

# Longitudinal change in regional brain volumes with exposure to repetitive head impacts

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## Study objective and summary result

This study tested the hypothesis that exposure to repetitive head impacts (RHI) is longitudinally associated with regional brain volume reductions, and the results support the hypothesis, in certain regions.

## What is known and what this paper adds

Past studies have reported cross-sectional associations between RHI exposure and regional brain volume reductions. This investigation provides evidence for longitudinal associations.

## Participants and setting

The investigators analyzed data from 50 active boxers, 23 retired boxers, 100 active mixed martial arts (MMA) fighters, and 31 controls who participated in the Professional Fighters Brain Health Study (PFBHS), which began enrolment in 2011. The controls had no histories of neurologic disorders, head trauma, military service, or participation in sports associated with head trauma. The controls were age-matched to the active boxers and active MMA fighters but were younger than the retired boxers.

## Design, size, and duration

The PFBHS participants underwent annual high-resolution T1-weighted MRI scans that were used to measure the volumes of the hippocampus, the amygdala, and subcortical gray matter regions. Linear mixed models were used to assess longitudinal changes in regional brain volumes.

## Main results and the role of chance

Relative to the controls, the active boxers had greater annual volume loss rates in the left thalamus, the middle anterior corpus callosum, and the central corpus callosum ( $p \leq 0.018$ ). Similarly, the active MMA fighters had elevated annual volume loss rates in the left thalamus and the central corpus

**Table** Regional annual volume loss rates in the active fighters

Region	Annual volume losses in the active boxers, mm <sup>3</sup> /y	Annual volume losses in the active MMA fighters, mm <sup>3</sup> /y
Left thalamus	102.3	57.5
Middle anterior corpus callosum	10.2	
Central corpus callosum	16.5	9.7

callosum ( $p \leq 0.036$ ). The retired boxers had elevated annual volume loss rates in the bilateral amygdala and the right hippocampus ( $p \leq 0.01$ ).

## Bias, confounding, and other reasons for caution

The sample of professional fighters might have been biased in favor of persons concerned about their neurologic health.

## Generalizability to other populations

The predominance of men among the PFBHS participants may limit the generalizability of these results to women.

## Study funding/potential competing interests

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*A draft of the short-form article was written by M. Dalefield, a writer with Editage, a division of Cactus Communications. The corresponding author(s) of the full-length article and the journal editors edited and approved the final version.*

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