Longitudinal Changes in Cognitive Functioning and Brain Structure in Professional Boxers and Mixed Martial Artists After They Stop Fighting

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Study Question
How does cognitive functioning and brain structure change longitudinally in professional boxers and mixed martial artists who stop fighting in their early 30s?

What Is Known and What This Paper Adds
Repetitive head hits (RHIs), both concussive and subconcussive, increase the risk of long-term neurologic conditions. However, the outcome remains unclear for individuals who have been exposed to RHI and then discontinued the exposure. This study’s results show that after fighters’ cessation of RHI exposure, cognitive function and brain thickness measures may stabilize and blood neurofilament light (NfL) levels may decline.

Methods
Participants were recruited from the Professional Fighters Brain Health Study. At time point 1 (TP1), all fighters were active, with continual exposure to RHI. At time point 2 (TP2), fighters were considered “transitioned” if they had no sanctioned professional fights and had not been sparring for the past 2 years. Fighters were considered “active” if they continued to train and compete. Forty-five male transitioned fighters (31.69 ± 6.27 years old [TP1]) and 45 demographically matched male active fighters (30.24 ± 5.44 years old [TP1]) were included in the analyses. All fighters underwent cognitive testing and 3 T MRI at both TPs. A subset of our fighters (50%) underwent blood sampling for characterization of NfL levels at both TPs. Linear mixed-effects models were applied to investigate the potentially different longitudinal trajectories (interaction effect between group and time) of cognitive function measures, NfL levels, and regional thickness measures (derived from structural MRI) between transitioned and active fighters.

Results and Study Limitations
Different longitudinal trajectories between transitioned and active fighters were observed in verbal memory (FDR = 4.73E-04, Figure), psychomotor speed (FDR = 4.73E-04), processing speed (FDR = 3.90E-02), and NfL levels (p = 0.02). Transitioned fighters demonstrated longitudinally improved cognitive functioning and decreased NfL levels, and active fighters demonstrated declines in cognitive performance and stable NfL levels. Of 68 cortical regions inspected, 54 regions demonstrated a consistently changing trajectory, with thickness measures stabilizing on a group level for transitioned fighters and subtly declining over time for active fighters. The present study’s limitations include the inability to quantify the precise amount of RHI each participant sustained, restricted interpretation to male fighters only, and no sensitivity analyses.

Study Funding and Competing Interests
This study was supported by the NIH, Lincy Foundation, Belator, Ultimate Fighting Championship Company (UFC), the August Rapone Family Foundation, Top Rank, and Haymon Boxing. The authors report no competing interests. Go to Neurology.org/N for full disclosures.
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