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Traumatic brain injury and violent behavior in females: A systematic review

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ABSTRACT

Background: Research on causes and consequences of neurodisability has established a positive link between traumatic brain injury (TBI) and risk of violence among males. The nature and contribution of TBI to violence risk in females is equivocal and research with females is under-represented in the domain. The primary objective of this paper was to systematically review the strength of results of empirical research into the relationship between TBI and violence in females.

Methods: Three databases were searched (PsychINFO, Scopus, and PubMed) and supplemented with citation searches (until February, 2013). Methodological rigor was appraised using the Cochrane Handbook's general guidance on non-experimental studies. Results: Only six of 153 identified papers met inclusion criteria. Three studies provided evidence of a positive relationship between violence and TBI in females specifically. The remaining found no significant gender differences between levels of post-TBI violence, suggesting females exhibit similar levels of violence to males. The studies contribute knowledge of other factors that may influence post-TBI violence in females, including psychiatric comorbidities and childhood abuse. It was concluded that the strength of evidence suggesting a relationship between TBI and violence in females is poor considering methodological limitations and scarcity of research. However, key findings herein indicate utility of further research to inform intervention and management.

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1. Introduction

1.1. Traumatic brain injury

Traumatic brain injury (TBI) is defined as 'an alteration in brain function, or other evidence of brain pathology, caused by an external force' (p. 1638; Menon, Schwab, Wright, & Maas, 2010), capturing the range of presentations that fit under the TBI diagnostic umbrella including loss of or decreased consciousness, any loss of memory, neurological deficits, and any alteration in mental state (e.g., confusion) (Menon et al., 2010). TBI is the most common form of acquired brain injury (ABI; Fleminger & Ponsford, 2005), with an estimated prevalence of 8.5% (Silver, Kramer, Greenwald, & Weissman, 2001) across all levels of severity. Annual incidence of TBI ranges from 180–250 per 100,000 in the US (Bruns & Hauser, 2003), and 91–419 per 100,000 in England (Tennant, 2005); however, rates may overlook milder TBI due to reliance on medical records (Tennant, 2005) and associated diagnostic and selection biases (Dean, O'Neill, & Sterr, 2012; Feigin et al., 2013). TBI severity traditionally has been classified by scores on the Glasgow Coma Scale (GCS; World Health Organization, 2006). Other commonly used measures include post-traumatic amnesia (PTA) and length of loss of consciousness (LOC; Sherer, Struchen, Yablon, Wang, & Nick, 2008). Researchers have not reached a consensus regarding the definition and classification systems for TBI, making comparison across studies difficult (Corrigan, Selassie, & Orman, 2010) and so highlighting the need for systematic reviews to lend coherence to the literature.

Up to twice the rate of TBI has been found in males than females in the general population (Hillbom & Holm, 1986; Hirtz et al., 2007). However, the prevalence of TBI across males and females may be an artifact of the research process (e.g., studies adopting a threshold of LOC for study inclusion might exclude groups with mild TBI without LOC). Research indicates that women typically have a high prevalence of mild TBI, whereas, conversely, men with TBI are typically more in the moderate to severe range (Diamond, Harzke, Magaletta, Cummins, & Frankowski, 2007). Reported gender differences in prevalence of TBI across severities may be attributable to gender-related behavioral patterns and factors (e.g., intimate partner violence (Valera & Berenbaum, 2003) and decreased likelihood of reporting mild TBIs.

1.2. TBI and violence

For the purpose of this review, the definition of violence suggested by Monahan et al. (2001) is adopted. Violence is confined to physical acts that could cause harm to others, indicating the serious nature of violent behavior. Violence 'includes acts of battery that result in physical injury; sexual assaults; assaultive acts that involve the use of a weapon; or threats made with a weapon' (p.17), consistent with forensic mental health literature.

TBI can result in an array of cognitive, emotional, physical, and behavioral sequelae. Some research suggests violence and impulsive behaviors are both antecedents and consequences of TBI (Anderson, Bechara, Damasio, Tranel, & Damasio, 1999). TBI has been associated with increased risk of developing aggression (Alderman, 2007; Cole et al., 2008; Rao et al., 2009; Visscher, van Meijel, Stolker, Wiersma, & Nijman, 2011). Aggression and violence following TBI has been characterized as unpredictable and ill-directed, which can occur in the absence of clear triggers or provocation (Eslinger, Grattan, & Geder, 1995; Wood & Liossi, 2006). Research from the Swedish population register found that individuals with TBI have a significantly increased risk of committing a violent crime (Fazel, Lichtenstein, Grann, & Långström, 2011). Prisoners with TBI also have higher reported rates of reoffending (Williams et al., 2010). Although TBI cannot be assumed to be the sole cause of violence, it appears that the cognitive and behavioral sequelae of TBI may predispose some individuals to violence (Miller, 1999).

TBIs, particularly mild and moderate, to which victims of intimate partner violence may be more susceptible, are often localized in the orbito-frontal and temporal polar zones of the brain (Zappalà, Thiebaut de Schotten, & Eslinger, 2012), areas associated with increased aggression (Daoust, Loper, Magaletta, & Diamond, 2006). Meta-analyses have demonstrated a medium effect size ($d = 0.47$; *95% CI* $= 0.42$-0.51; $p < 0.0001$) for the relationship between antisocial behavior and neuropsychological measures of executive functioning (Morgan & Lilienfeld, 2000; Ogilvie, Stewart, Chan, & Shum, 2011). However, this area of neuropsychological research is marred by methodological problems, rendering findings inconclusive. Comparing aggressive with non-aggressive individuals with severe TBI (Greve et al., 2001) and mild-severe ABI (Kerr, Oram, Tinson, & Shum, 2011), some research has demonstrated no significant cognitive (Greve et al., 2001) or injury-related differences (Kerr et al., 2011). However, another study of severely injured individuals found significantly greater deficits in verbal memory and visuo-perceptual skills in the aggressive group than in the non-aggressive group (Wood & Liossi, 2006).

1.3. TBI and violence in females

In the UK in 2011, 34% of arrested females and 31% of males were arrested for "violence against the person" (Ministry of Justice, 2011). Similarities in prevalence across gender challenge the stereotype that violence is a male issue. Within 12 months of release from prison, 17.8% of females reoffend across offense types (e.g., violence, theft, drug offenses) (Ministry of Justice, 2013). Despite these figures, female offenders are a relatively understudied population with a research gender bias favoring males.

No large community-based epidemiological study has explored gender differences in the relationship between violence and TBI, despite reported gender differences in the presentation of offenders such as psychiatric comorbidity (Zlotnick et al., 2008), the dominance of socioeconomic and child-raising risk factors for females, and parental characteristics for males (Farrington, Painter, & Britain, 2004). The Swedish population study controlled for gender through matching, rather than including it in the stratified analyses (Fazel et al., 2011). A recent report commissioned by the Barrow Cadbury Trust (an independent, charitable foundation in the UK) emphasized the need for research examining the causes and consequences of TBI in female offenders specifically (Williams, 2012).

Although females have a lower recorded prevalence of offending than males, females who perpetrate offenses are more likely than males to be experiencing a mental illness (Butler, Allnutt, Cain, Owens, & Muller, 2005). Rao et al. (2009), comparing individuals with and without verbal aggression post-TBI, found that new-onset major depression