mifflin Harcourt. 2012
- <sup>23</sup> UMass Lowell Center for Public Opinion. Poll: Majority of Americans Say Sports Concussions are Major Health Issue. July 20, 2016. <https://www.uml.edu/News/press-releases/2016/ConcussionPoll072016.aspx>