

NFL players who experienced concussion symptoms show reduced cognitive performance decades after retirement

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Former professional football players who reported experiencing concussion symptoms during their playing careers were found to

perform worse on a battery of cognitive tests than non-players, according to a study led by Mass General Brigham investigators from McLean Hospital and Spaulding Rehabilitation Network. Results of the study are published March 2nd in *Archives of Clinical Neuropsychology*.

Of the more than 350 former National Football League (NFL) players who were studied an average of 29 years after their playing career ended, those who reported experiencing [concussion symptoms](#) during their careers scored worse on assessments of episodic memory, sustained attention, processing speed and vocabulary. However, the number of concussions diagnosed by a medical professional or length of playing career had no observed effect on cognition.

A follow-up analysis compared the former players to more than 5,000 male volunteers in the general population who did not play [professional football](#), which found that [cognitive performance](#) was generally worse for former players than nonplayers. While younger former players outperformed nonplayers on some tests, older retired players more likely to perform worse than controls on cognitive tasks.

The researchers who led the study said that their results underline the importance of tracking concussion symptoms as opposed to diagnosed concussions in research. This work also adds evidence to the impact a professional football career can have on accelerating cognitive aging.

"It is well-established that in the hours and days after a concussion, people experience some cognitive impairment. However, when you look decades out, the data on the long-term impact have been mixed," said study senior author Laura Germine, Ph.D., director of the Laboratory for Brain and Cognitive Health Technology at McLean Hospital and associate professor of psychiatry at Harvard Medical School. "These new findings from the largest study of its kind show that professional football players can still experience cognitive difficulties associated with head

injuries decades after they have retired from the sport."

For the study, 353 retired NFL players completed hour-long neuropsychological tests through an online platform called TestMyBrain, which is supported by McLean Hospital and Harvard Medical School. Players were fully remote and completed tests on a laptop or desktop that included assessments that measured processing speed, visual-spatial and working memory, and aspects of short- and long-term memory and vocabulary.

Recollected concussion symptoms were measured by asking the players the number of times they experienced any one of the following symptoms following a blow to the head during play or practice: headaches, nausea, dizziness, loss of consciousness, memory problems, disorientation, confusion, seizure, visual problems or feeling unsteady on their feet. They were also asked whether they lost consciousness during their careers, and whether they were ever diagnosed with a concussion by a medical professional.

The results showed that the former players' cognitive performance (for example, on memory tasks) was associated with recalled football concussion symptoms. For example, differences observed in visual memory scores between former players with the highest and lowest reported concussion symptoms were equivalent to the differences in cognitive performance between a typical 35-year-old and 60-year-old.

However, poor cognitive performance was not associated with diagnosed concussions, years of professional play or age of first football exposure. The researchers noted that many head injuries or sub-concussive blows may not have been diagnosed as concussions due to a lack of awareness at the time or underreporting of symptoms by players.

When comparing the retired players to a group of 5,086 men who did

not play football, cognitive performance was generally worse for former players. On two tests of processing speed, age-related differences in cognitive performance were larger among the former player group than the nonplayer group, with older players performing worse.

These comparison data suggest that football exposure might accelerate age-related cognitive declines and produce greater disadvantages at older ages, according to the researchers, who added that more studies are needed to track cognitive performance in former players as they age. Another possibility is that improved awareness and management of head injuries may have spared younger retired players more than older ones. The researchers also noted that this comparative finding is limited by a lack of data on cognition prior to [head injuries](#), and that more research is needed that closely matches former players and nonplayers and measures their cognitive performances across their lifetimes.

"For both former players and researchers, we can glean some important takeaways from this study," said principal investigator of the Football Players Health Study, Ross Zafonte, DO. "Former players can support their cognitive health as they age by taking proactive steps, and continuing to consult with their providers and educate themselves on symptoms of head injury. For researchers and providers, these findings support efforts to develop ways to enhance diagnosis and define long-term sequelae of concussion." Zafonte is president of Spaulding Rehabilitation Network, a Mass General Brigham sports medicine physician, and the Earle P. and Ida S. Charlton Professor and Chair of the Harvard Medical School Department of Physical Medicine and Rehabilitation.

"The Community Based Participatory Research (CBPR) approach taken in this study is where this field is heading," said Germine. "We are grateful to the players and how much they have taught us. It would not have been possible to do a study like this without engaging and deeply

involving their community."

Research driven by input from former NFL players

The Football Players Health Study at Harvard University, launched in 2014, is a comprehensive research program dedicated to examining the multifactorial causes that impact the health of former NFL players. The research has been informed by the players themselves, who have provided input on the health concerns and conditions they face after a career in [football](#).

An interdisciplinary team of researchers from Harvard University and Harvard Medical School and its affiliated teaching hospitals, including those in the Mass General Brigham system, conduct research from neurology, cardiology, sports medicine, rehabilitation medicine, chronic pain and public health. While [concussion](#) and head injury are of paramount concern, the study examines all aspects of player health across the life span.

More information: Roger W Strong et al, Association of Retrospectively Reported Concussion Symptoms with Objective Cognitive Performance in Former American-Style Football Players, *Archives of Clinical Neuropsychology* (2023). [DOI: 10.1093/arclin/acad008](#)

Provided by Mass General Brigham

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