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Chronic Traumatic Encephalopathy Prevalence in Populations Exposed to Contact Sport-related Repetitive Head Impacts: Protocol for Systematic Review and Meta Analysis

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ADMINISTRATIVE INFORMATION

Support - No support.

Review Stage at time of this submission - Preliminary searches.

Conflicts of interest - DHD reported receiving personal fees for providing expert testimony related to traumatic brain injury and spinal cord injury, serving as a medical advisor and options holder for StataDx, receiving research funding from the Football Players Health Study at Harvard University (FPHS) funded by the NFL Players Association (NFLPA), serving as a volunteer member of the Mackey-White Committee of the NFLPA, and receiving clinical funding from the Brain and Body Program funded by the NFLPA, all outside the submitted work.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 18 June 2026 and was last updated on 18 June 2026.

INTRODUCTION

Review question / Objective The primary objective of this systematic review and meta-analysis is to review the available data from studies which investigate the prevalence of chronic traumatic encephalopathy (CTE) in cross-sectional studies, cohorts, and large case series among populations exposed to repetitive head impacts (RHI) from contact sports. This study aims to provide an updated pooled prevalence of CTE among those with contact sport RHI exposure and characterize CTE prevalence across levels of play and sport type.

Rationale CTE has been identified in many different groups exposed to RHI, including military service-members, victims of physical abuse, and contact sport athletes. Given the continued global popularity of contact sports, exposure to contact sport-related RHI remains a substantial public health concern with potentially serious long-term consequences, including CTE. This systematic review aims to further characterize the prevalence of CTE among those with contact sport-related RHI, leveraging a larger and more comprehensive cohort than that included in the previous systematic review published in 2025. Improved estimates of CTE prevalence across different sports, level of play, and athlete populations are critical for understanding disease risk and identifying priorities for future research.

Condition being studied Chronic traumatic encephalopathy (CTE).

METHODS

Search strategy A systematic search was conducted in PubMed (MEDLINE) and Embase

through June 5, 2026, following PRISMA 2020 guidelines. The search strategy will incorporate controlled vocabulary, (MeSH in PubMed and Emtree in Embase) with terms such as: “Chronic Traumatic Encephalopathy”, “Rate”, “Prevalence”, “Occurrence”, “Cohort”, “Brain Bank”, “Case Series”, “Neuropathology”, “Traumatic Brain Injury”, and “Repetitive Head Impacts”. Following the database search, authors will review abstracts and titles to identify relevant studies. Relevant studies will then be further examined to exclude articles which contain database overlap, non-sport RHI populations, and studies which investigate other neurodegenerative diseases.

Participant or population This systematic review addresses populations who have documented contact sport-related RHI exposure and underwent postmortem neuropathological evaluation for CTE following standardized criteria (NINDS/NIBIB consensus criteria). This study examines groups that are found in community-based cohorts, autopsy registries, and brain banks. Eligibility was not restricted by participant sex or age group.

Intervention This study evaluates the prevalence of CTE in groups exposed to contact sport-related RHI and there are no interventions being evaluated. Any group where participants sustained RHI from sports (e.g. American football, hockey, soccer, or rugby) were eligible for the review. Postmortem autopsy was required to confirm CTE.

Comparator Secondary comparisons will be made against previously published contact-sport RHI CTE prevalence estimations and non-RHI CTE prevalence estimations.

Study designs to be included This review includes studies that report the prevalence of CTE in groups exposed to contact sport-related RHI. Eligible studies consist of cross-sectional studies, cohorts, and large case series from brain banks and autopsy registries.

Eligibility criteria The inclusion criteria for this study consists of observational studies which report the neuropathological diagnosis of CTE in cross-sectional studies, cohorts, and large case series from brain banks and autopsy registries in those with documented contact sport RHI exposure. Additional exclusion criteria include, (1) overlapping cohorts from the same source population, (2) studies including individuals with non-sport related RHI (e.g. military, individuals with epilepsy, victims of abuse), (3) studies evaluating traumatic encephalopathy syndrome (TES), and (4) narrative reviews and case reports.

Information sources The articles and sources used in this review were sourced from PubMed (MEDLINE) and Embase. The reference lists of all included article and key review papers will be manually screened to identify additional eligible sources. Corresponding authors of selected studies may be contacted to clarify cohort characteristics or to provide neuropathological data that are not fully reported in the original publication.

Main outcome(s) The main outcome of this review is the pooled prevalence of CTE diagnosed through neuropathological assessment among those with documented contact sport RHI exposure.

Data management Data will be collected and organized using a standardized data extraction template. Two reviewers will independently extract all relevant variables, with any disagreements resolved by a third reviewer through consensus. All extracted data will be stored in a secure electronic database.

Quality assessment / Risk of bias analysis To assess quality and bias in our included sources, the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Prevalence Studies will be applied. Two reviewers will use the checklist to label each source as "low risk", "moderate risk" and "high risk". Disagreement will be resolved through discussion with a third reviewer through consensus. Studies will not be excluded solely due to a “high risk” designation.

Strategy of data synthesis In this review, statistical analysis of the data will be done using R Studio Version 4.6.0. The PLOGIT transformation will be applied prior to pooling to stabilize variance, normalize the distribution of prevalence estimates, and appropriately account for rare events and small sample sizes. For studies reporting zero events, a continuity correction 0.5 will be applied. Pool prevalence will be calculated using a random effects meta-analysis model to account for anticipated between-study heterogeneity. Between study heterogeneity will be assessed using the Cochran's Q test, I^2 statistic, and Tau^2, with the latter estimated using restricted maximum likelihood (REML). Publication bias will be assessed using Egger’s test and through visual inspection of funnel plots. For all pooled prevalence estimates, 95% confidence intervals (CIs) and 95% prediction intervals (PIs) will be reported.

Subgroup analysis A subgroup analysis will explore pooled prevalence estimates by level of play and sport.

Sensitivity analysis A sensitivity analysis will be conducted using the leave-one-out method to identify potential outlier studies, defined as any study that causes a reduction of statistical heterogeneity (I^2) greater than 10% upon exclusion.

Language restriction English.

Country(ies) involved United States.

Keywords Chronic Traumatic Encephalopathy; Repetitive Head Impacts; Contact Sports; Prevalence; Systematic Review; Meta Analysis.

Dissemination plans This systematic review and meta-analysis will be submitted to a peer-reviewed journal. Findings may also be presented at relevant national or international conferences.

Contributions of each author

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