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Systematic review of mental health measures associated with concussive and subconcussive head trauma in former athletes

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ABSTRACT

Public concern has been a catalyst for an emerging body of research investigating the potential long-term negative health consequences associated with sport-related concussion and subconcussive impacts. We conducted a systematic review of the literature on mental health measures associated with sport-related brain injuries in former athletes. Ovid MEDLINE, EMBASE, CINAHL, and PsychINFO databases were used. Thirteen studies were included in the final review. We identified a consistent positive association between a history of concussion and depression among former athletes, although the underlying causation remains unclear. Limited and inconsistent findings were observed in studies that evaluated subconcussive impacts. Overall, several methodological shortcomings were noted, including selection bias, research design, operational definitions, and measurement tools. Future research will benefit from employing prospective longitudinal studies, surveillance data systems and standardized collection methods, and should attempt to account for psychosocial modifiers or confounders when reporting the mental health status of former athletes. This area would also benefit from studies that include equal representation of male and female athletes, examine mental health disorders beyond depression, and assess a variety of sports and competition levels.

1. Introduction

Sport participation has been associated with numerous mental health benefits, including lower levels of depression, anxiety and psychological distress (Skead and Rogers, 2016; Dunn and Jewell, 2010; Deslandes et al., 2009; Penedo and Dahn, 2005). Yet, one of the challenges facing both the public and medical community is balancing the prospective benefits versus the inherent risk of injury. In line with this, concussion is among the most common injuries in sport, with the potential risk of acute and long-term disability (Silverberg and Iverson, 2011; Collins et al., 2002). Indeed, recent evidence has identified symptoms of maladies such as depression, anxiety, and aggression in former athletes with a history of concussion (Meehan et al., 2016; Goswami et al., 2016; Guskiewicz et al., 2007). Furthermore, there have been several post-mortem reports of structural abnormalities consistent with neurodegeneration in former athletes who participated in sports with inherent and purposeful collision (McKee et al., 2016; Omalu et al., 2005). Upon retrospective investigation of these cases, evidence of cognitive impairment and mood disturbances was identified (McKee et al., 2016; Omalu et al., 2005). These works have led to the recognition that traumatic blows that fail to present clinically as concussive injury - termed subconcussive impacts - may also contribute to long-term negative health outcomes, including cognitive and emotional disturbances (Talavage et al., 2014; Gavett et al., 2011; Killam et al., 2005).

While the natural history of recovery among collegiate and professional athletes is most often reported within 10 days (McCrory et al., 2016), recent evidence has suggested that biological perturbations persist beyond clinical recovery (Hutchison et al., 2017; Zhu et al., 2015; Chamard et al., 2013; McCrea et al., 2010). For example, neuroimaging abnormalities and blood biomarker perturbations have been found in concussed athletes beyond symptom resolution (Zhu et al., 2015; Di Battista et al., 2016), potentially indicating underlying functional and structural changes; similar findings have also been observed in individuals participating in sports with purposeful collision (Di Battista et al., 2016; Abbas et al., 2015; Johnson et al., 2014). The possible relationship between these biological findings and negative health consequences such as mild cognitive impairment (MCI),

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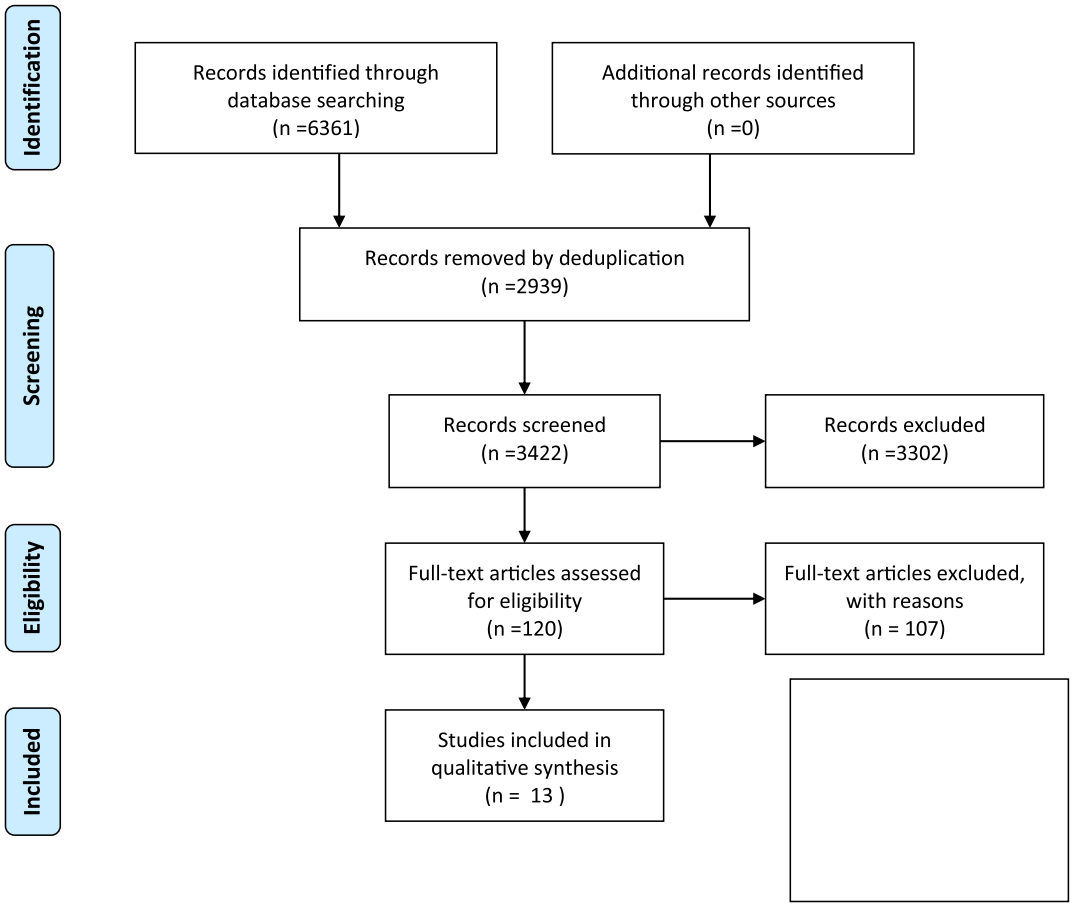

Fig. 1. PRISMA flow diagram of results.

Parkinson's, Alzheimer's, and chronic traumatic encephalopathy (CTE) remains unclear. However, this raises important questions regarding both the natural history of recovery from concussion, as well as exposure to subconcussive impacts.

While much of the early research on sport-related concussion (SRC) focused on diagnosis and injury management, current interests now include the potential long-term health effects. Increased public concern has been a catalyst for an emerging body of research investigating the potential negative health consequences of both concussion and subconcussive injury across the lifespan, spanning all levels of sport participation. In view of this, recent systematic reviews have been helpful in consolidating the literature on the long-terms sequelae of SRC, although they have predominantly focused on cognition (Manley et al., 2017; Karr et al., 2014) and neuropathology (Manley et al., 2017); there still remains a void in the literature pertaining to mental health outcomes.

Investigating the relationship between long-term mental health and sport-related brain injury is a complex undertaking. For example, deconditioning, loss of both the athletic social support network and identity, as well as substance abuse, have all been associated with emotional difficulties in former athletes (Webb et al., 1998; Lally, 2007). Yet, despite this complexity, mental health may be significantly impacted by concussion and/or subconcussive impacts, and this relationship remains poorly understood.

Therefore, the purpose of this systematic review was to consolidate the body of research that has examined the relationships between concussive and subconcussive head trauma, and mental health in former athletes. The results may aid in clarifying whether concussive and subconcussive injury differ in their relationship to mental health, and help inform future research.

2. Methods

2.1. Literature search

Ovid MEDLINE (1946 to January Week 2, 2017), EMBASE (1974 to January Week 2, 2017), CINAHL (1973 to January Week 2, 2017) and PsychINFO (1806 to January Week 2, 2017) were searched for relevant studies. Search strategies were limited to English articles only. Keywords and Medical Subject Headings (MeSH) were used in all compatible databases, while keywords and subject headings were used in databases where MeSH terms were not accepted. All search terms whose suffixes could differ were truncated with asterisks to capture all relative terms. Search terms comprised three separate groups that were later combined. The first group included terms relating to injury: 'concuss*', 'brain inj*', 'head inj*', 'MTBI', and 'subconcuss*'. The second group included terms relating to sport: 'sport*' and 'athlet*'. The final group included terms relating to age: 'former*', 'retir*', 'adult', 'middle aged', 'aging*' and 'long-term'. The Boolean operator 'OR' was used to combine the terms within each group to encompass a broad spectrum of papers relevant to each topic. The three groups were then combined using the Boolean operator 'AND' to capture the specific topic of interest. Lastly, reference lists of included articles were screened for additional studies. See Appendix A for the complete search strategy.

2.2. Study selection

All primary research studies retrieved from the initial electronic search were imported as Research Information Systems (RIS) files into the reference manager program Endnote (version x8, Thompson Reuters, USA). The files were then automatically de-duplicated and further screened by a thorough review of titles, abstracts and keywords.