



ABSTRACT SUBMISSION

Title: A linear dose-response relationship between self-reported concussions and later-life neurobehavioral functioning in former football players

Abstract No. 0738

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Abstract

OBJECTIVES: The long-term effects of sports-related concussions on neurobehavioral function are uncertain. We hypothesized that there would be a linear dose-response relationship between later-life neurobehavioral functioning and self-reported concussions in former football players.

METHODS: 200 former youth, high-school, college, semi-professional, and professional football players from the Longitudinal Examination to Gather Evidence of Neurodegenerative Disease study completed the Behavior Rating Inventory of Executive Function (BRIEF-A), a standardized self-report measure of executive functioning. Raw scores were converted into age-appropriate T-scores that yield an overall composite score (Global Executive Composite [GEC]), two index scores, (Behavioral Regulation Index [BRI] and Metacognition Index [MI]), and nine clinical scales. Participants self-reported four estimates of concussion exposure: (1) a spontaneous estimate of total concussions; (2) a second estimate after being read a comprehensive definition of concussion based on current medical literature (post-definition); (3) an estimate of concussions with associated loss of consciousness (LOC); and (4) an estimate of concussions subjectively self-reported as major. Each estimate was evaluated for recall bias heteroscedasticity, an increase in memory bias as a result of an increase in the number of concussions experienced by the participant, using the Breusch-Pagan test. Estimates of concussions were modeled as independent variables on four linear regressions of dependent BRIEF-A outcomes. For linear regressions, Alpha was set *a priori* to 0.0125 after Bonferroni's correction.

RESULTS: The post-definition number significantly regressed with the GEC ($B = 2.55$, $SE = 0.52$, $p < .0125$), MI ($B = 2.20$, $SE = 0.62$, $p < .0125$), BRI ($B = 2.62$, $SE = 0.58$, $p < .0125$), and 7 of the 9 clinical scales. Major concussions significantly regressed with the GEC ($B = 3.72$, $SE = 1.33$, $p < .0125$), MI ($B = 4.01$, $SE = 1.38$, $p < .0125$), and 3 of the 9 clinical scales. Only the post-definition number significantly regressed with BRI, which is a measure of emotional and behavioral regulation. Memory recall heteroscedasticity significantly affected spontaneous concussion number ($p = 0.046$) and LOC concussion number ($p = 0.013$). Spontaneous and LOC concussion numbers were not linearly associated with BRIEF-A outcomes.

CONCLUSIONS: After providing participants with a definition of concussion, the number of reported concussions was linearly related to self-reported problems with executive functioning. In contrast, this dose-response relation was weaker or non-existent when no-definition was given or when concussion were defined as having LOC or described as "major." The small standard error of the estimated beta-coefficients and the lack of recall heteroscedasticity highlight the validity of concussion estimates made with a definition. In contrast, spontaneous estimates were heteroscedastic, and not associated with executive functioning. Our findings support the utility in educating athletes to improve retrospective concussion reports. Moreover, this approach should enhance future research that examines the relationship between exposure and later-life functioning.

Approval

Confirm

Affiliations (1) Boston University School of Medicine, Boston, MA, USA
(2) Boston University School of Public Health, Boston, MA, USA

Authors Philip Montenegro (1) Presenting
Yorghos Tripodis (2)
Daniel Daneshvar (1)
Daniel Seichepine (1)
Christine Baugh (1)
Clifford Robbins (1)
David Riley (1)
Nathan Fritts (1)
Brett Martin (2)
Christopher Nowinski (1)
Ann Mckee (1)
Robert Cantu (1)
Michael McClean (2)
Robert Stern (1)

Type Adult

Categories Neurotrauma – case reports/clinical research

Presentation No preference

Biography Mr. Montenegro is an MD/PhD candidate in the department of Anatomy and Neurobiology at the Boston University School of Medicine. He is currently working under the mentorship of Dr. Robert Stern at the Center for the Study of Traumatic Encephalopathy. His research interests involve quantifying exposure to repetitive head impacts and modeling the effects on later-life neurobehavioral impairments, including Chronic Traumatic Encephalopathy.

Young Investigator Award No

Prior publication No

Website Yes

Permission Yes

Conflict No

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