The New York Times https://www.nytimes.com/2026/08/25/us/nfl-cte-brain-disease.html

The actual prevalence, researchers said, may be much higher.

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By John Branch
John Branch has reported on C.T.E. in sports for more than 15 years.

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Since the degenerative brain disease known as C.T.E. was first scientifically linked to football about 20 years ago, and as hundreds of former professional football players have been diagnosed with the disease after their deaths, a haunting question has lingered:

Just how many N.F.L. players will end up with C.T.E.?

New data provides a sobering indication: At least one in four of all the people who have played in the N.F.L. might expect to end up with chronic traumatic encephalopathy, according to a study of hundreds of cases over a recent six-year period.

Researchers considered every former N.F.L. player who died from 2016 to 2021. There were 878. Some died in their 20s, some in their 80s, most in between.

The study's main finding was simple math: At least 215 of those 878 former players — 24.5 percent — had C.T.E.

The actual prevalence could be far higher. The roughly 25 percent rate does not consider the 643 brains that were not examined. Some of those, maybe many of them, likely had C.T.E. too.

C.T.E. is a progressive neurological disease caused by repeated impacts to the head. It can be definitively diagnosed only by examining the brain after death.

Studies have shown that the rate of C.T.E. in people who have not sustained repeated impacts to the head is nearly zero.

If the new study's statistics were applied to today's players — 1,696 on the league's 32 regular-season rosters, not including more than 500 members of practice squads and those ineligible due to injury — at least 400 of them would be diagnosed with C.T.E.

Experts say that the rate of brain disease represents an occupational safety hazard with little comparison in the American workplace.

"There are workers who've been exposed to high levels of asbestos exposure, which leads to very high rates of lung disease," said David Michaels, who led the Occupational Safety and Health Administration during the Obama administration and is now a professor at the George Washington School of Public Health. "And certainly, you know, a lifetime working in coal mines leads to very high risk of black lung disease.

"But a degenerative neurological disease — I've never seen anything comparable."

C.T.E. was first discovered in boxers nearly a century ago and termed "dementia pugilistica." Symptoms can include memory loss, confusion and uncharacteristic mood swings, decreases in executive function and increases in erratic and impulsive behavior, including addiction.

These days, C.T.E. is most commonly associated with football players, but it has been found in the brains of other athletes who sustained repetitive blows to the head, including hockey, rugby and soccer players, as well as wrestlers and bobsledders. Those in the military also seem susceptible to the disease.

Zack Wittman for The New York Times

For years, the N.F.L. downplayed the risks of repeated head trauma, often insisting that not enough is known about C.T.E. to draw conclusions about its dangers, origins and prevalence. Uncertainty has left room for inaction; scientists have yet to decipher, among many things, why some people can play football for decades and not get C.T.E., while others have had severe cases in their teens.

But the prevalence rate now reported by researchers might be hard to ignore. It is the latest research from neuropathologists and other scientists mostly affiliated with Mass General Brigham, Boston University and the UNITE Brain Bank, which have led C.T.E. research and handled most donated brains of former athletes over the past two decades.

Researchers involved in this study, published on Tuesday in The BMJ, hope to produce a subsequent paper in the coming months estimating the overall rate of C.T.E. in all N.F.L. players at the time of their death.

Making such an estimation is complicated by unknowns. What is certain, researchers said, is that C.T.E. is preventable.

“We know what’s causing it,” said Dr. Daniel Daneshvar, the lead author of the study, the chief of brain injury rehabilitation at Spaulding Rehabilitation Hospital and an associate professor at Harvard Medical School. “It’s a neurodegenerative disease where we know and have complete control over the risk. And understanding the extent of that risk is one of the steps into making sure that we can mitigate and decrease that risk.”

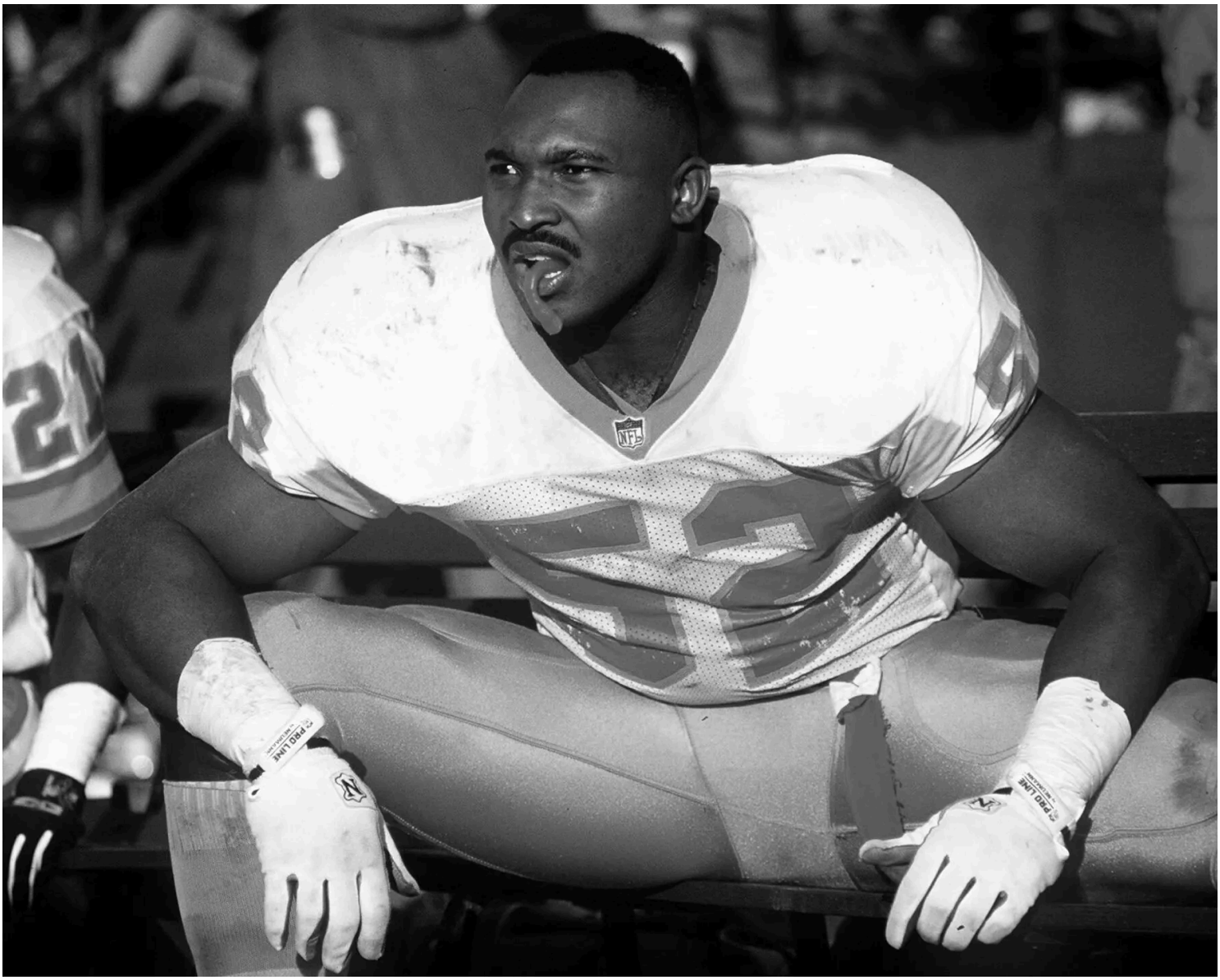
Dr. Daneshvar said that the biggest predictor of C.T.E. is the cumulative force of hits to a head over a lifetime — including those sustained before reaching the N.F.L.

“We can change that cumulative force without changing the game of football,” he said, suggesting that children refrain from playing tackle football and that teams at all levels eliminate hits during practices.

The 25 percent rate cited in the latest research may surprise fans or others who view the game from a distance, but not those close to football.

“I bet the real number is a lot bigger,” said Randy Grimes, 66, who played center for the Tampa Bay Buccaneers from 1983 to 1992. “Obviously, it’s going to be a lot bigger if you add the untested ones.”

At least two of his former offensive linemates, both guards, were diagnosed with C.T.E.: Tom McHale, who died at 45; and John Bruhin, who died at 57. Another teammate, linebacker Keith McCants, had C.T.E. and died at 53.



Keith McCants of the Tampa Bay Buccaneers in 1992. Otto Greule Jr./Getty Images

If the new data were applied to the rest of his teammates over his career, Mr. Grimes is likely to have played with dozens of C.T.E. victims, who either died without being tested or who are aging quietly in the shadows.

Mr. Grimes said that he has yet to feel the symptoms that would make him worry about his own cognitive health. But he runs a nonprofit organization that counsels retired athletes, including football players, and sees symptoms that he suspects are associated with C.T.E.

“It’s not something that’s brought up, it’s not something that players want to talk about,” Mr. Grimes said. “We probably could move forward faster in our research if we did talk more about it. But players don’t want to do it. They don’t want to think they have it, they don’t want to think they’re seeing it. Deep down, we all know that probably the majority of us are going to have some form of C.T.E.”

While hundreds of former N.F.L. players have been diagnosed with C.T.E., typically after loved ones donate the brains because of worrisome symptoms, most C.T.E. cases are not publicly disclosed.

Only a few cases reach public consciousness, usually when attached to a famous name, like Junior Seau, Ken Stabler and Frank Gifford, all inducted into the Pro Football Hall of Fame.

Junior Seau’s daughter, Sydney Seau, at the Pro Football Hall of Fame ceremony in 2015. Gene J. Puskar/Associated Press

Others become notorious because of criminal behavior that might later be explained, in part, by C.T.E., like Aaron Hernandez and Phillip Adams, who committed murder and were diagnosed with C.T.E. after their own deaths. In July 2025, Shane Tamura, who played football but did not reach the N.F.L., killed four people in a New York City building that houses the league's headquarters. After Mr. Tamura's death, an autopsy confirmed that he had C.T.E.

C.T.E. cannot be diagnosed in the living, though some ex-football players, like Hall of Fame running back Tony Dorsett, presume they have it. Some players, like Chris Borland and John Urschel, walked away from their professional careers early as a preventive measure to protect their brains.

The growing roster of C.T.E. cases has done little to diminish football's popularity. The N.F.L. reportedly earned more than $23 billion in revenue in 2024.

"The N.F.L. continuously strives to make the game of football safer, including by implementing strategies to reduce concussions and head impacts," the league said in a statement. "The N.F.L. remains committed to ensuring that the N.F.L. community has access to a robust — and expanding — set of resources to enhance their physical and mental well being."

The N.F.L. Players Association, the union representing players, said that the new study "is a sobering reminder that football carries real risks, and those risks can have lasting consequences for players and their families."

It added: "The findings should serve as a call to action across the entire football ecosystem."

Scientists hope to soon be able to clinically diagnose C.T.E. in the living with a large degree of certainty, the way that other neurodegenerative diseases, like Parkinson's and Alzheimer's, often are.

For now, most brains of former N.F.L. players are never examined, so an unknown number of possible C.T.E. cases go undiagnosed. As awareness of the disease grows, family members are increasingly donating the brains of recently deceased

former players who displayed C.T.E.'s stew of symptoms. The brains that are donated are not a random sample. Telltale signs of the disease were often evident.

In 2017, 110 of the first 111 brains of former N.F.L. players that had been donated to that point were diagnosed with C.T.E.

What is different for the latest study is that it applied C.T.E. cases to the broader context of a general N.F.L. population in the same time period — not just those whose brains were donated.

Researchers tallied all of the former N.F.L. players known to have died between 2008 and 2021 (2,079 of them) and found that 16.6 percent — one in six — had been diagnosed with C.T.E.

They narrowed the data to the most recent six-year period because, they said, it coincided with a surge of brain donations after several well-publicized cases of C.T.E. and the 2015 film "Concussion." (In 2014, 17 brains were donated to what is now called the UNITE Brain Bank. In 2018, 53 were.)

In that subset, 235 brains had been donated for examination. Most of them, 215, were found to have at least some level of C.T.E.

That means, "under the most conservative of assumptions," researchers wrote, 24.5 percent of the players who died had C.T.E. The total does not include several other brains examined by scientists not affiliated with the researchers, and thus unverifiable, or those widely presumed to have had C.T.E. due to the severity of symptoms but who were not tested at death.

The identity of most C.T.E. diagnoses is not made public, but loose extrapolation can be revealing. How many C.T.E. victims in N.F.L. history played for, say, the New York Giants? (Thousands, perhaps.) Or for coaches like Bill Belichick or Pete Carroll? (Hundreds, probably.) How many were teammates of Tom Brady? (Scores, at least.)

Law enforcement officials at the Manhattan building where Shane Tamura killed four people in July 2025. Hiroko Masuike/The New York Times

The growing sample size of C.T.E. cases makes for stark realizations. For example, eight members of the 1972 Miami Dolphins, the only undefeated team in modern N.F.L. history, have been diagnosed with C.T.E.

The latest, previously unreported, was Mercury Morris, the speedy halfback who played eight seasons in the N.F.L., struggled with headaches and drug addiction in retirement, and died in 2024 at age 77.

Not all C.T.E. cases belong to long-retired players in their geriatric years. The 2001 New England Patriots, who won the Super Bowl, had seven former players die between the ages of 35 and 50, according to The Boston Globe. At least three were diagnosed with C.T.E., researchers said.

The latest research, however, suggests that at least 10 others from that team might have C.T.E., if the one-in-four ratio applies.

The 2009 Chargers, a team that went 13-3 in the regular season, already have three deceased players who were found to have C.T.E. and whose names were made public.

One was Vincent Jackson, a three-time Pro Bowl receiver who died in a hotel room of alcohol poisoning at 38. Another was Kevin Ellison, a defensive back who died at 31 when he was struck by a car after wandering onto a California freeway.

The other was defensive back Paul Oliver, who was 29 in 2013 when he shot himself on the stairs of his family home in front of his wife, Chelsea, and their two young sons.

Ms. Oliver said that she occasionally hears from her husband's former teammates or their family members, worried that they, too, are feeling the effects of C.T.E. She suspects that the 25 percent figure is far lower than the reality.

"I feel like if we were able to test everybody for C.T.E. while they're still alive, the majority would have C.T.E.," she said.

Her husband played four years in the N.F.L. and sustained a series of concussions, she said, and then became someone "who just wasn't him." He lived with headaches, became delusional and paranoid, and began drinking heavily, she said. The couple discussed the prospect of C.T.E. shortly after Mr. Seau, the longtime Chargers star who finished his career with New England, shot himself in the chest to preserve his brain for testing.

Learning that, statistically, her husband might have had a dozen or more teammates with C.T.E., that he was not alone with his disease, does not bring any measure of solace, Ms. Oliver said. “It just makes me sad.”

She does not expect fans to understand. She reads comments on stories about former football players behaving badly or dying by suicide. “You’ll see multiple people, like, ‘Bet they’re going to blame C.T.E.’ I just shake my head. These people have no clue. They just don’t, because they haven’t lived it firsthand. So I can’t fault them.”

“To them,” she added, “concussions, C.T.E., that’s a not-them problem.”

If you are having thoughts of suicide, call or text 988 to reach the 988 Suicide and Crisis Lifeline or go to SpeakingOfSuicide.com/resources for a list of additional resources.

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