

What is Chronic Traumatic Encephalopathy (CTE)?

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What is CTE?

According to the Boston University CTE Center, Chronic Traumatic Encephalopathy (CTE) is a degenerative brain disease found in athletes, military Veterans, and others with a history of repetitive brain trauma. It is caused in part by repeated traumatic brain injuries, including concussions and nonconcussive impacts. In CTE, a structural protein in neurons called tau misfolds, spreads through the brain, and leads to the death of brain cells.

Right now, CTE can only be definitively diagnosed by autopsy after death. It has been identified in individuals as young as 17, though symptoms typically appear years after repeated head impacts. Much of what we know comes from the research of [Dr. Ann McKee](#), director of the [UNITE Brain Bank](#) at Boston University, co-founded by CLF in 2008. In Canada, research is also supported by the Canadian Concussion Centre (CCC) and the Brain Health Imaging Centre at CAMH.

[Watch the video](#) to learn more about CTE from [Dr. Gabor Kovacs](#), the lead pathologist for our partnership with the CCC.

Symptoms of CTE

Cognitive

- Short-term memory loss
- Impaired Executive Function
- Impaired judgement
- Impaired organizational skills
- Dementia

Mood & Behavioral

- Impulse control problems
- Aggression
- Mood swings
- Depression
- Paranoia
- Anxiety

Sleep

- Issues with sleep
- Symptoms of REM sleep disorder (acting out dreams)
- [Watch this video](#) to learn more about sleep findings from the 2020 UNITE Brain Bank study.



What causes CTE?

CTE is caused in part by repeated traumatic brain injuries, which include concussions and nonconcussive impacts. This does not mean a handful of concussions, in the absence of other hits to the head, puts you at risk for CTE; most people diagnosed with CTE suffered hundreds or thousands of head impacts over the course of many years playing contact sports, serving in the military, or, more rarely, as victims of interpersonal violence.

In October 2022, the National Institute of Neurological Disorders and Stroke (NINDS), part of the U.S. National Institutes of Health (NIH), formally acknowledged that CTE is caused by repetitive traumatic brain injuries, following a letter from CLF co-signed by 41 experts urging a review of the Bradford Hill criteria. NINDS joined the U.S. Centers for Disease Control and Prevention in recognizing this link.



The causal relationship was explored thoroughly in the 2022 article [Applying the Bradford Hill Criteria for Causation to Repetitive Head Impacts and CTE](#), published in *Frontiers in Neurology*.

The article was authored by CLFC's Dr. Samantha Bureau, and 13 other collaborators from around the world. The authors concluded with the highest confidence that repetitive head impacts (RHI) are the definitive cause of CTE.



Who is Most at Risk for CTE?

The UNITE Brain Bank has revolutionized how we understand CTE. More than 1,000 brains have been donated, helping identify who is at risk and how the disease manifests. The [1,000 Reasons for Hope](#) report highlights how these donors are shaping brain trauma research. The report shows that almost every person diagnosed with CTE has a history of repetitive hits to the head. CTE is most frequently found in contact sport athletes and military veterans.

In 2023, the UNITE Brain Bank reported that 345 of 376 NFL players studied were diagnosed with CTE, compared to 1 in 164 in the Framingham Heart Study (the lone case being a former college football player).

Importantly, not everyone exposed to repetitive head impacts will develop CTE. Risk varies based on age of first exposure, years of exposure, and genetics.

CTE has been found in individuals whose primary exposure to head impacts was through

- Tackle football
- The military
- Hockey
- Boxing
- Rugby
- Soccer
- Amateur wrestling
- In fewer cases: baseball, basketball, intimate partner violence, and individuals with developmental disorders who engaged in head-banging behaviours

Frequently Asked Questions (FAQs)



Can you treat CTE?

Treatments have not yet been developed to specifically treat CTE, BUT many of the symptoms of the disease can be treated. It's important to know there is hope if you think you or a loved one may be living with CTE.

Check out our [CTE Treatments](#) page to learn more.

How is CTE diagnosed?

Currently, CTE can only be diagnosed after death through brain tissue analysis. Specialists examine brain tissue using chemicals to identify abnormal tau in a pattern specific to CTE. This process can take several months and is not typically part of a standard autopsy. Until recently, few doctors were trained to diagnose CTE.

In 2015, researchers from the [UNITE Brain Bank](#), led by [Dr. Ann McKee](#), worked with the National Institutes of Health to develop diagnostic criteria for CTE. This allows neuropathologists to accurately diagnose CTE and has helped more scientists identify the disease and accelerate progress.

