

BMJ Open The association between adverse childhood experiences and traumatic brain injury/concussion in adulthood: A scoping review protocol

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ABSTRACT

Introduction Exposure to adverse childhood experiences (ACEs) is a significant risk factor for physical and mental illnesses later in life. Concussion or traumatic brain injury is a challenging condition where preinjury factors may interact to affect recovery. The association between ACEs and traumatic brain injury/concussion is not well mapped in any previous reviews of the literature. Using a scoping review methodology, the research question that will be addressed is: what is known from the existing literature about the association between ACEs and traumatic brain injury/concussion in adults?

Methods and analysis The methodological frameworks outlined by Arksey and O'Malley and Levac *et al* will be used. All original studies in English published since 2007 investigating ACEs and traumatic brain injury/concussion outcomes will be included with no limitations on study type. Literature search strategies will be developed using medical subject headings and text words related to ACEs and traumatic brain injury/concussions. Multiple electronic databases will be searched. Two independent reviewers will screen titles and abstracts for full-text review and full texts for final inclusion. Two independent reviewers will extract data on study characteristics for ACE exposure and traumatic brain injury/concussion outcomes. Extracted data will be summarised quantitatively using numerical counts and qualitatively using thematic analysis.

Dissemination This review will identify knowledge gaps on the associations between ACEs and traumatic brain injury/concussion and promote further research. Knowledge translation will occur throughout the review process with dissemination of project findings to stakeholders at the local, national and international levels.

INTRODUCTION

Adverse childhood experiences (ACEs) are typically defined as stress or trauma occurring in the first 18 years of life. Felitti and colleagues¹ first described ACEs and defined it as exposure to psychological, physical or sexual abuse, and household dysfunction including substance abuse (problem drinking/alcoholic and/or street drugs), mental illness, a mother treated violently and

Strengths and limitations of this study:

- No previous research has systematically mapped the association between adverse childhood experiences and traumatic brain injury/concussion.
- This review will be conducted using an exhaustive search strategy guided by an experienced information specialist.
- The review will include studies of all study designs to capture the full range of evidence.
- This review will be limited to English language studies only.
- The search may yield self-reported data, which are subject to response bias.

criminal behaviour in the household.¹ Along with the initial ACE study, other studies have characterised ACEs as neglect, parental separation, loss of family members or friends, long-term financial adversity and witness to violence.^{2,3} From the original cohort of 9508 American adults, more than half of respondents (52%) experienced at least one adverse childhood event.¹ Since the original cohort, ACE exposures have been investigated globally revealing comparable prevalence to the original cohort.^{4,5} More recently in 2014, a survey of 4000 American children found that 60.8% of children had at least one form of direct experience of violence, crime or abuse.⁶ The ACE study precipitated interest in the health conditions of adults maltreated as children as it revealed links to chronic diseases such as obesity, autoimmune diseases, heart, lung and liver diseases, and cancer in adulthood.¹ Since then, further evidence has revealed relationships between ACEs and physical and mental health outcomes, such as increased risk of substance abuse, suicide and premature mortality.^{4,7}

Individual studies have also shown that ACEs are positively associated with self-reported

disability, chronic pain, depression and headaches.^{8–12} Numerous structural MRI studies on maltreated children compared with control groups have shown that childhood abuse promotes long-term changes in brain development, and specifically structural impairments in areas involved in cognitive and emotional functioning such as the prefrontal cortex and limbic system.^{13–17} In addition, functional studies support the structural findings as maltreated children experience deficits in executive functioning and demonstrate hypervigilant responses to emotional threats, shown through variations in neural activation.^{17–19}

Concussion and traumatic brain injury are challenging and controversial conditions where previous research has identified that preinjury pain and psychological issues, such as anxiety and mood disorders, may affect recovery.^{20–22} Furthermore, a cumulative stressor model has been proposed to explain the aetiology of persistent postconcussion symptoms where stressors interact with premorbid health resulting in prolonged symptoms.²³ While previous systematic reviews have examined the associations between ACEs and various conditions including obesity,²⁴ cardiovascular disease risk,²⁵ type 2 diabetes,²⁶ cancer,²⁷ asthma,²⁸ schizotypy,²⁹ psychotic symptoms³⁰ and adult sleep disorders,³¹ to date, no reviews have been conducted on the associations between ACEs and traumatic brain injury/concussion. Thus, the specific research question of this scoping review is the following: what is known from the existing literature about the association between ACEs and traumatic brain injury/concussion in adults?

METHODS AND ANALYSIS

We will use the methodological frameworks proposed by Arksey and O'Malley as well as Levac and colleagues for the current scoping review.^{32 33} These frameworks outline six different stages involved in a scoping review: (1) identifying the research question; (2) identifying relevant studies; (3) selecting studies; (4) charting the data; (5) collating, summarising and reporting the results; and (6) consulting with relevant stakeholders.^{32 33} The research team has experience/expertise in ACEs (LD, PD), traumatic brain injury/concussion (SEPM, MTB, LR) and knowledge synthesis methods (SEPM, LP, ZM, MTB). Although traditionally applied to systematic review protocols, the preferred reporting items for systematic reviews and meta-analysis for protocols (PRISMA-P) was used to draft this protocol.³⁴

Eligibility criteria

For the purpose of this review, we will be using the definition of ACEs as outlined in the original ACEs study by Felitti and colleagues as it guided successive primary research and reviews on childhood adversity.^{1 5 7 10 27} ACEs are defined as stressful or traumatic life events that occur during the first 18 years of life, such as psychological, physical or sexual abuse.¹ ACEs may also include

exposure to various aspects of household dysfunction such as substance abuse (problem drinking/alcoholic and/or street drugs), mental illness, a mother treated violently and criminal behaviour in the household.¹ The specific behaviours are detailed in Felitti *et al's* ACEs questionnaire.¹ ACEs may be assessed using self-report, family member reporting or information extracted from police records, which is consistent with a previous systematic review on ACEs and adult sleep disorders.³¹ The outcome of interest will be any measure of traumatic brain injury or concussion defined as any injury to the head arising from blunt or penetrating trauma that manifests in changes in consciousness, memory or anatomical features.³⁵ Studies will be included where at least 50% of the sample includes individuals who are ≥ 18 years old of age at the time of traumatic brain injury or concussion. This outcome may be assessed subjectively, objectively or via clinical diagnosis. Furthermore, primary research published in the last 10 years (2007 to search date) of all study designs will be considered for inclusion (eg, observational studies, randomised controlled trials and qualitative studies). Systematic reviews, meta-analyses, editorials, commentaries and conference proceedings will not be included. Furthermore, only studies reported in English will be included.

Search strategy and information sources

Literature search strategies will be developed using medical subject headings (MeSH) and text words related to ACEs and concussion/traumatic brain injury. The search strategy will be developed by an information specialist (LP) with expertise in systematic and scoping reviews. The search will be conducted in MEDLINE (OVID interface), CINAHL (EBSCO interface), EMBASE (OVID interface), PsycINFO (OVID interface) and the Cochrane Central Register of Controlled Trials (Cochrane Library). The search strategy for MEDLINE can be found in the (online supplementary additional file). To ensure literature saturation, a hand search of the reference lists from reviews and selected articles will be completed. Finally, experts in the field of ACEs will be contacted and consulted in order to ensure that all relevant data are obtained, including members of the research team (LD, MB).

Data management

Literature search results will be uploaded to Covidence, a web-based software that facilitates collaboration among reviewers during the screening and data abstraction phases. The team will develop inclusion and exclusion criteria screening questions and forms for title and abstract screening (level 1 screening) and full-text screening (level 2 screening).

Study selection

Two reviewers (ZM & PD) will independently screen the titles and abstracts identified by the literature search for inclusion using the screening form. To promote the

inter-rater reliability, a pilot test of the level 1 screening form based on the aforementioned criteria will be conducted on a random sample of approximately 100 articles. The κ statistic will then be calculated to determine the inter-rater agreement.³⁶ If low agreement is observed, the inclusion and exclusion criteria will be modified to improve the consistent application of the selection criteria. After level 1 screening, the full text of potentially relevant articles will be collected and two independent reviewers will screen to determine final inclusion. A pilot test of the level 2 screening form will be performed on approximately 1% of the articles and the inter-rater reliability for study inclusion will also be calculated.³⁶ Discrepancies will be resolved by discussions, and if necessary, by a third reviewer who is knowledgeable in the research area. Studies excluded during the screening phases will be documented in Covidence along with an explanation for the exclusion.

Data items and data collection process

Abstracted data will include the following characteristics: author, year of publication, sample size, mean age, exposure/type of ACE (eg, psychological, physical and sexual abuse), traumatic brain injury/concussion-related outcome (ie, measure), covariates and main findings. Additional categories may be identified through the completion of the search and through discussions with the research team and key stakeholders. To ensure consistency across reviewers, the data abstraction form will also be pilot tested and modified if poor agreement is observed. For example, any wording on the form that may be related to poor agreement will be reviewed and clarified. Two reviewers will independently abstract all of the data from eligible studies. Disagreements will be resolved through discussion or third reviewer adjudication. The quality of evidence will not be evaluated as the purpose of a scoping review is to identify gaps in the literature and future areas for primary research or for a systematic review.^{33 34}

Synthesis

The data from this scoping review will be summarised quantitatively using numerical counts and qualitatively using thematic analysis. When appropriate, data will be grouped by type of ACE. This scoping review will identify research gaps as well as opportunities for future study either via implementation studies, consensus meeting or systematic review. Furthermore, information gleaned from this review will contribute to research and intervention development that address the needs of survivors.

DISCUSSION AND DISSEMINATION

As scoping reviews do not assess the quality of evidence and risk of bias of included studies, the findings from this review will be subject to the strengths and limitations of the included studies.^{33 34} The research question seeks out a temporal relationship between ACEs and subsequent

traumatic brain injury in adulthood that may not be well captured in the existing literature. For example, this requires authors to distinguish between traumatic brain injury incurred from childhood physical abuse and adulthood traumatic brain injury. Additionally, the search may yield studies based on self-reported and retrospective recall data that are widely used in epidemiological studies investigating ACEs.^{1 3 5-9 37}

Knowledge translation activities will occur from the initial stages of the review and continue throughout with dissemination of the research question to key stakeholders such as the Ontario Neurotrauma Foundation and March of Dimes Canada. Consultation with these organisations and other similar organisations is consistent with the final stage of the scoping review frameworks.^{33 34} These activities will help to ensure that our results and their interpretations are discussed among other experts in the field and disseminated to the appropriate audiences. End-of-grant knowledge translation will also take place through these stakeholders, their outlets (eg, print and online newsletters), as well as through conventional knowledge translation mechanisms (eg, peer-reviewed journals and conference). For example, the results of the scoping review could be presented at meetings locally, nationally and internationally (eg, International Brain Injury Association Conference in 2019). Additionally, the scoping review will be published in a peer-reviewed journal to present results to the appropriate academic and clinical audiences. Finally, the results of this scoping review will inform the standardised data collection strategies in collaboration with local clinical programme and/or research initiatives (eg, the Hull-Ellis Concussion and Research Clinic at Toronto Rehabilitation Institute, University Health Network).

Contributors SEPM: conceived of the scoping review, together with MTB, LP, ZM, and PD. SEPM and ZM: wrote the first draft of the protocol and are the guarantors of the review. SEPM, LP, ZM and LD: involved in the preliminary literature review. LP: conducted the literature search and provided methodological expertise (knowledge synthesis). LD, PC, LR and MTB: provided critical content expertise on adverse childhood experiences/traumatic brain injury/concussion that was integrated into the current protocol. All authors: involved in editing and revising the protocol for important intellectual content and approved the final version of the protocol.

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