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A literature review of outcome and treatment options after acquired brain injury: Suggestions for adult offenders using knowledge from the general population

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Abstract

Background: Acquired brain injury (ABI) is a major health problem, often with negative effects on behaviour and mental health as well as cognition. Prevalence of ABI is exceptionally high among offenders and increases their re-offending risk. Information on risk factors for ABI and its outcomes among offenders that could guide effective treatment for them is, nevertheless, scarce and dispersed. However, there is a more substantial literature about the general population that could inform work with brain-injured offenders, especially when selecting for samples or subgroups with similar relevant characteristics, such as lower socio-economic status (SES), pre-injury lower tested intelligence score (<85) and pre-injury mental health problems.

Aims: To explore brain injury data from non-offender samples of otherwise similar socio-economic and mental health and ability characteristics to offenders then, first, to describe their untreated outcomes and, secondly, outcomes

after frequently used interventions in these circumstances, noting factors associated with their effectiveness.

Method: Three databases were systematically searched for the years 2010–2022; first, using terms for brain injury or damage and cognitive (dys)function, mental health or quality of life. Second, in a separate search, we used these terms *and* terms for interventions and rehabilitation. In the second review, studies were selected for clear, distinguishable data on age, sex, SES and lifestyle factors to facilitate inferences for offenders. A narrative analytical approach was adopted for both reviews.

Results: Samples with characteristics that are typical in offender groups, including lower SES, lower pre-injury intelligence quotient (<85), prior cognitive impairments and prior mental health problems, had poorer cognitive and behavioural outcomes following ABI than those without such additional problems, together with lower treatment adherence. With respect to treatment, adequate motivation and self-awareness were associated with better cognitive and behavioural outcomes than when these were low or absent, regardless of the outcome measured.

Conclusions: More complex pre-injury mental health problems and social disadvantages typical of offenders are associated with poorer post-brain injury recovery. This paper adds to practical knowledge by bringing together work that follows specific outcome trajectories. Overall, succesful ABI-interventions in the general population that aim at pre-injury difficulties comparable to those seen among offenders, show that personalising injury-specific treatments and taking account of these difficulties, maximised positive outcomes.

KEYWORDS
acquired brain injury, forensic population, outcome, treatment

1 | INTRODUCTION

Globally, acquired brain injury (ABI) is a major social and health problem and its burden is increasing, mainly due to the growing and ageing world population and the increased use of (unsafe) vehicles in low-income countries (Brazinova et al., 2021; Dewan et al., 2019; Feigin et al., 2017). ABI appears to be exceptionally high in offenders,

among whom up to an estimated 50% may have had at least one such injury, almost tenfold of the prevalence in the general population (Durand et al., 2017; O'Rourke et al., 2016; Shiroma et al., 2010). There are also indications that the history of such trauma increases the risk of re-offending (Williams et al., 2018), and yet information on risk factors and outcomes that could guide the effectiveness of offender treatment is scarce and dispersed.

Treatment of offenders is often guided by the Risk-Need-Responsivity model, an offender rehabilitation model consisting of three main principles with a focus on reducing recidivism. The risk principle specifies that the intensity and duration of the treatment should match the offender's risk of re-offending, the need principle is that treatment should target the dynamic (changeable) criminogenic risk factors, and the responsivity principle posits that treatment should be offender specific—according to abilities such as intellectual capacities and motivation, to maximise treatment engagement (Bonta & Andrews, 2017). Offenders with ABI may have specialised needs and be less responsive to treatments due to, for example, post-injury cognitive and behavioural impairments. Thus, to improve the effectiveness of interventions and reduce recidivism, it is important to adjust the interventions, in line with this aspect of the responsivity component, but such ABI-informed adjustments are rare (De Geus et al., 2021). Therefore, our aims for the literature reviews reported here were to explore the needs associated with ABI and the relative effectiveness of needs-informed interventions from research with those in the general population. Whilst the characteristics of offenders differ in some respects from non-offenders, particularly in sex, age and psychosocial characteristic distributions (Olver et al., 2011; Piccolino & Solberg, 2014; Skarupski et al., 2018; Tomlin et al., 2021; Williams et al., 2018), a general population overview can provide indications for improving treatment among offenders, where it is possible to allow for such differences.

ABI is defined as 'an injury to the brain that is not congenital, degenerative, hereditary or caused by a birth trauma' (Brain Injury Association of America, 2019). A distinction is made between so called non-traumatic brain injury, when there is a sudden internal event causing harms (Lezak et al., 2012), with stroke as the main cause with an estimated prevalence between 5% and 10% worldwide (Truelsen et al., 2006; Wafa et al., 2020), and traumatic brain injury when an external force harms the brain; the main causes being motor vehicle accidents and falls in the general population (Peeters et al., 2015) with, among offenders, the added risk of violence and assault (Williams et al., 2018). Traumatic brain injury (TBI) is generally classified into three categories: mild, moderate and severe, reflected in the Glasgow Coma Scale, where longer duration of loss of consciousness and post-traumatic amnesia corresponds with more severe injury (Teasdale & Jennett, 1974). Traumatic brain injury is the most prevalent type of ABI with an estimated worldwide prevalence rate of 12% (Frost et al., 2013), probably an underestimate [2], and a worldwide incidence rate of 1.5% (Dewan et al., 2019). Most of this is mild and associated with no or few residual symptoms, but up to 8% of traumatic brain injuries are rated as severe, indicating more and more long-term negative outcomes (Dewan et al., 2019).

Some important risk factors for ABI are shared by general and offender populations, including age, sex and gender, socioeconomic status (SES) and health (Frost et al., 2013; Gittleman et al., 2018; Mollayeva et al., 2018; Peeters et al., 2015; Roy-O'Reilly & McCullough, 2018). Children under the age of 5 years, individuals aged 14–24 and those over 65 are at increased risk for sustaining TBI. The most common general cause of traumatic brain injury for under-fives and older people is falling, while for adolescents and young adults the main cause is road traffic accidents (Frost et al., 2013; Peeters et al., 2015; Thurman, 2016). The elderly are also at a much greater risk for stroke (Dolecek et al., 2012; Gittleman et al., 2018; Leece et al., 2017; Roy-O'Reilly & McCullough, 2018). Male sex is a risk factor for traumatic brain injury, with male-to-female ratios ranging between 1.2:1 and 4.6:1 (Peeters et al., 2015), while the reverse is true for non-traumatic brain injury; women are at a higher risk of having a stroke, although reports on brain cancer sex and gender effects are inconsistent (Avan et al., 2019; Bots et al., 2017; Dolecek et al., 2012; Gittleman et al., 2018; Kalan Farmanfarma et al., 2019; Porter et al., 2015; Roy-O'Reilly & McCullough, 2018). Sex differences in traumatic injury may be explained by the greater likelihood of men being involved in risky behaviours and sports; however, women are more prone to become victims of assault and intimate partner violence (Brazinova et al., 2021; Levin et al., 2021; Merritt et al., 2019; Mollayeva et al., 2018; Peeters et al., 2015). Interactions between sex, gender and age have also been shown, with older women more often

sustaining traumatic brain injury or having a stroke than older men (Brazinova et al., 2021; Levin et al., 2021; Mollayeva et al., 2018; Peeters et al., 2015; Phan et al., 2018; Willers et al., 2018). Regarding socio-economic status and lifestyle-related risk factors, low education levels and poverty, unemployment and belonging to a minority have all been evidenced as risk factors for ABI (Addo et al., 2012; Avan et al., 2019; Chen et al., 2020; Marshall et al., 2015; Mollayeva et al., 2018; Nordstrom et al., 2013; Pozzato et al., 2019; Semega et al., 2020; Stormacq et al., 2019; Wagner et al., 2000), although findings are inconsistent for the non-traumatic injury groups (Dolecek et al., 2012; Kruchko et al., 2018; Nilsson et al., 2018; Plascak & Fisher, 2013; Porter et al., 2015). Unhealthy lifestyles such as substance abuse and smoking, which are associated with high blood pressure, diabetes, cardiovascular diseases and obesity, are related to an increased risk of ABI (Avan et al., 2019; Boehme et al., 2017; Chen et al., 2020; Pozzato et al., 2019; Wagner et al., 2000). Hospital admissions due to alcohol or other drug intoxication have also been shown to be risk factors for traumatic brain injury (Nordstrom et al., 2013) as well as having a diagnosis of conduct disorder, attention-deficit hyperactivity disorder, depression and/or anxiety (Liou et al., 2018; Mollayeva et al., 2018; Vassallo et al., 2007). In addition, for any ABI, there appears to be an interaction between unhealthy lifestyle and socio-economic status, with unhealthy lifestyle factors being more common and having more devastating effects in lower than in higher socio-economic populations (Avan et al., 2019; Foster et al., 2018).

The negative outcomes of both traumatic and non-traumatic brain injuries can be severe and include changes in behaviour, impairments in cognition and impairments in social and neurological functioning. There is an extensive literature on factors affecting the outcome and treatment success in the general population with ABI, so our aim was to summarise the main findings from that literature that could be applicable to offenders. In line with that aim, our focus is on psychological and social outcomes after such an injury rather than on medical or physical outcomes. This review is divided into two parts, each referring to literature about the general population. In part 1, our research question was as follows: what factors influence or are associated with the nature and extent of the four most likely outcomes after ABI: (1) cognitive or neuropsychological impairments; (2) behavioural changes; (3) other mental health problems, including substance use disorders; (4) well-being, quality of life (QoL) and social engagement, including education or work? In part 2, our question was as follows: what frequently used interventions after ABI have been evidenced as effective in ameliorating such outcomes and what factors influence their effectiveness for non-offenders? Finally, we considered the extent to which the resulting information appeared applicable to offender populations and the extent to which there may be key research gaps in this area.

2 | METHOD

We conducted a systematic literature search and narrative review in two parts. In the first part, we were guided by the International Classification of Functioning, Disability and Health model (ICF model). This is an influential framework in outcome research following ABI, distinguishing between outcomes in impairments and in activity and participation (World Health Organization, 2001). According to the ICF model, outcomes after ABI are influenced by several factors, including injury factors (e.g. severity and location of the brain damage), personal factors (e.g. age, sex and education) or external/environmental factors (e.g. legislation, support from family or employer) (Donker-Cools et al., 2016; Matérne et al., 2019; Menon et al., 2010). In the second part, we explored frequently used interventions post-ABI in the general population and factors influencing treatment outcomes. Where relevant, we made a distinction between traumatic and non-traumatic brain injuries. Two separate searches for peer reviewed papers were conducted, the first examining factors affecting general outcomes after sustaining brain injury and the second examining outcomes after evidence-based interventions and factors related to these. For the first, search terms for brain injury or damage *and* cognitive (dys)function or QoL *and* demographic or socio-economic factors were used; for the second, for brain injury or damage *and* interventions or rehabilitation or goal management were entered into the literature databases PubMed, Web of Science and PsycInfo for the years 2010–2022, inclusive. The full search algorithms are presented in Online Supplements S1 and S2. For both reviews, inclusion criteria were

that retrieved studies or reviews were (1) published in English, (2) published in peer-reviewed journals, (3) included adults with ABI and only for the second review studies included reports on treatment within one of the domains. We included systematic reviews and meta-analyses, but added large sample/high impact studies where possible. Studies including pharmacological treatment in addition to any psychological treatment were excluded since outcomes specific to psychological treatment could not be adequately separated. After the searches were completed and all duplicates were excluded, the titles and abstracts of the remaining articles were reviewed by the first and last author (EG and SN) using these criteria.

Given the heterogeneity of study approaches and outcome measures, including many not reporting on effect sizes, a meta-analysis was not possible, so only a narrative synthesis was possible.

3 | RESULTS

3.1 | Factors influencing outcomes after acquired brain injury

We found 50 reviews of outcomes after brain injury in otherwise unselected/general populations as well as 22 large cohort or sample studies not otherwise included (see Table 1). Outcomes fell into one or more of four domains: cognitive functions, behavioural or personality change, other mental health outcomes and social change. We will treat each separately; although, clearly, people might have been affected by the injury in more than one domain.

3.1.1 | Cognitive domains

Cognitive functions, such as memory, language, visuospatial skills, information processing, executive function and social cognition, may be impaired after ABI, separately or together, briefly, over a prolonged period or even permanently, depending on the nature and extent of the injury (Armstrong, 2018; Azouvi et al., 2017; Niemeier et al., 2007; Pula & Yuen, 2017; Rabinowitz & Levin, 2014). Meta-analyses, (systematic) reviews and longitudinal studies found evidence that in the cognitive domain, in addition to injury severity, poorer outcomes are associated with comorbid mental illnesses (e.g. substance use, anxiety or depression; Mitchell et al., 2017; Robinson & Jorge, 2016; Stangeland et al., 2018; Tang et al., 2018), older age (Hardy et al., 2018; Levin et al., 2021; Marshall et al., 2015; Mathias & Wheaton, 2015; Moretti et al., 2012; Rabinowitz et al., 2015; Tang et al., 2018), lower socio-economic status (Hardy et al., 2018; Marshall et al., 2015; Rabinowitz et al., 2015; Tang et al., 2018) and fewer years of education (Hardy et al., 2018; Mathias & Wheaton, 2015; Rassovsky et al., 2015; Renjen et al., 2015). The literature on sex and gender differences and cognitive outcomes after ABI is inconsistent (Merritt et al., 2019; Mollayeva et al., 2019; Tang et al., 2018; Vakil et al., 2019).

3.1.2 | Behavioural and personality changes

Behavioural and personality changes are common after ABI and more likely when they are pre-injury already present (Azouvi et al., 2017; Boele et al., 2015; Lupton et al., 2020; Osborne-Crowley & Mcdonald, 2018; Palmisano et al., 2020; Pouwels et al., 2019; Ryan et al., 2013; Schwartz et al., 2017). Behavioural changes are typically divided into lack of control including aggression and/or impulsivity, and lack of drive, including apathy, poor motivation and/or lack of initiative (Azouvi et al., 2017). While apathy is among the most prevalent of the behavioural outcomes, no clear relationship has been found between apathy and qualities of the injury, including severity, time since injury or age at injury onset or extraneous factors; however, only level of education has been examined in more than one review (Palmisano et al., 2020; Worthington & Wood, 2018). When personality change is strictly defined as lasting

TABLE 1 Papers with general population data on outcomes after acquired brain injury without treatment or with treatment unspecified.

	Authors	Year	Type of study	Outcome domain
1.	Addo et al.	2012	Review	Social
2.	Albrecht et al.	2016	Retrospective cohort study (n = 4854)	Social
3.	Ardila	2019	Review	Mental health
4.	Armstrong	2018	Review	Cognitive
5.	Ashley, Lee, and Heaton	2019	Review	Social
6.	Avan et al.	2019	Systematic review	Social
7.	Azouvi et al.	2027	Expert overview review	Cognitive; behavioural/personality
8.	Bartholomé and Winter	2020	Systematic review	Mental health; social
9.	Benedictus, Spikman, and Van Der Naalt	2010	Longitudinal cohort study (n = 434)	Behavioural/personality
10.	Béjot et al.	2011	Longitudinal population-based study	Mental health
11.	Bettger et al.	2014	Prospective cohort study (n = 1965)	Social
12.	Boele et al.	2015	Review	Behavioural/personality
13.	Bombardier et al.	2010	Longitudinal cohort study (n = 559)	Mental health
14.	Bushnell et al.	2014	Longitudinal cohort study (n = 1370)	Mental health
15.	Cancelliere, Donovan, and Cassidy	2016	Systematic review and meta-analysis	Social
16.	Carod-Artal	2012	Review	Mental health
17.	Carroll et al.	2014	Systematic review	Mental health
18.	Chan et al.	2013	Retrospective cohort study (n = 65,751)	Social
19.	Corrigan et al.	2014	Longitudinal cohort study (n = 13,700)	Mental health; social
20.	Dolecek et al.	2012	Longitudinal population-based study	Social
21.	Edwards et al.	2018	Systematic review	Social
22.	Elbogen et al.	2015	Longitudinal cohort study (n = 6315)	Behavioural/personality
23.	Fazel et al.	2014	Longitudinal cohort study (n = 218,300)	Mental health
24.	Ferro and Santos	2020	Review	Behavioural/personality
25.	Frost et al.	2013	Meta-analysis	Social
26.	Fynn et al.	2021	Meta-analysis	Behavioural/personality
27.	Garrelfs et al.	2015	Systematic review	Social
28.	Gittleman et al.	2018	Longitudinal population-based study	Social
29.	Hardy et al.	2018	Systematic review	Cognitive
30.	Jokinen et al.	2015	Prospective cohort study (n = 409)	Social

TABLE 1 (Continued)

	Authors	Year	Type of study	Outcome domain
31.	Jorge and Arciniegas	2014	Systematic review	Mental health
32.	Juengst et al.	2015	Longitudinal cohort study (n = 3012)	Mental health; social
33.	Levin et al.	2021	Prospective cohort study (n = 2299)	Cognitive
34.	Li and Li	2018	Large (n = 1389) prospective cohort study	Social
35.	Lupton et al.	2020	Review	Behavioural/personality; mental health
36.	Marshall et al.	2015	Review	Cognitive
37.	Mathias and Wheaton	2015	Meta-analysis	Cognitive
38.	McKinlay et al.	2014	Longitudinal birth cohort study (n = 1265)	Behavioural/personality
39.	Medeiros et al.	2020	Review	Mental health
40.	Merrit, Padgett, and Jak	2019	Systematic review	Cognitive
41.	Mikolic et al.	2020	Longitudinal cohort study (n = 2864)	Mental health; social
42.	Mitchell et al.	2017	Meta-analysis	Cognitive; mental health
43.	Mole and Demeyere	2020	Systematic review	Mental health
44.	Mollayeva et al.	2019	Systematic review and meta-analysis	Cognitive
45.	Moretti et al.	2012	Review	Cognitive
46.	Osborne-Crowley and McDonald	2018	Review	Behavioural/personality
47.	Palmisano, Fasotti, and Bertens	2020	Review	Behavioural/personality
48.	Peeters et al.	2015	Review	Social
49.	Ponsford, Alway, and Gould	2018	Review	Mental health
50.	Ponsford	2013	Review	Social
51.	Pouwels et al.	2019	Review	Behavioural/personality
52.	Prigatano and Sherer	2020	Review	Cognitive
53.	Pula and Yuen	2017	Review	Cognitive
54.	Rabinowitz and Levin	2014	Review	Cognitive
55.	Ricciardi et al.	2015	Review	Behavioural/personality
56.	Robinson and Jorge	2016	Review	Cognitive
57.	Roy-O'Reilly and McCullough	2018	Review	Social
58.	Saban et al.	2011	Longitudinal cohort study (n = 297)	Social
59.	Saltychev et al.	2013	Systematic review	Social
60.	Scaratti et al.	2017	Systematic review	Social
61.	Schiavolin et al.	2020	Review	Mental health; social
62.	Scholten et al.	2015	Prospective cohort study (n = 2066)	Mental health

(Continues)

TABLE 1 (Continued)

	Authors	Year	Type of study	Outcome domain
63.	Shi et al.	2017	Meta-analysis	Mental health
64.	Stangeland, Orgeta, and Bell	2018	Systematic review	Cognitive; mental health
65.	Tang et al.	2018	Systematic review	Cognitive
66.	Vakil et al.	2019	Meta-analysis	Cognitive
67.	van der Naalt et al.	2017	Longitudinal cohort study (n = 910)	Mental health
68.	Williams et al.	2014	Longitudinal cohort study (n = 253)	Social
69.	Wilson et al.	2017	Systematic review	Social
70.	Woodman et al.	2014	Systematic review and meta-analysis	Social
71.	Worthington and Wood	2018	Review	Behavioural/personality
72.	Wright et al.	2017	Systematic review and meta-analysis	Mental health

change in a person's characteristic behaviour, mood and attitude, a range of post-injury changes have been documented, including loss of emotional control or emotional lability, the inability of emotional awareness and more general impairments in social communication (Azouvi et al., 2017; Boele et al., 2015; Ferro & Santos, 2020; Fynn et al., 2021; Lupton et al., 2020; Osborne-Crowley & Mcdonald, 2018; Pouwels et al., 2019; Ricciardi et al., 2015; Ryan et al., 2013; Schwartz et al., 2017). Longitudinal studies have shown that social (communication) impairments precede and probably contribute to an increase in externalising behaviours, such as rule-breaking, aggression and delinquency (Elbogen et al., 2015; McKinlay et al., 2014; Ryan et al., 2013; Schwartz et al., 2017). Factors evidenced in several systematic reviews and longitudinal studies as likely to increase the odds of ABI-associated behavioural or personality changes, apart from severity of injury, are gender (men are more likely to demonstrate an increase in externalising behaviours than women), age (younger people are much more likely to show behavioural changes after injury than older people), pre-injury cognitive impairments, lower intelligence quotient (IQ) (IQ score below 85 on a standardized IQ test) and fewer years of education (Azouvi et al., 2017; Benedictus et al., 2010; Elbogen et al., 2015; Ferro & Santos, 2020; McKinlay et al., 2014; Pouwels et al., 2019; Schwartz et al., 2017; Stéfan & Mathé, 2016).

3.1.3 | Mental health problems

Mental health problems, such as anxiety, depression, psychosis and suicide, are more prevalent among people with ABI than in the general population, but it has also been shown that head injury is more common among people with such problems than those without them (Ardila, 2019; Bombardier et al., 2010; Jorge & Arciniegas, 2014; Mitchell et al., 2017; Ponsford et al., 2018). While such mental health problems have been related to poorer QoL following ABI (Bartholomé & Winter 2020; Béjot et al., 2011; Mole & Demeyere, 2020; Schiavolin et al., 2020), factors that have been associated with developing mental health problems post-ABI include lower pre-injury QoL and pre-morbid mental health problems (Fazel et al., 2014; Gorgoraptis et al., 2019; Jorge & Arciniegas, 2014; Mitchell et al., 2017; Shi et al., 2017; van der Naalt et al., 2017; Wright et al., 2017). Thus, on several counts, there is a circularity in sequencing of disorders that can make treatment planning difficult. Findings for age and mental health after brain injury are inconsistent, although there is slightly more evidence that younger patients are more likely to develop substance use disorders, while older patients are more likely to be diagnosed with a mood disorder

following ABI (Aza et al., 2021; Bombardier et al., 2010; Corrigan et al., 2014; Juengst et al., 2015; Lupton et al., 2020; Ponsford et al., 2018; Scholten et al., 2015; Shi et al., 2017; Zhu & Jiang, 2019). Women are more likely to report mood disorders than men after an ABI and also more likely to complete suicide in these circumstances than men (Bombardier et al., 2010; Bushnell et al., 2014; Carod-Artal, 2012; Carroll et al., 2014; Medeiros et al., 2020; Mikolic et al., 2020; Ponsford et al., 2018; Scholten et al., 2015; Shi et al., 2017). Men are at a higher risk than women of developing substance use disorders and psychosis after brain injury (Ponsford et al., 2018; Stangeland et al., 2018). Finally, higher SES, IQ or educational level appeared to be protective factors in this area, while low socio-economic status, belonging to a minority or low educational achievement were associated with greater likelihood of developing mental illness or substance use disorders (Aza et al., 2021; Carod-Artal, 2012; Chiang et al., 2016; Haley et al., 2011; Juengst et al., 2015; Lupton et al., 2020; Ponsford et al., 2018; Shi et al., 2017; Zhu & Jiang, 2019).

3.1.4 | Social outcomes

Social outcomes, including participation in the community, having contact with friends and family and the ability to live independently (World Health Organization, 2001) have all been evidenced as being affected negatively by brain injury (Corrigan et al., 2014; Dolecek et al., 2012; Wilson et al., 2017). There is consistent evidence that older age at time of injury was associated with poorer outcomes in these areas (Bartholomé & Winter 2020; Chan et al., 2013; Corrigan et al., 2014; Dolecek et al., 2012; Frost et al., 2013; Gittleman et al., 2018; Peeters et al., 2015; Ponsford, 2013; Roy-O'Reilly & McCullough, 2018; Schiavolin et al., 2020; Wardlaw et al., 2018; Wilson et al., 2017). There is some evidence that women have worse activity and participation outcomes than men but, here, the literature is inconclusive (Albrecht et al., 2016; Andelic et al., 2018; Cancelliere et al., 2016; Mikolic et al., 2020; Saban et al., 2011; Saltychev et al., 2013; Scaratti et al., 2017). There is moderately strong evidence that low socio-economic status, belonging to a minority, low levels of education or unemployment are associated with poorer outcomes (Addo et al., 2012; Avan et al., 2019; Bettger et al., 2014; Ponsford, 2013; Scaratti et al., 2017; Song et al., 2017), whereas higher educational background and pre-injury employment are factors contributing to better outcomes, such as return to work and community participation (Ashley et al., 2019; Ponsford, 2013; Wardlaw et al., 2018). Some health-related factors contribute to poorer social outcomes after the injury. Several studies, including longitudinal and systematic reviews, showed that these factors include physical health problems (diabetes, infections or infarction), premorbid psychiatric disorders (e.g. depression or substance dependence) and post-injury cognitive impairments (Andelic et al., 2018; Ashley et al., 2019; Carod-Artal, 2012; Edwards et al., 2018; Gulati et al., 2011; Jokinen et al., 2015; Juengst et al., 2015; Li & Li, 2018; Ponsford, 2013; Seagly et al., 2018; Wardlaw et al., 2018; Williams et al., 2014; Woodman et al., 2014). A longitudinal study ($N = 100$) found that neuropsychological dysfunction and problematic coping strategies, specifically passive coping, play a role in predicting social, community and daily participation after rehabilitation (Boosman et al., 2017). A systematic review, finding a strong negative association between psychiatric disorders and return to work after ABI, concluded that it is important to diagnose and treat the psychiatric disorder first, before a post-brain injury re-integration programme is introduced (Garrelfs et al., 2015).

3.2 | Interventions to improve the effects of acquired brain injury and factors contributing to treatment outcomes

Figure 1 shows the number of titles retrieved in the search for treatment studies and selection outcomes. As for the general outcome papers, those for final inclusion fell into four post-brain injury outcome areas: cognitive domains, behavioural and personality change, mental health problems and social integration. We will consider each in turn. In

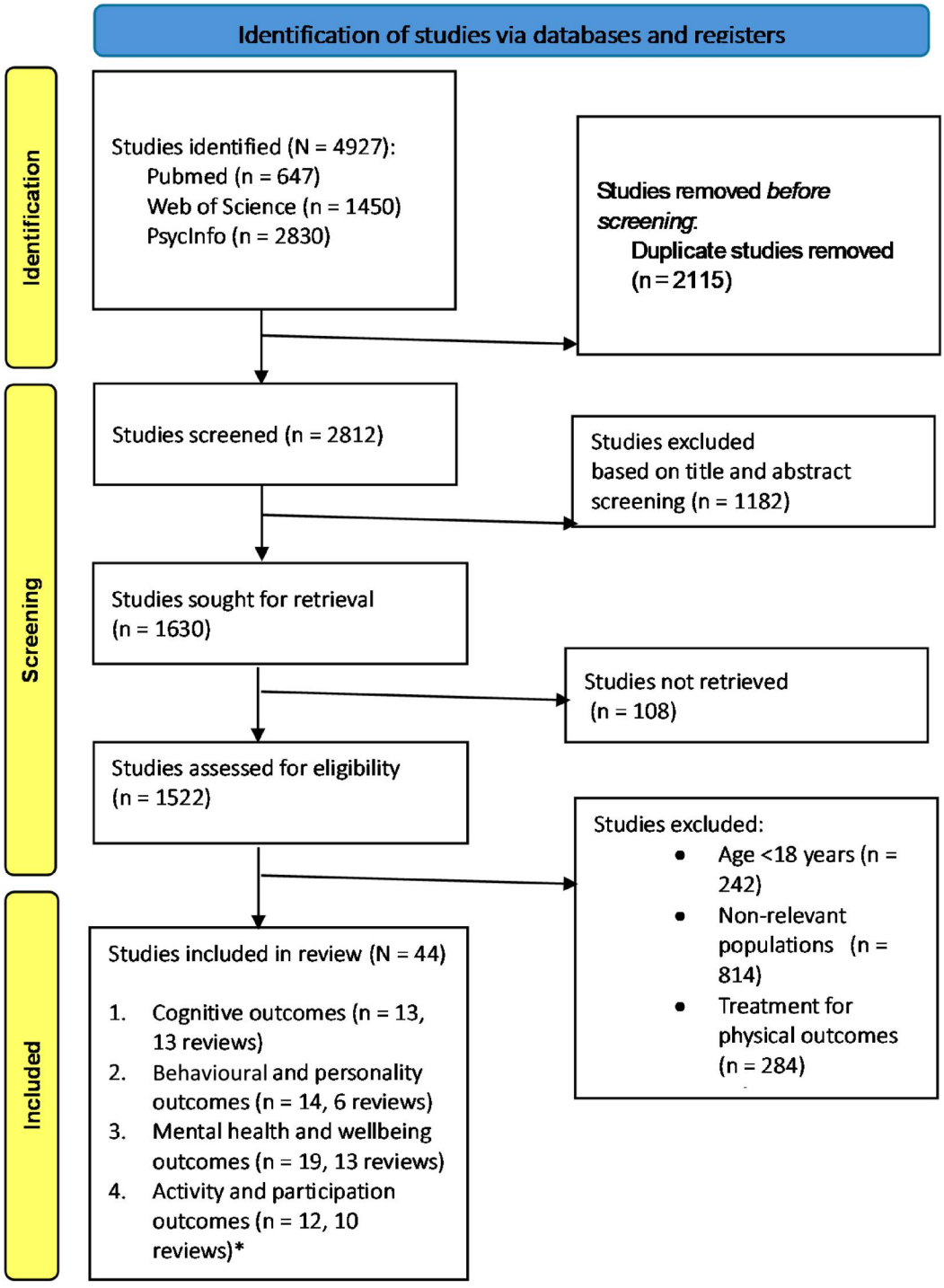

FIGURE 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart showing article selection for evidence of effectiveness of treatment after acquired brain injury in the general population. *The numbers add up to more than 44 in total because of overlap across the outcome domains.

TABLE 2 Overview of interventions after acquired brain injury, by outcome domain studied.

			TBI	nTBI
Cognition	Memory and attention	Cognitive training or rehabilitation	+ *151*	+ *151, 152–154*
		Strategy training	+ *160, 161*	+ *160, 161*
		Computer-based cognitive training	+/– *157–159*	+/– *157, 159*
		NBS interventions	– *155, 156*	– *155, 156*
		Physical exercise/mindfulness	+/– *162*	+/– *163*
	Executive functions	Cognitive training or rehabilitation	+ *160, 161*	+ *153, 160*
		Strategy training	+ *155*	+ *153, 154, 155*
		Computer-based cognitive training	+/– *157–159*	+/– *157, 159*
		NBS interventions	– *156*	– *156*
		Physical exercise/mindfulness	? *162*	–/+ *163*
	Social cognition	Cognitive training or rehabilitation	+ *151, 164*	+ *151*
		Strategy training	+ *151, 164*	+ *151*
		Computer-based cognitive training	?	?
		NBS interventions	?	?
		Physical exercise/mindfulness	?	?
Behavioural and personality changes	Disinhibition and aggression	CBT/psychotherapy	+/– *93, 165–168, 171, 173*	+/– *93, 165, 166, 171, 173*
		Behavioural management techniques	+ *165–168, 171*	+ *165, 166, 171*
		Strategy or skill training	+ *165*	+ *165*
		Psychoeducation	+ *174*	?

(Continues)

TABLE 2 (Continued)

			TBI	nTBI
		NBS interventions	?	?
		Physical exercise/mindfulness	?	?
	Emotional disorders (apathy, alexithymia, fatigue)	CBT/psychotherapy	+/− *89, 165, 171, 174, 175*	+/− *165, 170, 171, 176*
		Behavioural management techniques (motivational interviewing)	+ *89, 175*	− *165, 170, 171, 176*
		Strategy or skill training	?	?
		Psychoeducation	?	+/− *170*
		NBS interventions	?	+/− *193*
		Physical exercise/mindfulness	?	+/− *170*
Mental health and well-being	Depression	CBT/psychotherapy	+ *165, 171, 177, 180–182*	+ *86, 165, 171, 177–179, 181, 182, 184*
		Behavioural management techniques	+ *155, 177, 180, 182*	+ *177, 178*
		Strategy or skill training	?	+/− *178*
		Psychoeducation	?	+ *186*
		NBS interventions	+/− *177, 180, 182*	+/− *177, 178*
		Physical exercise/mindfulness	+ *102, 177, 180, 182, 185*	?
	Anxiety	CBT/psychotherapy	+/− *165, 171, 181,182, 183, 188, 189*	+/− *86, 165, 171,181, 184, 186, 188, 189*
		Behavioural management techniques	?	?
		Strategy or skill training	?	?
		Psychoeducation	?	?

TABLE 2 (Continued)

			TBI	nTBI
		NBS interventions	?	?
		Physical exercise/mindfulness	+/– *102, 188*	+/– *188*
	Psychotic disorders	CBT/psychotherapy	?	+/– *184, 186*
		Behavioural management techniques	?	?
		Strategy or skill training	?	?
		Psychoeducation	?	?
		NBS interventions	?	+/– *18, 86*
		Physical exercise/mindfulness	?	?
Activity and participation	Daily activities and community participation	Cognitive rehabilitation	– *191*	– *191*
		Occupational therapy	+ *192–195*	+ *192–195*
		Behavioural management techniques	+ *190, 192, 195*	+ *190, 192, 195*
		Strategy or skill training	+ *68, 161*	+ *68, 161*
		Psychoeducation	?	+ *86*
		Computer-based interventions	+/– *155*	+/– *155*
	Occupational outcomes and return to work	Cognitive rehabilitation	– *152*	– *152*
		Occupational therapy	+ *59, 195*	+ *59, 195*
		Behavioural management techniques	+ *59, 195*	+ *59, 195*
		Strategy or skill training	+ *59, 195*	+ *59, 195*

(Continues)

TABLE 2 (Continued)

		TBI	nTBI
	Psychoeducation	+ *59, 195*	+ *59, 195*
	Computer-based interventions	?	?

Note: − = no evidence for effectiveness; +/− = moderate evidence for effectiveness (less than half of the articles found evidence for effectiveness); + = strong evidence for effectiveness (more than half of the articles found evidence for effectiveness); ? = no information available. Subscript italic numbers refer to the corresponding studies in the reference list.

Abbreviations: CBT, cognitive behavioural therapy; NBS, non-invasive brain stimulation; nTBI, non-traumatic brain injury; TBI, traumatic brain injury.

addition, Table 2 shows the range of treatments and interventions that have been evaluated for their effectiveness in ameliorating one or more of the consequences of ABI.

3.2.1 | Treatment options for cognitive outcomes after acquired brain injury

A systematic review of 95 randomised controlled trial studies of rehabilitation after cognitive impairment found that, in general, it is effective (Van Heugten et al., 2012). Systematic review and meta-analytic studies on stroke corroborate this finding, reporting a similar effectiveness of rehabilitation for improving cognitive impairments (das Nair et al., 2016; Merriman et al., 2019; Rogers et al., 2018). However, with respect to personal smart technologies, such as smartphone apps or Neuropage (6 studies, total $n = 244$) (Kettlewell et al., 2019) or for non-invasive brain stimulation interventions, such as neurofeedback (4 studies, total $n = 86$) (Ali et al., 2020), there is only limited evidence for effectiveness according to other systematic reviews; collectively these provide insufficient evidence that these treatment options are effective in improving cognition after brain injury (see also Table 1).

The same goes for using computerised cognitive training or remediation methods to improve specific cognitive impairments, such as attention or information processing speed, after ABI (Fetta et al., 2017; Sigmundsdottir et al., 2016; Spreij et al., 2014). For memory impairments, post-ABI memory strategy training is supported by systematic reviews (total reviewed articles $N = 528$) (Cicerone et al., 2019; Radomski et al., 2016). These types of interventions include the use of internalised strategies, such as errorless learning, and external memory compensations, such as the use of diaries or electronic notebooks. Although physical exercise as treatment to improve cognitive functions after ABI is relatively new (Morris et al., 2016), recent reviews suggest positive effects on learning and memory abilities (Ali et al., 2018; Morris et al., 2016).

For improving executive function impairments after ABI, the most effective examples of treatment are strategy training, such as goal management training and metacognitive training (Cicerone et al., 2019; Radomski et al., 2016), while neurofeedback therapy and cognitive training, specifically for improving stroke-related impairments in executive functions, had only moderate effects (Ali et al., 2020; Merriman et al., 2019; Rogers et al., 2018). Reviews of computer-based cognitive training studies showed little evidence for its effectiveness in improving executive functioning after ABI (Sigmundsdottir et al., 2016; Spreij et al., 2014).

Interventions for impairments in social cognition after ABI generally use behavioural and cognitive rehabilitation techniques, such as errorless learning, repetition and positive reinforcement to target one specific component, for example, facial emotion recognition (Cassel et al., 2019; Cicerone et al., 2019). Reviews have found that, on balance, these lead to some improvement in the specific component trained, but little generalisation to other social cognition skills, although one social communication skill training showed generalisation to the daily living situation (Cassel et al., 2019; Cicerone et al., 2019).

3.2.2 | Treatment options for behavioural and personality outcomes after acquired brain injury

Several psychological interventions have been shown to be effective in managing behavioural and personality changes after ABI, including psychotherapy, behavioural management techniques, cognitive behavioural therapy (CBT), psychoeducation, strategy or skill training (Byrne & Coetzer, 2016; Dang et al., 2017; Ferro & Santos, 2020; Hart et al., 2017; Tay et al., 2021; Verberne et al., 2019; Ylvisaker et al., 2007). One review of specific social skill training showed that improvement observed in the targeted behaviour often failed to generalise to everyday social functioning (Doering & Exner, 2011).

Reviews have found little information about the treatment of disinhibition after ABI (Arciniegas & Wortzel, 2014; Osborne-Crowley & Mcdonald, 2018), but there is evidence that problems with disinhibition could be reduced using self-management techniques or electrical aversion therapy, where the patient receives a safe but uncomfortable shock when unwanted behaviour emerges (Verberne et al., 2019). Systematic reviews of interventions for post-TBI aggression or agitation are inconsistent (Alderman et al., 2013; Doering & Exner, 2011; Verberne et al., 2019). They find that CBT or other psychological interventions are more promising for reducing *externally* expressed anger or aggressive behaviours than *internally* focused anger, such as self-harm (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018). Two RCTs (collective $n = 180$) found evidence that psychoeducation interventions in combination with self-management training may also be effective in reducing aggression after ABI (Hart et al., 2017, 2020). A small study ($n = 13$) found that self-awareness interventions may help with emotion regulation (Neumann et al., 2017), but here more research is needed. The most effective and useful elements of psychoeducation interventions were normalising anger and explaining general anger management strategies, while also providing hope for improvement (Hart et al., 2017, 2020).

Motivational interviewing technique in combination with external compensation (e.g. adding tools to increase sustained activity towards cumulative goals) resulted in a reduction in apathy after ABI (Verberne et al., 2019; Table 1). While it has been suggested that CBT can provide a good framework to treat emotional disorders after stroke (Kneebone, 2016), literature on the specific treatment of post-stroke apathy is limited and heterogeneous (Alderman et al., 2013; Ferro & Santos, 2020; Tay et al., 2021; Verberne et al., 2019). A systematic review found indications that repetitive transcranial magnetic stimulation may reduce apathy following stroke, but these results were based on small samples and more research is needed to draw any conclusions about its efficacy, apart from it being very difficult to actually implement due to practical characteristics (Tay et al., 2021).

3.2.3 | Treatment options for mental health (well-being) after acquired brain injury

Non-pharmacological interventions for mental health problems following ABI are mostly concerned with the treatment of depression and anxiety (Liu et al., 2019; Stalder-Lüthy et al., 2013; Starkstein & Hayhow, 2019; Verberne et al., 2019; Waldron et al., 2013; Wang et al., 2018). A large, retrospective cohort study found that any type of medium- to high-level intensity rehabilitation therapy was associated with a lowered risk of psychiatric disorders (Yeh et al., 2020), while a systematic review found that cognitive rehabilitation is not effective for improving the mood after ABI (das Nair et al., 2016).

CBT and other psychological interventions have been shown to be effective in improving both anxiety and depression after TBI (Boele et al., 2015; Little et al., 2021; Stalder-Lüthy et al., 2013; Verberne et al., 2019; Waldron et al., 2013; Table 1). Mind–body interventions, such as mindfulness, but also transcranial magnetic stimulation seem promising (Jorge & Arciniegas, 2014; Liu et al., 2019; Perry et al., 2020; Verberne et al., 2019; Yeh et al., 2020; Zhang et al., 2020), although the latter may be difficult to use in a correctional facility. One review found that, for stroke patients specifically, psychosocial counselling, problem-solving interventions, motivational interviewing and psychoeducation about the possible effects of the injury are effective in reducing post-stroke depressive symptoms (Kim, 2017). However, for reducing anxiety symptoms, the evidence for CBT (Knapp

et al., 2017; Zhang et al., 2020) or other psychotherapies, such as acceptance and commitment therapy, was insufficient (Chun et al., 2018; Soo et al., 2011). In addition, two systematic reviews and meta-analyses and a nationwide population-based study found small- to medium-positive effects of physical exercise in reducing post-ABI depressive symptoms (Liu et al., 2019; Perry et al., 2020; Yeh et al., 2020). With regard to psychotic disorders there is little research, but three reviews studies conclude that neuromodulation, psychosocial therapy and CBT can reduce the distress caused by hallucinations or delusions in psychosis following TBI (Boele et al., 2015; Stangeland et al., 2018; Zhang et al., 2020). Finally, a systematic review found that personal smart technologies proved insufficient for reducing anxiety and depressive symptoms (Kettlewell et al., 2019).

3.2.4 | Treatment options for improving activity and participation after acquired brain injury

Goal setting is often used in interventions for improving activity and/or participation after ABI, with the caveat that it is important that goals are modulated to any individual's abilities and that the individual is actively involved in the goal setting process (Brett et al., 2017; Knutti et al., 2020). Systematic review and meta-analyses found that interventions with a goal management focus that are aimed at life or occupational situations and people's living experiences are effective in improving community living experiences (Ahn, 2020; Powell et al., 2016; Radomski et al., 2016).

Interventions such as multi-systemic therapy, external and/or multi-modal feedback and occupational rehabilitation seem effective for improving daily activity and reintegration and participation in the community (Engel et al., 2019; Legg et al., 2017; Powell et al., 2016; Radomski et al., 2016). One review found that psychoeducation about disease and corresponding changes relates to more participation following ABI (Boele et al., 2015). Cognitive rehabilitation was not effective in improving participation in activities of daily living according to a systematic review (das Nair et al., 2016). To date, there is insufficient evidence to conclude that personal smart technologies, such as smartphone apps, are effective for improving social participation after ABI (Kettlewell et al., 2019).

Occupational therapies for both physical and psychosocial problems are supported by one systematic review in improving participation and occupational performance, such as return to work (Wheeler et al., 2016). Another systematic review found strong evidence for the effectiveness of work-directed interventions, such as developing a personal plan to return to work together with the employer (Donker-Cools et al., 2016). Adding skill training, social skills training and/or coping strategies to the intervention can be beneficial for return to work and for increasing the number of working hours (Donker-Cools et al., 2016; Wheeler et al., 2016). No evidence has been found for the effectiveness of cognitive rehabilitation to facilitate return to work after ABI (Donker-Cools et al., 2016).

4 | DISCUSSION AND APPLICATIONS FOR TREATMENT RELEVANT TO OFFENDERS

In the absence of studies that focus specifically on offenders or offender patients, we have explored naturally occurring factors that appear to affect outcomes after ABI in the general population and treatments to enhance outcomes, together with generally occurring factors that may affect their effectiveness. Demographic and socio-economic factors that characterise offender groups, including being male, of low socio-economic status, low educational achievement and lower IQ (<85) as well as mental illness and substance use disorders, are associated with less favourable outcomes following brain injury. They are also associated with less good outcomes where treatment was implemented.

While some factors affecting outcome after ABI are more-or-less fixed, for example, being male, they could be taken into account more when designing interventions. An example of this is where sex-specific treatment in cardiovascular-related injury has yielded extra benefits (Walli-Attaei et al., 2020). In addition, pre-injury cognitive

functioning and IQ or educational level were associated with treatment enactment and effectiveness, rehabilitation outcomes and participation (Boosman et al., 2017; Davis et al., 2012; Hart et al., 2020; Stalder-Lüthy et al., 2013; Williams et al., 2021; Zhang et al., 2020), thus these too should be taken into account when tailoring interventions (Little et al., 2021; Stalder-Lüthy et al., 2013). Furthermore, since willingness to seek and continue treatment as well as coping style were also associated with effectiveness of interventions (Boosman et al., 2017; Davis et al., 2012; Stalder-Lüthy et al., 2013; Zhang et al., 2020), it is recommended that these characteristics are also evaluated to inform personalised interventions; there are parallels for offenders and interventions to reduce recidivism, so this is especially relevant for them (De Geus et al., 2021; Hachtel et al., 2019; Kusec et al., 2019; Nagele et al., 2019; Rapolienė et al., 2018). Remarkably, factors such as motivation were often not assessed in the included intervention studies or only limited information was available (Stalder-Lüthy et al., 2013; Zhang et al., 2020). Another limitation of many previous intervention studies was their adherence to strict inclusion criteria such that the participants included had to have good communication skills, preserved ability to learn or no premorbid psychiatric history, which makes them likely to be less relevant for people who do not have these advantages (Alderman et al., 2013).

Offender populations are often characterised by low levels of motivation, often not actively seeking help for their impairments (Hachtel et al., 2019). However, after brain injury, lack of motivation may originate from brain damage and reflect inability rather than premorbid apathetic tendencies (Kusec et al., 2019); when the individual does not recognise and acknowledge deficits, reluctance to compensate for them is more logical (Schrijnemaekers et al., 2014). Thus, goal setting with individually tailored treatment needs and goals is essential to improve responsivity of the patient (Brett et al., 2017; Knutti et al., 2020).

Impaired self-awareness or impaired disease-awareness is common after ABI (Prigatano & Sherer, 2020), and it is related to poorer outcomes, such as less activity, less participation, lower treatment motivation and fewer independent living skills but also to an increased risk of developing behavioural problems (Alderman et al., 2013; Engel et al., 2019; Hurst et al., 2020; Schrijnemaekers et al., 2014; Verberne et al., 2019; Villalobos et al., 2020). In addition, it was found that lower intelligence (tested IQ <85), which is highly prevalent in forensic populations (Munoz Garcia-Largo et al., 2020), was associated with less self-awareness and more problem behaviours (Azouvi et al., 2017). It is important to make a distinction between impaired self-awareness and denial; here, using the term denial to mean a purely psychological method of coping with a difficult situation (Prigatano & Sherer, 2020). Although the constructs seem similar, they have different underlying mechanisms and require a different approach in treatment (Leung & Liu, 2011; Prigatano & Sherer, 2020; Robertson & Schmitter-Edgecombe, 2015). Where treatment of impaired self-awareness often targets progressively more demanding tasks and to help the patient recognise the presence and extent of a functional limitation, treatment for denial focuses on managing underlying distress and defensiveness before possible functional limitations are discussed (Prigatano & Sherer, 2020). Treatment of impaired self-awareness has been associated with a broad range of outcomes, such as depressive symptoms, functional independence and enhanced activity and participation (Engel et al., 2019; Smeets et al., 2017; Villalobos et al., 2020). In addition, goal setting, especially individually made treatment goals, can improve therapy adherence (Brett et al., 2017; Knutti et al., 2020). Given that improving self-awareness can also be helpful in managing aggression in community settings (Verberne et al., 2019), treating self-awareness impairments after ABI may have more than one benefit (Engel et al., 2019; Hurst et al., 2020; Smeets et al., 2017; Villalobos et al., 2020).

When attempting to improve self-awareness, it is important to have established cognitive realities early on because cognitive functions, such as executive functioning, are important prerequisites for self-awareness (Schrijnemaekers et al., 2014; Villalobos et al., 2020). Interventions that improve self-awareness fall into two broad categories: behavioural modification techniques and (meta-) cognitive skills (Brett et al., 2017). Behavioural modification techniques focus on modelling and on positive reinforcements, components, including contingent reward techniques such as praise and approval, positive programming, motivational interviewing and shaping (Brett et al., 2017; Medley & Powell, 2010; Schrijnemaekers et al., 2014). Examples of (meta-) cognitive skill training are self- or error-monitoring, receiving feedback, generating, and using specific strategies. Error-monitoring had proved

especially helpful in improving self-awareness after ABI (Robertson & Schmitter-Edgecombe, 2015; Schmidt et al., 2011). Therefore, feedback on (task) performance should be a main focus of self-awareness improvement treatments, whether verbally or visually, individually or in groups (Radomski et al., 2016; Schmidt et al., 2011). To encourage generalisation of treatment effects, training functional skills in multiple real-life settings has been shown to be effective (Schrijnemaekers et al., 2014), especially where psychoeducation and self-awareness interventions are added, together increasing rehabilitation engagement (Robertson & Schmitter-Edgecombe, 2015; Schrijnemaekers et al., 2014; Smeets et al., 2017); these combinations are also useful for increasing self-knowledge about mental illness and reducing its symptoms (De Geus et al., 2021; Gilling McIntosh et al., 2021; MacInnes & Masino, 2019). Higher levels of this responsivity feature may be associated with lower levels of recidivism (Higley et al., 2019); thus, improving motivation through self-awareness interventions—as depicted above—may be particularly useful in offenders with ABI.

5 | CONCLUSIONS

In the absence of papers documenting outcomes after ABI specifically in offender groups, we conducted two separate searches for peer-reviewed papers published between 2010 and 2022, one examining factors affecting outcomes generally and the other examining evidenced treatments and factors affecting treatment outcomes. We found that those non-offenders whose progress is more challenging after ABI have many features in common with offenders, including being male, having low tested IQ and/or low educational attainment, being of lower socio-economic status and having pre-injury mental health problems. Thus, when designing interventions likely to be effective for offenders with ABI, it seems reasonable to draw on general population-based intervention literature that allows for these characteristics and modify interventions accordingly. A systematic search for evidence on interventions that have been maximally successful in general population samples with some of the key socio-demographic and health problems of offenders suggests that outcomes will be optimised by taking account of these premorbid factors at an early stage and planning personalised interventions informed by parallel assessments of these needs accordingly. Evidence has previously been reviewed separately for each stream of outcome type—such as specific cognitive change, behavioural change or mental illness. Our review brings all these elements together.

AUTHOR CONTRIBUTIONS

The idea for the review article was formed by Esther Q. J. de Geus, Siri D. S. Noordermeer, and Maarten V. Milders, after which Esther Q. J. de Geus performed the initial literature search. Data analysis in terms of article selection was done by Esther Q. J. de Geus and Siri D. S. Noordermeer, and where necessary Maarten V. Milders. The first versions were drafted in conjunction with Esther Q. J. de Geus, Siri D. S. Noordermeer, and Maarten V. Milders; and Joan E. van Horn, Frank A. Jonker, Thijs Fassaert, Juliette C. Hutten, Femke Kuipers and Christel Grimbergen read and revised the earlier versions of the manuscript. Preparation of the final manuscript in line with journal guidelines and submission was done by Esther Q. J. de Geus and Siri D. S. Noordermeer.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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REFERENCES

Addo, J., Ayerbe, L., Mohan, K. M., Crichton, S., Sheldenkar, A., Chen, R., Wolfe, C. D. A., & McKevitt, C. (2012). Socioeconomic status and stroke. *Stroke*, *43*(4), 1186–1191. https://doi.org/10.1161/strokeaha.111.639732

Ahn, S. N. (2020). Participation based intervention with acquired brain injury: Systematic review and meta-analysis. *Restorative Neurology and Neuroscience*, *38*(6), 419–429. https://doi.org/10.3233/RNN-201074

Albrecht, J. S., Mccunn, M., Stein, D. M., Simoni-Wastila, L., & Smith, G. S. (2016). Sex differences in mortality following isolated traumatic brain injury among older adults. *Journal of Trauma and Acute Care Surgery*, *81*(3), 486–492. https://doi.org/10.1097/ta.0000000000001118

Alderman, N., Knight, C., & Brooks, J. (2013). Rehabilitation approaches to the management of aggressive behavior disorders after acquired brain injury. *Brain Impairment*, *14*(1), 5–20. https://doi.org/10.1017/brimp.2013.7

Ali, F. S., Hussain, M. R., Gutierrez, C., Demireva, P., Ballester, L. Y., Zhu, J. J., Blanco, A., & Esquenazi, Y. (2018). Cognitive disability in adult patients with brain tumors. *Cancer Treatment Reviews*, *65*, 33–40. https://doi.org/10.1016/j.ctrv.2018.02.007

Ali, J. I., Viczko, J., & Smart, C. M. (2020). Efficacy of neurofeedback interventions for cognitive rehabilitation following brain injury: Systematic review and recommendations for future research. *Journal of the International Neuropsychological Society*, *26*(1), 31–46. https://doi.org/10.1017/s1355617719001061

Andelic, N., Howe, E. I., Hellstrom, T., Sanchez, M. F., Lu, J., Lovstad, M., & Roe, C. (2018). Disability and quality of life 20 years after traumatic brain injury. *Brain and Behavior*, *8*(7), e01018. https://doi.org/10.1002/brb3.1018

Arciniegas, D. B., & Wortzel, H. S. (2014). Emotional and behavioral dyscontrol after traumatic brain injury. *Psychiatric Clinics of North America*, *37*(1), 31–53. https://doi.org/10.1016/j.psc.2013.12.001

Ardila, A. (2019). Psychiatric disorders associated with acquired brain pathology. *Applied Neuropsychology: Adultspan*, *26*(6), 591–597. https://doi.org/10.1080/23279095.2018.1463224

Armstrong, R. A. (2018). Visual problems associated with traumatic brain injury. *Clinical and Experimental Optometry*, *101*(6), 716–726. https://doi.org/10.1111/cxo.12670

Ashley, K. D., Lee, L. T., & Heaton, K. (2019). Return to work among stroke survivors. *Workplace Health & Safety*, *67*(2), 87–94. https://doi.org/10.1177/2165079918812483

Avan, A., Digaleh, H., Di Napoli, M., Stranges, S., Behrouz, R., Shojaeianbabaei, G., Amiri, A., Tabrizi, R., Mokhber, N., Spence, J. D., & Azarpazhooh, M. R. (2019). Socioeconomic status and stroke incidence, prevalence, mortality, and worldwide burden: An ecological analysis from the Global Burden of Disease Study 2017. *BMC Medicine*, *17*(1), 191. https://doi.org/10.1186/s12916-019-1397-3

Aza, A., Verdugo, M. A., Orgaz, M. B., Amor, A. M., & Fernandez, M. (2021). Predictive factors of self-reported quality of life in acquired brain injury: One-year follow-up. *International Journal of Environmental Research and Public Health*, *18*(3), 927. https://doi.org/10.3390/ijerph18030927

Azouvi, P., Arnould, A., Dromer, E., & Vallat-Azouvi, C. (2017). Neuropsychology of traumatic brain injury: An expert overview. *Revue Neurologique*, *173*(7–8), 461–472. https://doi.org/10.1016/j.neurol.2017.07.006

Bartholomé, L., & Winter, Y. (2020). Quality of life and resilience of patients with juvenile stroke: A systematic review. *Journal of Stroke and Cerebrovascular Diseases*, *29*(10), 105129. https://doi.org/10.1016/j.jstrokecerebrovasdis.2020.105129

Béjot, Y., Aboa-Eboulé, C., Durier, J., Rouaud, O., Jacquin, A., Ponavoy, E., Richard, D., Moreau, T., & Giroud, M. (2011). Prevalence of early dementia after first-ever stroke. *Stroke*, *42*(3), 607–612. https://doi.org/10.1161/strokeaha.110.595553

Benedictus, M. R., Spikman, J. M., & Van Der Naalt, J. (2010). Cognitive and behavioral impairment in traumatic brain injury related to outcome and return to work. *Archives of Physical Medicine and Rehabilitation*, *91*(9), 1436–1441. https://doi.org/10.1016/j.apmr.2010.06.019

Bettger, J., Zhao, X., Bushnell, C., Zimmer, L., Pan, W., Williams, L. S., & Peterson, E. D. (2014). The association between socioeconomic status and disability after stroke: Findings from the Adherence eValuation After Ischemic stroke Longitudinal (AVAIL) registry. *BMC Public Health*, *14*(1), 281. https://doi.org/10.1186/1471-2458-14-281

Boehme, A. K., Esenwa, C., & Elkind, M. S. (2017). Stroke risk factors, genetics, and prevention. *Circulation Research*, *120*(3), 472–495. https://doi.org/10.1161/CIRCRESAHA.116.308398

Boele, F., Rooney, A., Grant, R., & Klein, M. (2015). Psychiatric symptoms in glioma patients: From diagnosis to management. *Neuropsychiatric Disease and Treatment*, 1413–1420. https://doi.org/10.2147/ndt.s65874

Bombardier, C. H., Fann, J. R., Temkin, N. R., Esselman, P. C., Barber, J., & Dikmen, S. S. (2010). Rates of major depressive disorder and clinical outcomes following traumatic brain injury. *JAMA*, *303*(19), 1938–1945. https://doi.org/10.1001/jama.2010.599

Bonta, J., & Andrews, D. A. (2017). *The psychology of criminal conduct*. Routledge, Taylor & Francis Group.

Boosman, H., Winkens, I., Van Heugten, C. M., Rasquin, S. M. C., Heijnen, V. A., & Visser-Meily, J. M. A. (2017). Predictors of health-related quality of life and participation after brain injury rehabilitation: The role of neuropsychological factors. *Neuropsychological Rehabilitation*, *27*(4), 581–598. https://doi.org/10.1080/09602011.2015.1113996

Bots, S. H., Peters, S. A. E., & Woodward, M. (2017). Sex differences in coronary heart disease and stroke mortality: A global assessment of the effect of ageing between 1980 and 2010. *BMJ Global Health*, *2*(2), e000298. https://doi.org/10.1136/bmjgh-2017-000298

Brain Injury Association of America. (2019). About brain injury. Retrieved February 5, 2020, from https://www.biausa.org/brain-injury/about-brain-injury/basics/overview

Brazinova, A., Rehorcikova, V., Taylor, M. S., Buckova, V., Majdan, M., Psota, M., Peeters, W., Feigin, V., Theadom, A., Holkovic, L., & Synnot, A. (2021). Epidemiology of traumatic brain injury in Europe: A living systematic review. *Journal of Neurotrauma*, *38*(10), 1411–1440. https://doi.org/10.1089/neu.2015.4126

Brett, C. E., Sykes, C., & Pires-Yfantouda, R. (2017). Interventions to increase engagement with rehabilitation in adults with acquired brain injury: A systematic review. *Neuropsychological Rehabilitation*, *27*(6), 959–982. https://doi.org/10.1080/09602011.2015.1090459

Bushnell, C. D., Reeves, M. J., Zhao, X., Pan, W., Prvu-Bettger, J., Zimmer, L., Olson, D., & Peterson, E. (2014). Sex differences in quality of life after ischemic stroke. *Neurology*, *82*(11), 922–931. https://doi.org/10.1212/WNL.0000000000000208

Byrne, C., & Coetzer, R. (2016). The effectiveness of psychological interventions for aggressive behavior following acquired brain injury: A meta-analysis and systematic review. *NeuroRehabilitation*, *39*(2), 205–221. https://doi.org/10.3233/NRE-161352

Cancelliere, C., Donovan, J., & Cassidy, J. D. (2016). Is sex an indicator of prognosis after mild traumatic brain injury: A systematic analysis of the findings of the World Health Organization Collaborating Centre Task Force on Mild Traumatic Brain Injury and the International Collaboration on Mild Traumatic Brain Injury Prognosis. *Archives of Physical Medicine and Rehabilitation*, *97*(2 Suppl), S5–S18. https://doi.org/10.1016/j.apmr.2014.11.028

Carod-Artal, F. J. (2012). Determining quality of life in stroke survivors. *Expert Review of Pharmacoeconomics & Outcomes Research*, *12*(2), 199–211. https://doi.org/10.1586/erp.11.104

Carroll, L. J., Cassidy, J. D., Cancelliere, C., Côté, P., Hincapié, C. A., Kristman, V. L., Holm, L. W., Borg, J., Nygren-De Boussard, C., & Hartvigsen, J. (2014). Systematic review of the prognosis after mild traumatic brain injury in adults: Cognitive, psychiatric, and mortality outcomes: Results of the International Collaboration on Mild Traumatic Brain Injury Prognosis. *Archives of Physical Medicine and Rehabilitation*, *95*(3), S152–S173. https://doi.org/10.1016/j.apmr.2013.08.300

Cassel, A., Mcdonald, S., Kelly, M., & Togher, L. (2019). Learning from the minds of others: A review of social cognition treatments and their relevance to traumatic brain injury. *Neuropsychological Rehabilitation*, *29*(1), 22–55. https://doi.org/10.1080/09602011.2016.1257435

Chan, V., Zagorski, B., Parsons, D., & Colantonio, A. (2013). Older adults with acquired brain injury: A population based study. *BMC Geriatrics*, *13*(1), 97. https://doi.org/10.1186/1471-2318-13-97

Chen, Y., Wright, N., Guo, Y., Turnbull, I., Kartsonaki, C., Yang, L., Bian, Z., Pei, P., Pan, D., Zhang, Y., Qin, H., Wang, Y., Lv, J., Liu, M., Hao, Z., Wang, Y., Yu, C., Peto, R., Collins, R., …, China Kadoorie Biobank Collaborative Group. (2020). Mortality and recurrent vascular events after first incident stroke: A 9-year community-based study of 0.5 million Chinese adults. *Lancet Global Health*, *8*(4), e580–e590. https://doi.org/10.1016/S2214-109X(20)30069-3

Chiang, C.-C., Guo, S.-E., Huang, K.-C., Lee, B.-O., & Fan, J.-Y. (2016). Trajectories and associated factors of quality of life, global outcome, and post-concussion symptoms in the first year following mild traumatic brain injury. *Quality of Life Research*, *25*(8), 2009–2019. https://doi.org/10.1007/s11136-015-1215-0

Chun, H.-Y. Y., Newman, R., Whiteley, W. N., Dennis, M., Mead, G. E., & Carson, A. J. (2018). A systematic review of anxiety interventions in stroke and acquired brain injury: Efficacy and trial design. *Journal of Psychosomatic Research*, *104*, 65–75. https://doi.org/10.1016/j.jpsychores.2017.11.010

Cicerone, K. D., Goldin, Y., Ganci, K., Rosenbaum, A., Wethe, J. V., Langenbahn, D. M., Malec, J. F., Bergquist, T. F., Kingsley, K., Nagele, D., Trexler, L., Fraas, M., Bogdanova, Y., & Harley, J. P. (2019). Evidence-based cognitive rehabilitation: Systematic review of the literature from 2009 through 2014. *Archives of Physical Medicine and Rehabilitation*, *100*(8), 1515–1533. https://doi.org/10.1016/j.apmr.2019.02.011

Corrigan, J. D., Cuthbert, J. P., Harrison-Felix, C., Whiteneck, G. G., Bell, J. M., Miller, A. C., Coronado, V. G., & Pretz, C. R. (2014). US population estimates of health and social outcomes 5 years after rehabilitation for traumatic brain injury. *The Journal of Head Trauma Rehabilitation*, *29*(6), E1–E9. https://doi.org/10.1097/HTR.0000000000000020

Dang, B., Chen, W., He, W., & Chen, G. (2017). Rehabilitation treatment and progress of traumatic brain injury dysfunction. *Neural Plasticity*, *2017*, 1–6. https://doi.org/10.1155/2017/1582182

das Nair, R., Cogger, H., Worthington, E., & Lincoln, N. B. (2016). Cognitive rehabilitation for memory deficits after stroke. *Cochrane Database of Systematic Reviews*, *9*, CD002293. https://doi.org/10.1002/14651858.CD002293.pub3

Davis, L. C., Sherer, M., Sander, A. M., Bogner, J. A., Corrigan, J. D., Dijkers, M. P., Hanks, R. A., Bergquist, T. F., & Seel, R. T. (2012). Preinjury predictors of life satisfaction at 1 year after traumatic brain injury. *Archives of Physical Medicine and Rehabilitation*, *93*(8), 1324–1330. https://doi.org/10.1016/j.apmr.2012.02.036

De Geus, E. Q. J., Milders, M. V., Van Horn, J. E., Jonker, F. A., Fassaert, T., Hutten, J. C., Kuipers, F., Grimbergen, C., & Noordermeer, S. D. S. (2021). Acquired brain injury and interventions in the offender population: A systematic review. *Frontiers in Psychiatry*, *12*, 658328. https://doi.org/10.3389/fpsyt.2021.658328

Dewan, M. C., Rattani, A., Gupta, S., Baticulon, R. E., Hung, Y.-C., Punchak, M., Agrawal, A., Adeleye, A. O., Shrime, M. G., Rubiano, A. M., Rosenfeld, J. V., & Park, K. B. (2019). Estimating the global incidence of traumatic brain injury. *Journal of Neurosurgery*, *130*(4), 1080–1097. https://doi.org/10.3171/2017.10.jns17352

Doering, B., & Exner, C. (2011). Combining neuropsychological and cognitive-behavioral approaches for treating psychological sequelae of acquired brain injury. *Current Opinion in Psychiatry*, *24*(2), 156–161. https://doi.org/10.1097/YCO.0b013e328343804e

Dolecek, T. A., Propp, J. M., Stroup, N. E., & Kruchko, C. (2012). CBTRUS statistical report: Primary brain and central nervous system tumors diagnosed in the United States in 2005–2009. *Neuro-Oncology*, *14*(suppl 5), v1–v49. https://doi.org/10.1093/neuonc/nos218

Donker-Cools, B. H. P. M., Daams, J. G., Wind, H., & Frings-Dresen, M. H. W. (2016). Effective return-to-work interventions after acquired brain injury: A systematic review. *Brain Injury*, *30*(2), 113–131. https://doi.org/10.3109/02699052.2015.1090014

Durand, E., Chevignard, M., Ruet, A., Dereix, A., Jourdan, C., & Pradat-Diehl, P. (2017). History of traumatic brain injury in prison populations: A systematic review. *Annals of Physical and Rehabilitation Medicine*, *60*(2), 95–101. https://doi.org/10.1016/j.rehab.2017.02.003

Edwards, J. D., Kapoor, A., Linkewich, E., & Swartz, R. H. (2018). Return to work after young stroke: A systematic review. *International Journal of Stroke*, *13*(3), 243–256. https://doi.org/10.1177/1747493017743059

Elbogen, E. B., Wolfe, J. R., Cueva, M., Sullivan, C., & Johnson, J. (2015). Longitudinal predictors of criminal arrest after traumatic brain injury: Results from the traumatic brain injury model system national database. *The Journal of Head Trauma Rehabilitation*, *30*(5), E3–E13. https://doi.org/10.1097/HTR.0000000000000083

Engel, L., Chui, A., Goverover, Y., & Dawson, D. R. (2019). Optimising activity and participation outcomes for people with self-awareness impairments related to acquired brain injury: An interventions systematic review. *Neuropsychological Rehabilitation*, *29*(2), 163–198. https://doi.org/10.1080/09602011.2017.1292923

Fazel, S., Wolf, A., Pillas, D., Lichtenstein, P., & Langstrom, N. (2014). Suicide, fatal injuries, and other causes of premature mortality in patients with traumatic brain injury: A 41-year Swedish population study. *JAMA Psychiatry*, *71*(3), 326–333. https://doi.org/10.1001/jamapsychiatry.2013.3935

Feigin, V. L., Abajobir, A. A., Abate, K. H., Abd-Allah, F., Abdulle, A. M., Abera, S. F., Abyu, G. Y., Ahmed, M. B., Aichour, A. N., Aichour, I., Aichour, M. T. E., Akinyemi, R. O., Alabed, S., Al-Raddadi, R., Alvis-Guzman, N., Amare, A. T., Ansari, H., Anwari, P., Ärnlöv, J., …, Vos, T. (2017). Global, regional, and national burden of neurological disorders during 1990–2015: A systematic analysis for the Global Burden of Disease Study 2015. *The Lancet Neurology*, *16*(11), 877–897. https://doi.org/10.1016/s1474-4422(17)30299-5

Ferro, J. M., & Santos, A. C. (2020). Emotions after stroke: A narrative update. *International Journal of Stroke*, *15*(3), 256–267. https://doi.org/10.1177/1747493019879662

Fetta, J., Starkweather, A., & Gill, J. M. (2017). Computer-based cognitive rehabilitation interventions for traumatic brain injury: A critical review of the literature. *Journal of Neuroscience Nursing*, *49*(4), 235–240. https://doi.org/10.1097/jnn.0000000000000298

Foster, H. M. E., Celis-Morales, C. A., Nicholl, B. I., Petermann-Rocha, F., Pell, J. P., Gill, J. M. R., O'Donnell, C. A., & Mair, F. S. (2018). The effect of socioeconomic deprivation on the association between an extended measurement of unhealthy lifestyle factors and health outcomes: A prospective analysis of the UK Biobank cohort. *The Lancet Public Health*, *3*(12), e576–e585. https://doi.org/10.1016/s2468-2667(18)30200-7

Frost, R. B., Farrer, T. J., Primosch, M., & Hedges, D. W. (2013). Prevalence of traumatic brain injury in the general adult population: A meta-analysis. *Neuroepidemiology*, *40*(3), 154–159. https://doi.org/10.1159/000343275

Fynn, D. M., Gignac, G. E., Becerra, R., Pestell, C. F., & Weinborn, M. (2021). The prevalence and characteristics of alexithymia in adults following brain injury: A meta-analysis. *Neuropsychology Review*, *31*(4), 722–738. https://doi.org/10.1007/s11065-021-09484-6

Garrelfs, S. F., Donker-Cools, B. H. P. M., Wind, H., & Frings-Dresen, M. H. W. (2015). Return-to-work in patients with acquired brain injury and psychiatric disorders as a comorbidity: A systematic review. *Brain Injury*, *29*(5), 550–557. https://doi.org/10.3109/02699052.2014.995227

Gilling McIntosh, L., Janes, S., O'Rourke, S., & Thomson, L. D. G. (2021). Effectiveness of psychological and psychosocial interventions for forensic mental health inpatients: A meta-analysis. *Aggression and Violent Behavior*, *58*, 101551. https://doi.org/10.1016/j.avb.2021.101551

Gittleman, H., Boscia, A., Ostrom, Q. T., Truitt, G., Fritz, Y., Kruchko, C., & Barnholtz-Sloan, J. S. (2018). Survivorship in adults with malignant brain and other central nervous system tumor from 2000–2014. *Neuro-Oncology*, *20*(7), 6–16. https://doi.org/10.1093/neuonc/noy090

Gorgoraptis, N., Zaw-Linn, J., Feeney, C., Tenorio-Jimenez, C., Niemi, M., Malik, A., Ham, T., Goldstone, A. P., & Sharp, D. J. (2019). Cognitive impairment and health-related quality of life following traumatic brain injury. *NeuroRehabilitation*, *44*(3), 321–331. https://doi.org/10.3233/nre-182618

Gulati, S., Jakola, A. S., Nerland, U. S., Weber, C., & Solheim, O. (2011). The risk of getting worse: Surgically acquired deficits, perioperative complications, and functional outcomes after primary resection of glioblastoma. *World Neurosurgery*, *76*(6), 572–579. https://doi.org/10.1016/j.wneu.2011.06.014

Hachtel, H., Vogel, T., & Huber, C. G. (2019). Mandated treatment and its impact on therapeutic process and outcome factors. *Frontiers in Psychiatry*, *10*, 219. https://doi.org/10.3389/fpsyt.2019.00219

Haley, W. E., Roth, D. L., Kissela, B., Perkins, M., & Howard, G. (2011). Quality of life after stroke: A prospective longitudinal study. *Quality of Life Research*, *20*(6), 799–806. https://doi.org/10.1007/s11136-010-9810-6

Hardy, S. J., Krull, K. R., Wefel, J. S., & Janelsins, M. (2018). Cognitive changes in cancer survivors. *American Society of Clinical Oncology Educational Book*, *38*(38), 795–806. https://doi.org/10.1200/EDBK_201179

Hart, T., Brockway, J. A., Maiuro, R. D., Vaccaro, M., Fann, J. R., Mellick, D., Harrison-Felix, C., Barber, J., & Temkin, N. (2017). Anger self-management training for chronic moderate to severe traumatic brain injury: Results of a randomized controlled trial. *The Journal of Head Trauma Rehabilitation*, *32*(5), 319–331. https://doi.org/10.1097/htr.0000000000000316

Hart, T., Vaccaro, M. J., Fann, J. R., Maiuro, R. D., Neuberger, S., & Sinfield, S. (2020). Psychoeducational interventions for problematic anger in chronic moderate to severe traumatic brain injury: A study of treatment enactment. *Journal of the International Neuropsychological Society*, *26*(1), 119–129. https://doi.org/10.1017/S1355617719000833

Higley, C. A., Lloyd, C. D., & Serin, R. C. (2019). Age and motivation can be specific responsivity features that moderate the relationship between risk and rehabilitation outcome. *Law and Human Behavior*, *43*(6), 558–567. https://doi.org/10.1037/lhb0000348

Hurst, F. G., Ownsworth, T., Beadle, E., Shum, D. H. K., & Fleming, J. (2020). Domain-specific deficits in self-awareness and relationship to psychosocial outcomes after severe traumatic brain injury. *Disability & Rehabilitation*, *42*(5), 651–659. https://doi.org/10.1080/09638288.2018.1504993

Iruthayarajah, J., Alibrahim, F., Mehta, S., Janzen, S., Mcintyre, A., & Teasell, R. (2018). Cognitive behavioural therapy for aggression among individuals with moderate to severe acquired brain injury: A systematic review and meta-analysis. *Brain Injury*, *32*(12), 1443–1449. https://doi.org/10.1080/02699052.2018.1496481

Jokinen, H., Melkas, S., Ylikoski, R., Pohjasvaara, T., Kaste, M., Erkinjuntti, T., & Hietanen, M. (2015). Post-stroke cognitive impairment is common even after successful clinical recovery. *European Journal of Neurology*, *22*(9), 1288–1294. https://doi.org/10.1111/ene.12743

Jorge, R. E., & Arciniegas, D. B. (2014). Mood disorders after TBI. *Psychiatric Clinics of North America*, *37*(1), 13–29. https://doi.org/10.1016/j.psc.2013.11.005

Juengst, S. B., Adams, L. M., Bogner, J. A., Arenth, P. M., O'Neil-Pirozzi, T. M., Dreer, L. E., Hart, T., Bergquist, T. F., Bombardier, C. H., Dijkers, M. P., & Wagner, A. K. (2015). Trajectories of life satisfaction after traumatic brain injury: Influence of life roles, age, cognitive disability, and depressive symptoms. *Rehabilitation Psychology*, *60*(4), 353–364. https://doi.org/10.1037/rep0000056

Kalan Farmanfarma, K. H., Mohammadian, M., Shahabinia, Z., Hassanipour, S., & Salehiniya, H. (2019). Brain cancer in the world: An epidemiological review. *World Cancer Research Journal*, *6*(e1356), 1–5. https://doi.org/10.32113/wcrj_20197_1356

Kettlewell, J., Das Nair, R., & Radford, K. (2019). A systematic review of personal smart technologies used to improve outcomes in adults with acquired brain injuries. *Clinical Rehabilitation*, *33*(11), 1705–1712. https://doi.org/10.1177/0269215519865774

Kim, J. S. (2017). Management of post-stroke mood and emotional disturbances. *Expert Review of Neurotherapeutics*, *17*(12), 1179–1188. https://doi.org/10.1080/14737175.2017.1395281

Knapp, P., Campbell Burton, C. A., Holmes, J., Murray, J., Gillespie, D., Lightbody, C. E., Watkins, C. L., Chun, H.-Y. Y., & Lewis, S. R. (2017). Interventions for treating anxiety after stroke. *Cochrane Database of Systematic Reviews*, *2017*(5), CD008860. https://doi.org/10.1002/14651858.cd008860.pub3

Kneebone, I. I. (2016). A framework to support cognitive behavior therapy for emotional disorder after stroke. *Cognitive and Behavioral Practice*, *23*(1), 99–109. https://doi.org/10.1016/j.cbpra.2015.02.001

Knutti, K., Bjorklund Carlstedt, A., Clasen, R., & Green, D. (2020). Impacts of goal setting on engagement and rehabilitation outcomes following acquired brain injury: A systematic review of reviews. *Disability & Rehabilitation*, *44*(12), 1–10. https://doi.org/10.1080/09638288.2020.1846796

Kruchko, C., Ostrom, Q. T., Gittleman, H., & Barnholtz-Sloan, J. S. (2018). The CBTRUS story: Providing accurate population-based statistics on brain and other central nervous system tumors for everyone. *Neuro-Oncology*, *20*(3), 295–298. https://doi.org/10.1093/neuonc/noy006

Kusec, A., Velikonja, D., Dematteo, C., & Harris, J. E. (2019). Motivation in rehabilitation and acquired brain injury: Can theory help us understand it? *Disability & Rehabilitation*, *41*(19), 2343–2349. https://doi.org/10.1080/09638288.2018.1467504

Leece, R., Xu, J., Ostrom, Q. T., Chen, Y., Kruchko, C., & Barnholtz-Sloan, J. S. (2017). Global incidence of malignant brain and other central nervous system tumors by histology, 2003–2007. *Neuro-Oncology*, *19*(11), 1553–1564. https://doi.org/10.1093/neuonc/nox091

Legg, L. A., Lewis, S. R., Schofield-Robinson, O. J., Drummond, A., & Langhorne, P. (2017). Occupational therapy for adults with problems in activities of daily living after stroke. *Cochrane Database of Systematic Reviews*, *2023*(3), CD003585. https://doi.org/10.1002/14651858.cd003585.pub3

Leung, D. P., & Liu, K. P. (2011). Review of self-awareness and its clinical application in stroke rehabilitation. *International Journal of Rehabilitation Research*, *34*(3), 187–195. https://doi.org/10.1097/MRR.0b013e3283487f31

Levin, H. S., Temkin, N. R., Barber, J., Nelson, L. D., Robertson, C., Brennan, J., Stein, M. B., Yue, J. K., Giacino, J. T., McCrea, M. A., Diaz-Arrastia, R., Mukherjee, P., Okonkwo, D. O., Boase, K., Markowitz, A. J., Bodien, Y., Taylor, S., Vassar, M. J., Manley, G. T., …, Zafonte, R. (2021). Association of sex and age with mild traumatic brain injury-related symptoms: A TRACK-TBI study. *JAMA Network Open*, *4*(4), e213046. https://doi.org/10.1001/jamanetworkopen.2021.3046

Lezak, M. D., Howieson, D. B., Bigler, E. D., & Tranel (2012). *Neuropsychological assessment 5th edition*. Oxford University Press.

Li, L., & Li, C. (2018). Microvascular complications of diabetes worsen long-term functional outcomes after acute ischemic stroke. *Journal of International Medical Research*, *46*(8), 3030–3041. https://doi.org/10.1177/0300060517734743

Liou, Y.-J., Wei, H.-T., Chen, M.-H., Hsu, J.-W., Huang, K.-L., Bai, Y.-M., Su, T.-P., Li, C.-T., Yang, A. C., Tsai, S.-J., Lin, W.-C., & Chen, T.-J. (2018). Risk of traumatic brain injury among children, adolescents, and young adults with attention-deficit hyperactivity disorder in Taiwan. *Journal of Adolescent Health*, *63*(2), 233–238. https://doi.org/10.1016/j.jadohealth.2018.02.012

Little, A., Byrne, C., & Coetzer, R. (2021). The effectiveness of cognitive behaviour therapy for reducing anxiety symptoms following traumatic brain injury: A meta-analysis and systematic review. *NeuroRehabilitation*, *48*(1), 67–82. https://doi.org/10.3233/nre-201544

Liu, Q., Li, R., Qu, W., Li, B., Yang, W., & Cui, R. (2019). Pharmacological and non-pharmacological interventions of depression after traumatic brain injury: A systematic review. *European Journal of Pharmacology*, *865*, 172775. https://doi.org/10.1016/j.ejphar.2019.172775

Lupton, A., Abu-Suwa, H., Bolton, G. C., & Golden, C. (2020). The implications of brain tumors on aggressive behavior and suicidality: A review. *Aggression and Violent Behavior*, *54*, 101416. https://doi.org/10.1016/j.avb.2020.101416

MacInnes, D., & Masino, S. (2019). Psychological and psychosocial interventions offered to forensic mental health in-patients: A systematic review. *BMJ Open*, *9*(3), e024351. https://doi.org/10.1136/bmjopen-2018-024351

Marshall, I. J., Wang, Y., Crichton, S., McKevitt, C., Rudd, A. G., & Wolfe, C. D. A. (2015). The effects of socioeconomic status on stroke risk and outcomes. *The Lancet Neurology*, *14*(12), 1206–1218. https://doi.org/10.1016/s1474-4422(15)00200-8

Matérne, M., Strandberg, T., & Lundqvist, L.-O. (2019). Risk markers for not returning to work among patients with acquired brain injury: A population-based register study. *Journal of Occupational Rehabilitation*, *29*(4), 728–739. https://doi.org/10.1007/s10926-019-09833-6

Mathias, J. L., & Wheaton, P. (2015). Contribution of brain or biological reserve and cognitive or neural reserve to outcome after TBI: A meta-analysis (prior to 2015). *Neuroscience & Biobehavioral Reviews*, *55*, 573–593. https://doi.org/10.1016/j.neubiorev.2015.06.001

McKinlay, A., Corrigan, J., Horwood, L. J., & Fergusson, D. M. (2014). Substance abuse and criminal activities following traumatic brain injury in childhood, adolescence, and early adulthood. *The Journal of Head Trauma Rehabilitation*, *29*(6), 498–506. https://doi.org/10.1097/HTR.0000000000000001

Medeiros, G. C., Roy, D., Kontos, N., & Beach, S. R. (2020). Post-stroke depression: A 2020 updated review. *General Hospital Psychiatry*, *66*, 70–80. https://doi.org/10.1016/j.genhosppsych.2020.06.011

Medley, A. R., & Powell, T. (2010). Motivational interviewing to promote self-awareness and engagement in rehabilitation following acquired brain injury: A conceptual review. *Neuropsychological Rehabilitation*, *20*(4), 481–508. https://doi.org/10.1080/09602010903529610

Menon, D. K., Schwab, K., Wright, D. W., & Maas, A. I. (2010). Position statement: Definition of traumatic brain injury. *Archives of Physical Medicine and Rehabilitation*, *91*(11), 1637–1640. https://doi.org/10.1016/j.apmr.2010.05.017

Merriman, N. A., Sexton, E., McCabe, G., Walsh, M. E., Rohde, D., Gorman, A., Jeffares, I., Donnelly, N. A., Pender, N., Williams, D. J., Horgan, F., Doyle, F., Wren, M. A., Bennett, K. E., & Hickey, A. (2019). Addressing cognitive impairment following stroke: Systematic review and meta-analysis of non-randomised controlled studies of psychological interventions. *BMJ Open*, *9*(2), e024429. https://doi.org/10.1136/bmjopen-2018-024429

Merritt, V. C., Padgett, C. R., & Jak, A. J. (2019). A systematic review of sex differences in concussion outcome: What do we know? *The Clinical Neuropsychologist*, *33*(6), 1016–1043. https://doi.org/10.1080/13854046.2018.1508616

Mikolic, A., van Klaveren, D., Oude Groeniger, J., Wiegers, E. J. A., Lingsma, H. F., Zeldovich, M., von Steinbuchel, N., Maas, A. I. R., Roeters van Lennep, J. E., Polinder, S., Participants, C.-T., Amrein, K., Andelic, N., Andreassen, L., Anke, A., Antoni, A., Audibert, G., Azouvi, P., Azzolini, M. L., …, Zoerle, T. (2020). Differences between men and women in treatment and outcome after traumatic brain injury. *Journal of Neurotrauma*, *38*(2), 235–251. https://doi.org/10.1089/neu.2020.7228

Mitchell, A. J., Sheth, B., Gill, J., Yadegarfar, M., Stubbs, B., Yadegarfar, M., & Meader, N. (2017). Prevalence and predictors of post-stroke mood disorders: A meta-analysis and meta-regression of depression, anxiety and adjustment disorder. *General Hospital Psychiatry*, *47*, 48–60. https://doi.org/10.1016/j.genhosppsych.2017.04.001

Mole, J. A., & Demeyere, N. (2020). The relationship between early post-stroke cognition and longer term activities and participation: A systematic review. *Neuropsychological Rehabilitation*, *30*(2), 346–370. https://doi.org/10.1080/09602011.2018.1464934

Mollayeva, T., Mollayeva, S., & Colantonio, A. (2018). Traumatic brain injury: Sex, gender and intersecting vulnerabilities. *Nature Reviews Neurology*, *14*(12), 711–722. https://doi.org/10.1038/s41582-018-0091-y

Mollayeva, T., Mollayeva, S., Pacheco, N., D'Souza, A., & Colantonio, A. (2019). The course and prognostic factors of cognitive outcomes after traumatic brain injury: A systematic review and meta-analysis. *Neuroscience & Biobehavioral Reviews*, *99*, 198–250. https://doi.org/10.1016/j.neubiorev.2019.01.011

Moretti, L., Cristofori, I., Weaver, S. M., Chau, A., Portelli, J. N., & Grafman, J. (2012). Cognitive decline in older adults with a history of traumatic brain injury. *The Lancet Neurology*, *11*(12), 1103–1112. https://doi.org/10.1016/s1474-4422(12)70226-0

Morris, T., Gomes Osman, J., Tormos Munoz, J. M., Costa Miserachs, D., & Pascual Leone, A. (2016). The role of physical exercise in cognitive recovery after traumatic brain injury: A systematic review. *Restorative Neurology and Neuroscience*, *34*(6), 977–988. https://doi.org/10.3233/RNN-160687

Munoz Garcia-Largo, L., Marti-Agusti, G., Martin-Fumado, C., & Gomez-Duran, E. L. (2020). Intellectual disability rates among male prison inmates. *International Journal of Law and Psychiatry*, *70*, 101566. https://doi.org/10.1016/j.ijlp.2020.101566

Nagele, D., Vaccaro, M., Schmidt, M. J., & Keating, D. (2019). Brain injury in an offender population: Implications for reentry and community transition. *Journal of Offender Rehabilitation*, *57*(8), 562–585. https://doi.org/10.1080/10509674.2018.1549178

Neumann, D., Malec, J. F., & Hammond, F. M. (2017). Reductions in alexithymia and emotion dysregulation after training emotional self-awareness following traumatic brain injury: A phase I trial. *The Journal of Head Trauma Rehabilitation*, *32*(5), 286–295. https://doi.org/10.1097/HTR.0000000000000277

Niemeier, J. P., Marwitz, J. H., Lesher, K., Walker, W. C., & Bushnik, T. (2007). Gender differences in executive functions following traumatic brain injury. *Neuropsychological Rehabilitation*, *17*(3), 293–313. https://doi.org/10.1080/09602010600814729

Nilsson, J., Holgersson, G., Järås, J., Bergström, S., & Bergqvist, M. (2018). The role of income in brain tumor patients: A descriptive register-based study. *Medical Oncology*, *35*(4), 52. https://doi.org/10.1007/s12032-018-1108-5

Nordstrom, A., Edin, B. B., Lindstrom, S., & Nordstrom, P. (2013). Cognitive function and other risk factors for mild traumatic brain injury in young men: Nationwide cohort study. *BMJ*, *346*, f723. https://doi.org/10.1136/bmj.f723

Olver, M. E., Stockdale, K. C., & Wormith, J. S. (2011). A meta-analysis of predictors of offender treatment attrition and its relationship to recidivism. *Journal of Consulting and Clinical Psychology*, *79*(1), 6–21. https://doi.org/10.1037/a0022200

O'Rourke, C., Linden, M. A., Lohan, M., & Bates-Gaston, J. (2016). Traumatic brain injury and co-occurring problems in prison populations: A systematic review. *Brain Injury*, *30*(7), 839–854. https://doi.org/10.3109/02699052.2016.1146967

Osborne-Crowley, K., & Mcdonald, S. (2018). A review of social disinhibition after traumatic brain injury. *Journal of Neuropsychology*, *12*(2), 176–199. https://doi.org/10.1111/jnp.12113

Palmisano, S., Fasotti, L., & Bertens, D. (2020). Neurobehavioral initiation and motivation problems after acquired brain injury. *Frontiers in Neurology*, *11*, 23. https://doi.org/10.3389/fneur.2020.00023

Peeters, W., van den Brande, R., Polinder, S., Brazinova, A., Steyerberg, E. W., Lingsma, H. F., & Maas, A. I. (2015). Epidemiology of traumatic brain injury in Europe. *Acta Neurochirurgica*, *157*(10), 1683–1696. https://doi.org/10.1007/s00701-015-2512-7

Perry, S. A., Coetzer, R., & Saville, C. W. N. (2020). The effectiveness of physical exercise as an intervention to reduce depressive symptoms following traumatic brain injury: A meta-analysis and systematic review. *Neuropsychological Rehabilitation*, *30*(3), 564–578. https://doi.org/10.1080/09602011.2018.1469417

Phan, H. T., Blizzard, C. L., Reeves, M. J., Thrift, A. G., Cadilhac, D. A., Sturm, J., Heeley, E., Otahal, P., Vemmos, K., Anderson, C., Parmar, P., Krishnamurthi, R., Barker-Collo, S., Feigin, V., Bejot, Y., Cabral, N. L., Carolei, A., Sacco, S., Chausson, N., …, Gall, S. L. (2018). Factors contributing to sex differences in functional outcomes and participation after stroke. *Neurology*, *90*(22), e1945–e1953. https://doi.org/10.1212/wnl.0000000000005602

Piccolino, A. L., & Solberg, K. B. (2014). The impact of traumatic brain injury on prison health services and offender management. *Journal of Correctional Health Care*, *20*(3), 203–212. https://doi.org/10.1177/1078345814530871

Plascak, J. J., & Fisher, J. L. (2013). Area-based socioeconomic position and adult glioma: A hierarchical analysis of surveillance epidemiology and end results data. *PLoS One*, *8*(4), e60910. https://doi.org/10.1371/journal.pone.0060910

Ponsford, J. (2013). Factors contributing to outcome following traumatic brain injury. *NeuroRehabilitation*, *32*(4), 803–815. https://doi.org/10.3233/nre-130904

Ponsford, J., Alway, Y., & Gould, K. R. (2018). Epidemiology and natural history of psychiatric disorders after TBI. *Journal of Neuropsychiatry and Clinical Neurosciences*, *30*(4), 262–270. https://doi.org/10.1176/appi.neuropsych.18040093

Porter, A. B., Lachance, D. H., & Johnson, D. R. (2015). Socioeconomic status and glioblastoma risk: A population-based analysis. *Cancer Causes & Control*, *26*(2), 179–185. https://doi.org/10.1007/s10552-014-0496-x

Pouwels, C., Wolters Gregorio, G., Spauwen, P. J. J., Bus, B. A. A., Winkens, I., & Ponds, R. W. (2019). Prevalence and manifestations of aggression in adult patients with acquired brain injury: A review. *Tijdschrift voor Psychiatrie*, *61*(12), 862–878. PMID: 31907901.

Powell, J. M., Rich, T. J., & Wise, E. K. (2016). Effectiveness of occupation- and activity-based interventions to improve everyday activities and social participation for people with traumatic brain injury: A systematic review. *American Journal of Occupational Therapy*, *70*(3), 7003180040p1–7003180040p9. https://doi.org/10.5014/ajot.2016.020909

Pozzato, I., Tate, R. L., Rosenkoetter, U., & Cameron, I. D. (2019). Epidemiology of hospitalised traumatic brain injury in the state of New South Wales, Australia: A population-based study. *Australian & New Zealand Journal of Public Health*, *43*(4), 382–388. https://doi.org/10.1111/1753-6405.12878

Prigatano, G. P., & Sherer, M. (2020). Impaired self-awareness and denial during the postacute phases after moderate to severe traumatic brain injury. *Frontiers in Psychology*, *11*, 1569. https://doi.org/10.3389/fpsyg.2020.01569

Pula, J. H., & Yuen, C. A. (2017). Eyes and stroke: The visual aspects of cerebrovascular disease. *Stroke and Vascular Neurology*, *2*(4), 210–220. https://doi.org/10.1136/svn-2017-000079

Rabinowitz, A. R., & Levin, H. S. (2014). Cognitive sequelae of traumatic brain injury. *Psychiatric Clinics of North America*, *37*(1), 1–11. https://doi.org/10.1016/j.psc.2013.11.004

Rabinowitz, A. R., Li, X., McCauley, S. R., Wilde, E. A., Barnes, A., Hanten, G., Mendez, D., McCarthy, J. J., & Levin, H. S. (2015). Prevalence and predictors of poor recovery from mild traumatic brain injury. *Journal of Neurotrauma*, *32*(19), 1488–1496. https://doi.org/10.1089/neu.2014.3555

Radomski, M. V., Anheluk, M., Bartzen, M. P., & Zola, J. (2016). Effectiveness of interventions to address cognitive impairments and improve occupational performance after traumatic brain injury: A systematic review. *American Journal of Occupational Therapy*, *70*(3), 7003180050–7003180059. https://doi.org/10.5014/ajot.2016.020776

Rapolienė, J., Endzelytė, E., Jasevičienė, I., & Savickas, R. (2018). Stroke patients motivation influence on the effectiveness of occupational therapy. *Rehabilitation Research and Practice*, *2018*, 1–7. https://doi.org/10.1155/2018/9367942

Rassovsky, Y., Levi, Y., Agranov, E., Sela-Kaufman, M., Sverdlik, A., & Vakil, E. (2015). Predicting long-term outcome following traumatic brain injury (TBI). *Journal of Clinical and Experimental Neuropsychology*, *37*(4), 354–366. https://doi.org/10.1080/13803395.2015.1015498

Renjen, P. N., Gauba, C., & Chaudhari, D. (2015). Cognitive impairment after stroke. *Cureus*, *7*(9), e335. https://doi.org/10.7759/cureus.335

Ricciardi, L., Demartini, B., Fotopoulou, A., & Edwards, M. J. (2015). Alexithymia in neurological disease: A review. *Journal of Neuropsychiatry and Clinical Neurosciences*, *27*(3), 179–187. https://doi.org/10.1176/appi.neuropsych.14070169

Robertson, K., & Schmitter-Edgecombe, M. (2015). Self-awareness and traumatic brain injury outcome. *Brain Injury*, *29*(7–8), 848–858. https://doi.org/10.3109/02699052.2015.1005135

Robinson, R. G., & Jorge, R. E. (2016). Post-stroke depression: A review. *American Journal of Psychiatry*, *173*(3), 221–231. https://doi.org/10.1176/appi.ajp.2015.15030363

Rogers, J. M., Foord, R., Stolwyk, R. J., Wong, D., & Wilson, P. H. (2018). General and domain-specific effectiveness of cognitive remediation after stroke: Systematic literature review and meta-analysis. *Neuropsychology Review*, *28*(3), 285–309. https://doi.org/10.1007/s11065-018-9378-4

Roy-O'Reilly, M., & McCullough, L. D. (2018). Age and sex are critical factors in ischemic stroke pathology. *Endocrinology*, *159*(8), 3120–3131. https://doi.org/10.1210/en.2018-00465

Ryan, N. P., Anderson, V., Godfrey, C., Eren, S., Rosema, S., Taylor, K., & Catroppa, C. (2013). Social communication mediates the relationship between emotion perception and externalizing behaviors in young adult survivors of pediatric traumatic brain injury (TBI). *International Journal of Developmental Neuroscience*, *31*(8), 811–819. https://doi.org/10.1016/j.ijdevneu.2013.10.002

Saban, K. L., Smith, B. M., Collins, E. G., & Pape, T. L.-B. (2011). Sex differences in perceived life satisfaction and functional status one year after severe traumatic brain injury. *Journal of Women's Health*, *20*(2), 179–186. https://doi.org/10.1089/jwh.2010.2334

Saltychev, M., Eskola, M., Tenovuo, O., & Laimi, K. (2013). Return to work after traumatic brain injury: Systematic review. *Brain Injury*, *27*(13–14), 1516–1527. https://doi.org/10.3109/02699052.2013.831131

Scaratti, C., Leonardi, M., Sattin, D., Schiavolin, S., Willems, M., & Raggi, A. (2017). Work-related difficulties in patients with traumatic brain injury: A systematic review on predictors and associated factors. *Disability & Rehabilitation*, *39*(9), 847–855. https://doi.org/10.3109/09638288.2016.1162854

Schiavolin, S., Raggi, A., Scaratti, C., Toppo, C., Silvaggi, F., Sattin, D., Broggi, M., Ferroli, P., & Leonardi, M. (2020). Outcome prediction in brain tumor surgery: A literature review on the influence of nonmedical factors. *Neurosurgical Review*, *44*(2), 807–819. https://doi.org/10.1007/s10143-020-01289-0

Schmidt, J., Lannin, N., Fleming, J., & Ownsworth, T. (2011). Feedback interventions for impaired self-awareness following brain injury: A systematic review. *Journal of Rehabilitation Medicine*, *43*(8), 673–680. https://doi.org/10.2340/16501977-0846

Scholten, A. C., Haagsma, J. A., Andriessen, T. M., Vos, P. E., Steyerberg, E. W., van Beeck, E. F., & Polinder, S. (2015). Health-related quality of life after mild, moderate and severe traumatic brain injury: Patterns and predictors of suboptimal functioning during the first year after injury. *Injury*, *46*(4), 616–624. https://doi.org/10.1016/j.injury.2014.10.064

Schrijnemaekers, A. C., Smeets, S. M., Ponds, R. W., van Heugten, C. M., & Rasquin, S. (2014). Treatment of unawareness of deficits in patients with acquired brain injury: A systematic review. *The Journal of Head Trauma Rehabilitation*, *29*(5), E9–E30. https://doi.org/10.1097/01.HTR.0000438117.63852.b4

Schwartz, J. A., Connolly, E. J., & Brauer, J. R. (2017). Head injuries and changes in delinquency from adolescence to emerging adulthood. *Journal of Research in Crime and Delinquency*, *54*(6), 869–901. https://doi.org/10.1177/0022427817710287

Seagly, K. S., O'Neil, R. L., & Hanks, R. A. (2018). Pre-injury psychosocial and demographic predictors of long-term functional outcomes post-TBI. *Brain Injury*, *32*(1), 78–83. https://doi.org/10.1080/02699052.2017.1374467

Semega, J., Kollar, M., Shrider, E. A., & Creamer, J. F. (2020). *Income and poverty in the United States: 2019 Current population reports*. U.S. Government Publishing Office.

Shi, Y., Yang, D., Zeng, Y., & Wu, W. (2017). Risk factors for post-stroke depression: A meta-analysis. *Frontiers in Aging Neuroscience*, *9*, 218. https://doi.org/10.3389/fnagi.2017.00218

Shiroma, E. J., Ferguson, P. L., & Pickelsimer, E. E. (2010). Prevalence of traumatic brain injury in an offender population: A meta-analysis. *Journal of Correctional Health Care*, *16*(2), 147–159. https://doi.org/10.1177/1078345809356538

Sigmundsdottir, L., Longley, W. A., & Tate, R. L. (2016). Computerised cognitive training in acquired brain injury: A systematic review of outcomes using the International Classification of Functioning (ICF). *Neuropsychological Rehabilitation*, *26*(5–6), 673–741. https://doi.org/10.1080/09602011.2016.1140657

Skarupski, K. A., Gross, A., Schrack, J. A., Deal, J. A., & Eber, G. B. (2018). The health of America's aging prison population. *Epidemiologic Reviews*, *40*(1), 157–165. https://doi.org/10.1093/epirev/mxx020

Smeets, S. M. J., Vink, M., Ponds, R. W. H. M., Winkens, I., & Van Heugten, C. M. (2017). Changes in impaired self-awareness after acquired brain injury in patients following intensive neuropsychological rehabilitation. *Neuropsychological Rehabilitation*, *27*(1), 116–132. https://doi.org/10.1080/09602011.2015.1077144

Song, T., Pan, Y., Chen, R., Li, H., Zhao, X., Liu, L., Wang, C., Wang, Y., & Wang, Y. (2017). Is there a correlation between socioeconomic disparity and functional outcome after acute ischemic stroke? *PLoS One*, *12*(7), e0181196. https://doi.org/10.1371/journal.pone.0181196

Soo, C., Tate, R. L., & Lane-Brown, A. (2011). A systematic review of Acceptance and Commitment therapy (ACT) for managing anxiety: Applicability for people with acquired brain injury? *Brain Impairment*, *12*(1), 54–70. https://doi.org/10.1375/brim.12.1.54

Spreij, L. A., Visser-Meily, J. M. A., Van Heugten, C. M., & Nijboer, T. C. W. (2014). Novel insights into the rehabilitation of memory post acquired brain injury: A systematic review. *Frontiers in Human Neuroscience*, *8*, 933. https://doi.org/10.3389/fnhum.2014.00993

Stalder-Lüthy, F., Messerli-Bürgy, N., Hofer, H., Frischknecht, E., Znoj, H., & Barth, J. (2013). Effect of psychological interventions on depressive symptoms in long-term rehabilitation after an acquired brain injury: A systematic review

and meta-analysis. *Archives of Physical Medicine and Rehabilitation*, *94*(7), 1386–1397. https://doi.org/10.1016/j.apmr.2013.02.013

Stangeland, H., Orgeta, V., & Bell, V. (2018). Poststroke psychosis: A systematic review. *Journal of Neurology, Neurosurgery & Psychiatry*, *89*(8), 879–885. https://doi.org/10.1136/jnnp-2017-317327

Starkstein, S. E., & Hayhow, B. D. (2019). Treatment of post-stroke depression. *Current Treatment Options in Neurology*, *21*(7), 31. https://doi.org/10.1007/s11940-019-0570-5

Stéfan, A., & Mathé, J.-F. (2016). What are the disruptive symptoms of behavioral disorders after traumatic brain injury? A systematic review leading to recommendations for good practices. *Annals of Physical and Rehabilitation Medicine*, *59*(1), 5–17. https://doi.org/10.1016/j.rehab.2015.11.002

Stormacq, C., Van Den Broucke, S., & Wosinski, J. (2019). Does health literacy mediate the relationship between socio-economic status and health disparities? Integrative review. *Health Promotion International*, *34*(5), e1–e17. https://doi.org/10.1093/heapro/day062

Tang, E. Y., Amiesimaka, O., Harrison, S. L., Green, E., Price, C., Robinson, L., Siervo, M., & Stephan, B. C. (2018). Longitudinal effect of stroke on cognition: A systematic review. *Journal of the American Heart Association*, *7*(2), e006443. https://doi.org/10.1161/jaha.117.006443

Tay, J., Morris, R. G., & Markus, H. S. (2021). Apathy after stroke: Diagnosis, mechanisms, consequences, and treatment. *International Journal of Stroke*, *16*(5), 510–518. https://doi.org/10.1177/1747493021990906

Teasdale, G., & Jennett, B. (1974). Assessment of coma and impaired consciousness. A practical scale. *Lancet*, *2*(7872), 81–84. https://doi.org/10.1016/s0140-6736(74)91639-0

Thurman, D. J. (2016). The epidemiology of traumatic brain injury in children and youths. *Journal of Child Neurology*, *31*(1), 20–27. https://doi.org/10.1177/0883073814544363

Tomlin, J., Lega, I., Braun, P., Kennedy, H. G., Herrando, V. T., Barroso, R., Castelletti, L., Mirabella, F., Scarpa, F., Völlm, B., Pham, T., Müller-Isberner, R., Taube, M., Rivellini, G., Calevro, V., Liardo, R., Pennino, M., Markiewicz, I., Barbosa, F., …, Čėsnienė, I. (2021). Forensic mental health in Europe: Some key figures. *Social Psychiatry and Psychiatric Epidemiology*, *56*(1), 109–117. https://doi.org/10.1007/s00127-020-01909-6

Truelsen, T., Piechowski-Jozwiak, B., Bonita, R., Mathers, C., Bogousslavsky, J., & Boysen, G. (2006). Stroke incidence and prevalence in Europe: A review of available data. *European Journal of Neurology*, *13*(6), 581–598. https://doi.org/10.1111/j.1468-1331.2006.01138.x

Vakil, E., Greenstein, Y., Weiss, I., & Shtein, S. (2019). The effects of moderate-to-severe traumatic brain injury on episodic memory: A meta-analysis. *Neuropsychology Review*, *29*(3), 270–287. https://doi.org/10.1007/s11065-019-09413-8

van der Naalt, J., Timmerman, M. E., de Koning, M. E., van der Horn, H. J., Scheenen, M. E., Jacobs, B., Hageman, G., Yilmaz, T., Roks, G., & Spikman, J. M. (2017). Early predictors of outcome after mild traumatic brain injury (UPFRONT): An observational cohort study. *The Lancet Neurology*, *16*(7), 532–540. https://doi.org/10.1016/s1474-4422(17)30117-5

Van Heugten, C., Wolters Gregório, G., & Wade, D. (2012). Evidence-based cognitive rehabilitation after acquired brain injury: A systematic review of content of treatment. *Neuropsychological Rehabilitation*, *22*(5), 653–673. https://doi.org/10.1080/09602011.2012.680891

Vassallo, J. L., Proctor-Weber, Z., Lebowitz, B. K., Curtiss, G., & Vanderploeg, R. D. (2007). Psychiatric risk factors for traumatic brain injury. *Brain Injury*, *21*(6), 567–573. https://doi.org/10.1080/02699050701426832

Verberne, D. P. J., Spauwen, P. J. J., & Van Heugten, C. M. (2019). Psychological interventions for treating neuropsychiatric consequences of acquired brain injury: A systematic review. *Neuropsychological Rehabilitation*, *29*(10), 1509–1542. https://doi.org/10.1080/09602011.2018.1433049

Villalobos, D., Caperos, J. M., Bilbao, Á., Bivona, U., Formisano, R., & Pacios, J. (2020). Self-awareness moderates the association between executive dysfunction and functional independence after acquired brain injury. *Archives of Clinical Neuropsychology*, *35*(7), 1059–1068. https://doi.org/10.1093/arclin/acaa048

Wafa, H. A., Wolfe, C. D. A., Emmett, E., Roth, G. A., Johnson, C. O., & Wang, Y. (2020). Burden of stroke in Europe. *Stroke*, *51*(8), 2418–2427. https://doi.org/10.1161/strokeaha.120.029606

Wagner, A. K., Sasser, H. C., Hammond, F. M., Wiercisiewski, D., & Alexander, J. (2000). Intentional traumatic brain injury: Epidemiology, risk factors, and associations with injury severity and mortality. *Journal of Trauma and Acute Care Surgery*, *49*(3), 404–410. https://doi.org/10.1097/00005373-200009000-00004

Waldron, B., Casserly, L. M., & O'Sullivan, C. (2013). Cognitive behavioural therapy for depression and anxiety in adults with acquired brain injury. What works for whom? *Neuropsychological Rehabilitation*, *23*(1), 64–101. https://doi.org/10.1080/09602011.2012.724196

Walli-Attaei, M., Joseph, P., Rosengren, A., Chow, C. K., Rangarajan, S., Lear, S. A., AlHabib, K. F., Davletov, K., Dans, A., Lanas, F., Yeates, K., Poirier, P., Teo, K. K., Bahonar, A., Camilo, F., Chifamba, J., Diaz, R., Didkowska, J. A., Irazola, V., …, Yusuf, S. (2020). Variations between women and men in risk factors, treatments, cardiovascular disease incidence, and death in 27 high-income, middle-income, and low-income countries (PURE): A prospective cohort study. *Lancet*, *396*(10244), 97–109. https://doi.org/10.1016/S0140-6736(20)30543-2

Wang, S.-B., Wang, Y.-Y., Zhang, Q.-E., Wu, S.-L., Ng, C. H., Ungvari, G. S., Chen, L., Wang, C.-X., Jia, F.-J., & Xiang, Y.-T. (2018). Cognitive behavioral therapy for post-stroke depression: A meta-analysis. *Journal of Affective Disorders*, *235*, 589–596. https://doi.org/10.1016/j.jad.2018.04.011

Wardlaw, C., Hicks, A. J., Sherer, M., & Ponsford, J. L. (2018). Psychological resilience is associated with participation outcomes following mild to severe traumatic brain injury. *Frontiers in Neurology*, *9*, 563. https://doi.org/10.3389/fneur.2018.00563

Wheeler, S., Acord-Vira, A., & Davis, D. (2016). Effectiveness of interventions to improve occupational performance for people with psychosocial, behavioral, and emotional impairments after brain injury: A systematic review. *American Journal of Occupational Therapy*, *70*(3), 7003180060p1–7003180060p9. https://doi.org/10.5014/ajot.115.020677

Willers, C., Lekander, I., Ekstrand, E., Lilja, M., Pessah-Rasmussen, H., Sunnerhagen, K. S., & Von Euler, M. (2018). Sex as predictor for achieved health outcomes and received care in ischemic stroke and intracerebral hemorrhage: A register-based study. *Biology of Sex Differences*, *9*(1), 11. https://doi.org/10.1186/s13293-018-0170-1

Williams, M. W., Rapport, L. J., Hanks, R. A., & Parker, H. A. (2021). Engagement in rehabilitation therapy and functional outcomes among individuals with acquired brain injuries. *Disability & Rehabilitation*, *43*(1), 33–41. https://doi.org/10.1080/09638288.2019.1613682

Williams, M. W., Rapport, L. J., Millis, S. R., & Hanks, R. A. (2014). Psychosocial outcomes after traumatic brain injury: Life satisfaction, community integration, and distress. *Rehabilitation Psychology*, *59*(3), 298–305. https://doi.org/10.1037/a0037164

Williams, W. H., Chitsabesan, P., Fazel, S., McMillan, T., Hughes, N., Parsonage, M., & Tonks, J. (2018). Traumatic brain injury: A potential cause of violent crime? *The Lancet Psychiatry*, *5*(10), 836–844. https://doi.org/10.1016/S2215-0366(18)30062-2

Wilson, L., Stewart, W., Dams-O'Connor, K., Diaz-Arrastia, R., Horton, L., Menon, D. K., & Polinder, S. (2017). The chronic and evolving neurological consequences of traumatic brain injury. *The Lancet Neurology*, *16*(10), 813–825. https://doi.org/10.1016/s1474-4422(17)30279-x

Woodman, P., Riazi, A., Pereira, C., & Jones, F. (2014). Social participation post stroke: A meta-ethnographic review of the experiences and views of community-dwelling stroke survivors. *Disability & Rehabilitation*, *36*(24), 2031–2043. https://doi.org/10.3109/09638288.2014.887796

World Health Organization. (2001). International classification of functioning, disability and health (ICF). World Health Organization.

Worthington, A., & Wood, R. L. (2018). Apathy following traumatic brain injury: A review. *Neuropsychologia*, *118*, 40–47. https://doi.org/10.1016/j.neuropsychologia.2018.04.012

Wright, F., Wu, S., Chun, H.-Y. Y., & Mead, G. (2017). Factors associated with poststroke anxiety: A systematic review and meta-analysis. *Stroke Research and Treatment*, *2017*, 1–7. https://doi.org/10.1155/2017/2124743

Yeh, T. C., Chien, W. C., Chung, C. H., Liang, C. S., Chang, H. A., Kao, Y. C., Yeh, H. W., Yang, Y. J., & Tzeng, N. S. (2020). Psychiatric disorders after traumatic brain injury: A nationwide population-based cohort study and the effects of rehabilitation therapies. *Archives of Physical Medicine and Rehabilitation*, *101*(5), 822–831. https://doi.org/10.1016/j.apmr.2019.12.005

Ylvisaker, M., Turkstra, L., Coehlo, C., Yorkston, K., Kennedy, M., Sohlberg, M. M., & Avery, J. (2007). Behavioural interventions for children and adults with behaviour disorders after TBI: A systematic review of the evidence. *Brain Injury*, *21*(8), 769–805. https://doi.org/10.1080/02699050701482470

Zhang, S., Xu, M., Liu, Z.-J., Feng, J., & Ma, Y. (2020). Neuropsychiatric issues after stroke: Clinical significance and therapeutic implications. *World Journal of Psychiatry*, *10*(6), 125–138. https://doi.org/10.5498/wjp.v10.i6.125

Zhu, W., & Jiang, Y. (2019). Determinants of quality of life in patients with hemorrhagic stroke: A path analysis. *Medicine (Baltimore)*, *98*(5), e13928. https://doi.org/10.1097/MD.0000000000013928

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