Factors Associated with Self-Esteem Following Acquired Brain Injury in Adults: A Systematic Review

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Abstract

Self-esteem is potentially a key factor in psychological and psychosocial wellbeing following acquired brain injury (ABI). The current review aimed to identify, synthesise and appraise all existing quantitative empirical studies on predictors or correlates of self-esteem following ABI in adulthood. In total, 27 papers met the inclusion criteria. A range of clinical factors were related to self-esteem after ABI, including the degree of physical and functional impairment. It is unclear if cognitive impairment is related to high or low self-esteem. Additionally, psychological variables such as coping styles, adjustment and perception of problems or rehabilitation are related to self-esteem following ABI. Depression is strongly associated with low self-esteem, alongside anxiety, psychological distress and quality of life. Limitations of the available research and recommendations for clinical practice and further research are discussed. In particular, there is a need to engage with contemporary theoretical understandings of self-esteem, integrated with and supported by developments in how self-esteem is conceptualised and measured over time in an ABI population. The findings of the review suggest that self-esteem is an important factor to consider following ABI, particularly in the context of developing individualised, formulation-driven rehabilitation interventions which take into account biological, social and psychological factors.

Keywords: Self-esteem, acquired brain-injury, rehabilitation, psychological.

Factors Associated with Self-Esteem Following Acquired Brain Injury in Adults: A Systematic Review

Acquired brain injury (ABI) is a broad term encompassing a range of acute focal and diffuse injuries including trauma (e.g., head injury or surgical intervention), vascular accident (e.g., stroke or subarachnoid haemorrhage), anoxia or other metabolic imbalance (e.g., hypoglycaemia), infection or inflammation (e.g., meningitis or encephalitis; Royal College of Physicians & British Society of Rehabilitation Medicine, 2003). People who have experienced an ABI often experience physical consequences (e.g., mobility problems, paralysis, motor/speech impairments, ataxia) alongside cognitive and behavioural changes such as problems with word finding, attention, memory, executive functioning, processing speed, perseveration and reduced motivation or initiation (Hiott & Labbate, 2002; Moore, Terryberry-Spohr, & Hope, 2006; Wright & Telford, 1996). Additionally, emotional problems including depression and anxiety are common following ABI (Thomas & Lincoln, 2008; Burton, Murray, Holmes, Astin, Greenwood, & Knapp, 2012; Malec, Brown, Moessner, Stump & Monahan, 2010), and many people report reduced quality of life, with high rates of unemployment (Yasuda, Wehman, Targett, Cifu, & West, 2001), social isolation (Doig, Fleming & Tooth, 2001; Yates, 2003) and relationship problems (Hibbard, Gordon, Flanagan, Haddad, & Labinsky, 2000). In short, people who have experienced an ABI face an uncertain future as they come to terms with the physical, cognitive, psychological and psychosocial consequences of the injury, alongside the unpredictable nature of rehabilitation and society's response to those injuries (Fleminger & Ponsford, 2005; Simpson & Thomas, 2014).

Both physical and psychological factors are important in influencing recovery. While the neurological consequences of an ABI have long been seen as an important determinant of recovery (e.g., Katz & Alexander, 1994), more recent interest has focused on psychological

predictors. Indeed it is now acknowledged theoretically (Gracey et al., 2009) and empirically (Khan-Bourne & Brown, 2003) that psychological problems post-ABI can affect cognition, mood and motivation, thus further impeding recovery and engagement with rehabilitation. Moreover, one of the most influential models of psychosocial adjustment post-ABI sets out an explicit role for both direct (neurological and neuropsychological impairment) and indirect (situational and environmental) antecedent factors, alongside mediating psychological variables which influence appraisal and coping styles (Kendall & Terry, 1996). The model also suggests that a key personal resource contributing to psychosocial functioning after ABI is self-esteem.

Self-esteem has been defined as an individual's global, subjective and emotional evaluation of their perceived worth as a person (Rosenberg, 1965). However, despite much research, limited consistency is evident in how self-esteem is conceptualised and defined (Guindon, 2002; Robson, 1988). Guindon (2002) calls for consistency in how researchers conceptualise self-esteem and proposes the following definition:

> The attitudinal, evaluative component of the self; the affective judgments placed on the self-concept consisting of feelings of worth and acceptance, which are developed and maintained as a consequence of awareness of competence, sense of achievement, and feedback from the external world. (p. 207)

Some similarity has been suggested between self-esteem and other related concepts such as self-concept (appraisals made about multiple dimensions of the self), self-confidence (anticipation of successfully overcoming challenges or obstacles) or self-identity (see Ownsworth, 2014, for discussion of self and identity reformation following ABI). However, these concepts differ from self-esteem as they do not incorporate a global, emotional evaluation of the self (Brown, 1993; Szymanski & O'Donohue, 1995).

Furthermore, due to conflicting patterns in empirical studies, self-esteem is increasingly seen as being more complex than the single low to high continuum originally proposed by Rosenberg (1965). The concept of "high" self-esteem has been discussed as dichotomous by Kernis (2003), who compared secure high self-esteem with fragile high self-esteem. Fragile self-esteem is more in need of protection from threats and is associated with higher levels of distress and psychological problems, (see Zeigler-Hill, 2011 for a review). Moreover, Zeigler-Hill (2011) also discusses the discrepancy between implicit and explicit self-esteem as a marker for fragility. Explicit self-esteem is defined as conscious appraisals and feelings of self-worth (Dijksterhuis, Albers & Bongers, 2009). Conversely, implicit self-esteem reflects non-conscious and automatic self-evaluations that people are unable or unwilling to report (Buhrmester, Blanton, & Swann, 2011; Zeigler-Hill, 2006).

The debates around the construct have also led to further distinctions being drawn between global, state and selective self-esteem. Rosenberg (1965), in his early conceptualisation of the construct, considered self-esteem to be a global and uni-dimensional construct, reflecting an overall evaluative self-estimate of one's value and attitudes about the self. Global self-esteem is perceived to be relatively stable (Leary & Baumeister, 2004). Conversely, the term state self-esteem has been used to refer to more temporary evaluations of self-worth which are more transitory and affected by threats (e.g., a divorce) or boosts (e.g., a promotion) to one's perceptions (Brown, 2006). Selective self-esteem is conceptualised as evaluations of one's own value in a particular domain or situation (Leary & Baumeister, 2004). While global self-esteem is generally considered as less amenable to change than selective or state self-esteem, Guindon's (2002) assertion that global self-esteem is comprised of selective, variable elements may mean that, while general attitudes towards the self may be relatively stable, changes in those evaluations can be affected by life events or situational factors (Buhrmester et al., 2011).

Whether self-esteem is conceptualised as a state or a global personality trait, the potential for changeability may be increased by the experience of a sudden, catastrophic event such as ABI. While prospective research examining self-esteem before and after ABI is not available, people who have experienced ABI report significantly lower self-esteem than people who have not (Kelly, Ponsford, & Couchman, 2013; Downing, Stolwyk, & Ponsford, 2013; Vickery, Sepehri, & Evans, 2008a). Retrospective reports from people who have experienced an ABI show that their current self-esteem is rated as lower than before their injury (Cooper-Evans, Alderman, Knight, & Oddy, 2008; Keppel & Crowe, 2000). Additionally, qualitative research conducted with people who have experienced an ABI highlights how people often feel self-conscious about the physical and cognitive impact of their injuries (Morris et al., 2005). Self-esteem instability is characterised by enhanced sensitivity to external events and high concerns around self-image, which may be compromised by the consequences of an ABI, particularly if someone is less able to receive the same social feedback on which they once relied or do the things they used to do. Consequently, the impact of an ABI may have significant consequences for self-esteem.

Although the relationship is complex and non-linear, links between low self-esteem and psychological difficulties such as anxiety and depression in the general population are well established (for further discussion, see Zeigler-Hill, 2011; Orth & Robins, 2013). People who have low self-esteem following ABI may be less able to utilise coping strategies and manage the physical, cognitive, psychological and psychosocial consequences of the injury if they are less able to focus on competence over limitations, or to maintain a sense of self-worth over feelings of hopelessness (Kendall & Terry, 1996). People with high self-esteem are more likely to attempt to increase their feelings of self-worth, whereas people with low or fragile self-esteem may be more unconciously concerned with protecting the limited self-

esteem resources they have, therefore becoming more reluctant to risk failure or rejection (Zeigler-Hill, 2011).

The present review aims to synthesise the available research findings around factors associated with self-esteem after ABI in adulthood. A more developed understanding of how self-esteem is affected by the physical, cognitive, psychological and psychosocial sequelae of ABI may help clinicians identify people at risk of developing psychological problems, while exploring whether self-esteem is associated with or predictive of psychological and functional outcomes will support understanding of factors which facilitate motivation and ability to engage with neuropsychological rehabilitation. As research in this area has been limited by the variability in definitions of self-esteem and the integration of different constructs, this literature review will not include related constructs (e.g., self-concept, self-confidence) and will instead focus solely on self-esteem, however this is conceptualised or measured, consistent with the range of theoretical perspectives as outlined above. Additionally, as ABI is a broad term encompassing a range of neurological problems this review will, in line with recent ABI reviews (e.g., Turner-Stokes, Nair, Sedki, Disler & Wade, 2011) focus on acute insults to the brain as opposed to degenerative or progressive neurological conditions. In summary, this review aims to review and appraise systematically the available quantitative research examining predictors or correlates of self-esteem following ABI.

Method

Search Strategy

A systematic approach was used to identify and examine all research relevant to the research question. The following terms were combined using AND/OR Boolean operators to identify relevant research articles: brain injur*; head injur*; ABI; TBI; concussion; head trauma; brain damage; stroke; cerebrovascular; self-esteem; self-image; self-concept; self-

worth[1]. No additional key-words were used by included papers, suggesting that the search strategy employed should have captured all relevant research articles. No limitations were placed on publication date. Seven electronic databases were searched for articles published in peer-reviewed journals: EMBASE, PsycINFO, Medline, Allied and Complementary Medicine (AMED), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science and ProQuest (International Bibliography of the Social Sciences). Reference lists of included papers were hand-searched for potentially relevant articles. Key journals (Journal of Head Trauma Rehabilitation; Brain Injury; Stroke; Journal of Stroke and Cerebrovascular Diseases; International Journal of Stroke) were individually searched for articles relating to self-esteem. The final literature search was conducted on 28th November 2014.

Inclusion and Exclusion Criteria

This review focused on the relationship between factors in adults who had experienced ABI and self-esteem. All quantitative studies exploring factors which related to self-esteem in people who have sustained an ABI were considered for inclusion in the review, including cross-sectional and longitudinal studies. Only studies which focused primarily on adults (i.e., the majority of the participants were aged over 18) were included in the review. To explore factors relating to self-esteem post-ABI, studies were considered for inclusion if they measured self-esteem in people who have sustained an ABI, alongside at least one other variable. No restrictions were placed on how injuries were diagnosed or validated, or the amount of time since injury before the measures were taken. The review only included studies which employed standardised measures of self-esteem validated for use with an ABI population, with no restrictions on who completed the measure (e.g., self-report, clinician,

[1] As discussed above, self-image, self-concept and self-worth are generally considered distinct theoretical constructs. However, the terms were included in the search strategy to ensure all relevant articles examining self-esteem were identified as these descriptive terms can contain some overlap.

carer). Studies were included if they utilised a measure of self-esteem, regardless of whether this was as an outcome or predictor variable. Only papers which were written in English were eligible for inclusion.

Studies were excluded if they did not incorporate measures specifically designed to measure self-esteem. Studies which focused on people with diseases of the central nervous system with a recurrent, degenerative or progressive course (e.g., multiple sclerosis, dementia) were excluded from the review. Articles were excluded if they aggregated ABI data with results from another population (e.g., a different health condition). Studies exploring the experiences of family members or caregivers were not included. Studies were required to report explicitly their measures and methodology. Qualitative studies were not included. While it is recognised that publication bias can result in skewed conclusions, the decision was taken to exclude studies where the full manuscript was not published in a peer-reviewed journal (e.g., conference presentations and dissertations) for practical access issues and to provide a baseline level of quality assurance.

Search Results

The electronic search identified 3862 records. An initial screening of titles and abstracts identified 70 potentially relevant studies once duplicates were removed. Manual searches of relevant journals identified no additional papers. Reference lists of relevant papers subsequently identified 18 additional potentially relevant articles. A total of 88 full-text articles were accessed and considered against the inclusion and exclusion criteria, with 27 subsequently included in the systematic review. An overview of this process is depicted in Figure 1.

[INSERT FIGURE 1 HERE]

Data Synthesis and Quality Assessment

Data relevant to the review's aims were extracted from each study. This included general study characteristics and details of participants, alongside factors associated with self-esteem following ABI and details of any statistical relationships reported. Due to the heterogeneity of the studies included and the variables measured, statistical synthesis via meta-analysis was considered inappropriate (Deeks, Higgins & Altman, 2008). All retrieved articles were critically appraised in terms of their methodological strengths and limitations. Criteria based on those developed for cohort, case-control and cross-sectional studies (Strengthening the Reporting of Observational Studies in Epidemiology [STROBE], 2011) were used to appraise each study on the basis of the reporting of its population, methods, analyses, results and generalisability (Figure 2). Using a similar approach to a recent literature review around psychological and psychosocial factors associated with traumatic brain injury (Gill, Mullin & Simpson, 2014), these criteria were developed and expanded. This allowed for consideration of methodological issues specific to ABI studies using correlational and regression designs, in addition to the generalised reporting guidelines provided by STROBE.

[INSERT FIGURE 2 HERE]

Each study was scored against the individual criteria displayed in Figure 2, with a positive score indicating that the article provides sufficient information to meet the criteria and negative scores indicating either that information was either absent or considered inadequate. Total scores were calculated for each study and the quality of each was categorised as *low* (0 to 4), *medium* (5 to 10) or *high* (11 to 16) to facilitate appraisal when considering the overall results of all studies. No studies were excluded on the basis of the critical appraisal of their methodological quality as all had met the inclusion criteria.

Results

Characteristics of Included Studies

The main characteristics of each study included in the review are summarised in Table 1.

[INSERT TABLE 1 HERE]

Participants

The total number of participants who had experienced an ABI across the 27 included studies was 2655, excluding those duplicated in samples which were shared across the following studies: Downing, Stolwyk, and Ponsford (2013) and Ponsford, Downing and Stolwyk (2013); Anson and Ponsford (2006a) and Anson and Ponsford (2006b); Vickery, Evans, Lee, Sepehri, & Jabeen (2009a) and Vickery, Evans, Sepehri, Jabeen, & Gayden (2009b). Although the same samples were used in these papers, the papers were still included as they used different analysis techniques to answer different research questions. Of these participants 1298 experienced traumatic brain injuries, 1348 experienced stroke or cerebrovascular accident, and 9 experienced ABI as a result of other medical problems (e.g., anoxia, encephalitis, viral infection). In total 301 non-clinical participants were employed as controls across five studies (Downing et al., 2013; Howes, Edwards, & Benton, 2005a; 2005b; Ponsford, Kelly, & Couchman, 2014; Vickery, Sepehri, & Evans, 2008).

Sample sizes ranged from 13 (Howes, Edwards, & Benton, 2005a) to 986 (Ponsford et al., 2013). The mean age of ABI participants (excluding duplicates) across the included studies was 54.21 years, ranging from 14 (Keppel & Crowe, 2000)[2] to 96 (Teoh, Sims, & Milgrom, 2009). Across the included studies, 40.85% of ABI participants (excluding duplicates) were female. Studies were conducted in Australia (n = 8), United Kingdom (n = 8), United States (n = 8), China (n = 2) and Japan (n = 1).

[2] Two studies (Keppel & Crowe, 2000; Ponsford et al., 2013) included participants under the age of 18. As the majority of participants used in both studies were over 18, the studies were included in the review.

Average time since injury ranged from 6.5 days (Chang & Mackenzie, 1998) to 11.17 years (Carroll & Coetzer, 2011). The main method of verifying ABI was by directly recruiting participants from ABI services or charities (n = 26), with one study recruiting discharged patients via a hospital database and confirming eligibility with a general practitioner (Teoh, Sims, & Milgrom, 2009). Eight of the included studies considered length of post-traumatic amnesia (PTA) or Glasgow Coma Scale (GCS) scores as a means of validating ABI and assessing severity. Five studies also used information from computerised tomography (CT) or magnetic resonance imaging (MRI) scans.

Methodological Characteristics

In total, 17 of the 27 included studies utilised a cross-sectional design. Longitudinal designs following individuals post-ABI were employed by eight of the studies, with the remaining two studies in the review assessing self-esteem pre- and post-intervention. In total 15 studies conducted regression analyses, 11 studies reported bivariate correlations, 4 reported between-group comparisons with controls and 3 made within-group comparisons.

Measures

All included studies adopted self-report measures of self-esteem. The most commonly used measure in the studies was the Rosenberg Self-Esteem Scale (RSES, Rosenberg, 1965; n = 17), with other studies including the State Self-Esteem Scale (SSES, Heatherton & Polivy, 1991; n = 6), Visual Analogue Self-Esteem Scale (VASES, Brumfitt & Sheeran, 1999; n = 5) and Coopersmith Self-Esteem Inventory (CSEI, Coopersmith, 1981; n = 1). Only two studies (Fung, Lui, & Chau, 2006; Vickery et al., 2008) used two different measures of self-esteem, with the majority employing a single assessment of the construct. One study (Cooper-Evans et al., 2008) made use of retrospective ratings of self-esteem.

Key Findings

Demographic variables. Of the seven studies which explored the relationship between age and self-esteem, Vickery et al. (2009b) found that younger participants had significantly higher self-esteem while Shida et al. (2014) found that participants older than 75 reported higher self-esteem. Five studies found no significant association between age and self-esteem (Thomas & Lincoln, 2008; Vickery, 2006; Vickery et al., 2008b; Vickery et al., 2008c; Vickery et al., 2009c). Vickery et al. (2009a) and, examining the same sample, Vickery et al. (2009b), reported that males showed higher self-esteem, while six other articles reported no significant association with gender (Keppel & Crowe, 2000; Thomas & Lincoln, 2008; Vickery, 2006; Vickery et al., 2008b; Vickery et al., 2008c; Vickery et al., 2009c). Vickery et al. (2009a) found that self-esteem improved less with increasing age.

Four studies explored the relationship between self-esteem and education. Vickery et al. (2009b) reported that self-esteem was significantly associated with higher levels of education. However, in a separate sample Vickery et al. (2008b) reported that lower education was associated with higher levels of self-esteem instability in the SSES Appearance subscale. Furthermore, Vickery (2006) found no significant correlation between education level and self-esteem as measured by the VASES. Only two studies explored the relationship between ethnicity and self-esteem after ABI. Vickery (2006) found no significant relationship between ethnicity and self-esteem as measured by the VASES, although Vickery et al. (2008b) reported that African-American participants had significantly higher self-esteem as measured by the SSES. Thomas and Lincoln (2008) and Fung et al. (2006) explored the relationship between self-esteem and marital status, finding no significant association.

Injury variables. Vickery et al. (2009b) and Vickery et al. (2009c) found that having history of stroke was associated with significantly lower self-esteem, however four studies

found no significant association with having had a previous ABI (Thomas & Lincoln, 2008; Vickery, 2006; Vickery et al., 2008b; Vickery et al., 2008c). No significant relationships were found between self-esteem and injury severity, as measured by PTA within one sample of participants (Anson & Ponsford, 2006a; 2006b) or coma duration (Fung et al., 2006). Age at injury was not found to be significantly related to self-esteem in three articles (Anson & Ponsford, 2006a and, with the same sample, Anson & Ponsford, 2006b; Fung et al., 2006). Shida et al. (2014) found that participants who had experienced their ABI more than four years ago had higher self-esteem, though no justification was given for why this length of time was chosen. Four other articles explored the relationship between self-esteem and time since injury, all reporting no significant association (Anson & Ponsford, 2006a and, with the same sample, Anson & Ponsford, 2006b; Keppel & Crowe, 2000; Riley et al., 2010).

Four of the eight articles exploring the relationship of self-esteem with laterality (i.e., whether the ABI occurred within the right or left hemisphere of the brain) found significant associations. Four studies found that participants with right hemisphere ABIs reported significantly lower self-esteem scores on VASES (Vickery, 2006; Vickery et al., 2008c; Vickery et al., 2009a and, with the same sample, Vickery et al., 2009b). Vickery et al. (2009c) found that self-esteem correlated significantly with laterality of stroke but did not report the direction of this relationship. Conversely, four articles found no significant relationship between location of brain injury and self-esteem as measured by RSES, (Keppel & Crowe, 2000; Thomas & Lincoln, 2008), VASES (Vickery et al., 2008a) and SSES (Vickery et al., 2008b).

Physical health. A significant positive relationship was found between self-esteem and physical condition in a female sample (Howes et al., 2005a), though the same authors found no significant association with extent of physical disability in a male sample (Howes et al., 2005b). Vickery et al. (2009c) found that number of comorbid physical health problems

was significantly associated with lower self-esteem. Similarly, Shida et al. (2014) found that self-esteem was negatively associated with sleep problems, pain and paralysis.

Cognitive functioning. General cognitive functioning and self-esteem were found to be significantly positively correlated (Cooper-Evans et al., 2008; Vickery et al., 2008b; Vickery et al., 2009a; Vickery et al., 2009c), with Vickery et al. (2008b) also finding that cognitive functioning was positively correlated with stability of self-esteem. However, Howes et al. (2005a) found that, in a sample of women who had experienced ABI, higher cognitive functioning was associated with lower self-esteem. Howes et al. (2005b) reported no significant correlation between self-esteem and general cognitive functioning while Cooper-Evans et al. (2008) found no significant relationship with magnitude of cognitive impairment. Pre-morbid intellectual functioning was found to be positively significantly associated with self-esteem in one study (Anson & Ponsford, 2006a), though with the same sample Anson and Ponsford (2006b) found that it did not correlate significantly with percentage change on self-esteem following a coping skills group intervention.

Mixed findings were reported by studies investigating specific domains of cognitive abilities. No significant relationships were observed between self-esteem and memory (McGuire & Greenwood, 1990; Anson & Ponsford, 2006a and, with the same sample, Anson & Ponsford, 2006b; Vickery, 2006) or attention (Vickery, 2006). Cooper-Evans et al. (2008) found a significant relationship between executive functioning and self-esteem, suggesting that greater impairment was associated with higher self-esteem. However, three studies report no significant relationship between self-esteem and executive functioning (Anson & Ponsford, 2006a and, with the same sample, Anson & Ponsford, 2006b; Vickery, 2006). Poorer self-awareness was found to be significantly associated with higher self-esteem in one study (Carroll & Coetzer, 2011), while Cooper-Evans et al. (2008) reported that people with poorer awareness of executive functioning impairments had significantly higher levels of

self-esteem. However, two studies (utilising one sample) found no significant relationship (Anson & Ponsford, 2006a; 2006b).

Thomas and Lincoln (2008) found that expressive and receptive language impairment was associated with lower self-esteem, though Vickery (2006) found no significant relationship. Additionally, Bakheit et al. (2004) found no significant relationship between self-esteem and aphasia severity. In the only study to assess visuo-perceptual integrity, Vickery (2006) found that higher impairment was significantly related to lower levels of self-esteem.

Functional independence. Self-esteem was found to be significantly positively associated with and predictive of functional independence (Chang & Mackenzie, 1998; Fung et al., 2006; Howes et al., 2005a; Shida et al., 2014; Teoh et al., 2009; Thomas & Lincoln, 2008; Vickery et al., 2008c; Vickery et al., 2009a). Vickery et al. (2009c) reported that lower self-esteem interacted with more functional independence to predict higher levels of depression on self-care, mobility and cognitive domains of functional independence. Self-esteem was also found to be significantly lower in people living in a nursing or rehabilitation home (Thomas & Lincoln, 2008), and negatively associated with length of rehabilitation stay (Vickery et al., 2009c).

Self-esteem was positively associated with perceived recovery (Vickery et al., 2009b) and satisfaction with rehabilitation (Fung et al., 2006; Shida et al., 2014). Vickery et al. (2009a) suggested that those with higher self-care, mobility skills and perceived recovery upon admission showed greater improvement in self-esteem over time. Additionally, low self-esteem was found to be related to higher subjective stress associated with being hospitalised (Vickery et al., 2009b).

Psychological factors. McGuire and Greenwood (1990) reported a significant relationship between self-esteem and the degree of perceived burden. Greater changes in

perceived identity (Carroll & Coetzer, 2011) and self-concept (Carroll & Coetzer, 2011; Ponsford et al., 2014) before and after ABI were associated with lower self-esteem. Additionally higher levels of perceived loss and poorer adjustment, the two areas of grief measured by the Brain Injury Grief Inventory (Coetzer, Vaughan & Ruddle, 2003), were both significantly related to lower self-esteem (Carroll & Coetzer, 2011).

Negative appraisal of coping resources and coping styles characterized by avoidance, worry, wishful thinking, self-blame, and using drugs and alcohol were associated with lower levels of self-esteem (Riley et al., 2010; Anson & Ponsford, 2006b). Additionally, participants who tended to overgeneralise negative outcomes were more likely to have lower self-esteem (Vickery et al., 2009b).

Sexuality and relationships. Higher self-esteem after ABI was found to be significantly associated with higher levels of sexual functioning and relationship quality, in addition to broader social functioning (Downing et al., 2013 and, with the same sample, Ponsford et al., 2013; Howes et al., 2005a). Additionally, body image (a significant factor in predicting relationship functioning) was found to be positively correlated with self-esteem (Keppel & Crowe, 2000).

Emotional wellbeing. Low self-esteem after ABI was found to be significantly associated with lower general mood ratings and psychological wellbeing, in addition to higher levels of emotional distress (Downing et al., 2013 and, with the same sample, Ponsford et al., 2013; Howes et al., 2005b; Shida et al., 2014; Vickery, 2006; Vickery et al., 2009b). Higher self-esteem was also found to be significantly associated with higher levels of anxiety in three studies (Cooper-Evans et al., 2008; Howes et al., 2005b; Vickery, 2006), though two papers reported no significant relationship between self-esteem and anxiety (Anson & Ponsford, 2006b; Ponsford et al., 2014). Teoh et al. (2009) also report a significant

relationship between higher quality of life and low self-esteem. Self-esteem was a significant predictor of overall psychosocial functioning in one study (Tate & Broe, 1999).

In total, 16 studies reported a significant relationship between low self-esteem and higher levels of depression after ABI (Anson & Ponsford, 2006a; Carroll & Coetzer, 2011; Cooper-Evans et al., 2008; Fung et al., 2006; Garske & Thomas, 1992; Howes et al., 2005a; Howes et al., 2005b; Ponsford et al., 2013; Teoh et al., 2009; Vickery, 2006; Vickery et al., 2008a; Vickery et al., 2008b; Vickery et al., 2008c; Vickery et al., 2009a and, with the same sample, Vickery et al., 2009b; Vickery et al., 2009c). Vickery et al. (2009b) also report that having a history of depression was significantly associated with low self-esteem.

Vickery et al. (2009c) report significant main effects of self-esteem on depressive symptoms, which were qualified by interactions between self-esteem and self-care and cognitive scores, and self-esteem stability and mobility. These remained significant after controlling for onset-admission interval, laterality of stroke and number of comorbidities. Vickery et al. (2009a) reported that higher mood was associated with higher initial scores of self-esteem, but mood did not significantly moderate the change in self-esteem during the course of acute stroke rehabilitation.

Quality Appraisal

The quality assessments of the included studies can be found in Table 2. All studies were rated as high, scoring eleven or above and indicating strong quality in terms of populations, methods, analyses, results and generalisability.

[INSERT TABLE 2 HERE]

All studies included in the review described the setting and how participants were recruited. All but one of the included studies provided appropriate details on demographic and clinical characteristics of participants. However four studies did not report inclusion and exclusion criteria, while only three studies provided details on how sample sizes were

determined. Of the twelve studies which collected data from participants at more than one time point, nine report on attrition.

All but one study provide details on the outcomes of statistical analyses reported, however only three report a priori power calculations. None of the included articles reported post hoc power calculations. Only four of the eleven studies which conducted multiple correlational analyses discussed corrections made. By failing to correct the effect size for the number of comparisons made, these studies may be at increased risk of Type I errors (i.e., reporting a significant relationship between two variables when one does not truly exist).

Discussion

This review took a systemtatic approach, offering a rigourous, transparaent and comprehensive synthesis of all available quantitative research on this topic. This method allows for the identification of gaps in knowledge and methodological weaknesses, which will be discussed in the context of highlighting future research prioroties. However, it is recognised that a systematic review is reliant on the design, methods and results of the original research, which inherently introduces bias. In the present review, resource limitations meant that it was not feasible to correspond with all individual authors or consider reproduction or replication of results. Additionally, the focus of the systematic review on synthesis of quantitative research means that findings from qualitative studies in this area were not included. As research relating to neuropsychological rehabilitation is multi-disciplinary in nature, it is important that different types of evidence are not overlooked.

Despite the limitations, the review highlights a broad range of pre-ABI and post-ABI factors which relate to self-esteem. The available research suggests that self-esteem is lower in people who have experienced an ABI, though only a small number of included studies examined this using control groups containing either people with other chronic health conditions or no health condition. The review highlights conflicting findings around the

relationship between self-esteem post-ABI and a range of demographic factors (e.g., age, gender) and injury variables (e.g., history of stroke, laterality, injury severity), making it difficult to draw definitive conclusions regarding how these factors relate to self-esteem.

There is some evidence to support a relationship between self-esteem and cognitive functioning. However relatively few studies examine these factors directly, with many finding no significant relationship. Results are also mixed with regards to whether higher self-esteem is related to higher or lower levels of impairment. This is particularly evident in relation to executive functioning and awareness of cognitive problems, with three studies suggesting that greater impairment is related to higher self-esteem but two studies reporting no significant relationship. Low self-esteem appears to be moderately related to low functional independence (in terms of physical ability and activities of daily living), with nine studies offering support for this relationship.

Self-esteem also appears to be strongly related to psychological outcomes, with low self-esteem found to be associated with lower quality of life and general psychological wellbeing. Three studies found that low self-esteem correlated with higher levels of anxiety, though two found no relationship. Depression was the most frequently investigated variable amongst the included studies and it is clear from the available results that self-esteem is significantly related to and predictive of higher levels of depression following ABI, with most studies reporting large effect sizes ($r > 0.5$) on a range of measures.

The review findings also suggest that a broad range of psychological variables may be associated with self-esteem, with all studies which examined psychological factors in relation to self-esteem reporting statistically significant relationships. Low self-esteem was found to correlate with greater changes in perceived identity and self-concept, in addition to poorer adjustment and higher levels of perceived loss. Use of negative coping styles, alongside negative appraisal of coping resources and outcomes, was found to be associated with lower

self-esteem across three studies. Perceptions of impairment and burden, alongside satisfaction with rehabilitation, appear to be strongly associated with self-esteem.

The significance of psychological factors in the included papers is consistent with increasing theoretical and empirical consensus that emotional wellbeing and psychosocial functioning are affected by a range of variables following ABI, with psychological factors playing a role above and beyond clinical and demographic variables (e.g., Khan-Bourne & Brown, 2003; Tate & Broe, 1999). In their model for rehabilitation processes following ABI, Gracey et al. (2009) highlight the importance of psychological factors by advocating the growth of adaptive, realistic self-representations, alongside consolidation of identity development through reducing discrepancy between pre-injury and post-injury representations of the self. They discuss the impact of coping style on adjustment, particularly in terms of cognitive, emotional and behavioural responses following a significant traumatic event (Gracey et al., 2009).

Furthermore, given that low self-esteem is associated with anxiety and depression in the general population (Zeigler-Hill, 2011; Orth & Robins, 2013), and psychological problems are common following ABI (Broomfield et al., 2014; Bryant et al., 2010), the findings of the present review support the notion that self-esteem appears to be a key personal resource to consider following ABI, particularly in the development of psychological problems such as depression and anxiety (as also specified in Kendall & Terry's model).

However, the findings of the review must be considered in the context of several key limitations across the included studies, which may explain why such conflicting findings were observed. It appears that self-esteem is potentially an important variable to consider following ABI, particularly in relation to outcomes such as psychological wellbeing. However, as outlined above, for self-esteem to be applied in a meaningful way to an ABI population, future research must be conceptualised in a way which reflects the complexities

in the construct. There is a general failure across the included studies to critically engage with how they conceptualise or measure self-esteem. As discussed, contemporary conceptualisations of self-esteem expand on the traditional dichotomous construct (i.e., high or low) and distinctions have been drawn between global, state and selective self-esteem. Yet, as self-esteem was assessed as both a predictor and outcome variable across the included studies, it remains unclear whether lowered self-esteem is a consequence of ABI, if self-esteem has any predictive value in identifying problems post-ABI, or if self-esteem should be targeted in rehabilitation to improve outcomes. All of the included studies conceptualised self-esteem as a dichotomous (i.e., high or low), uni-dimensional construct. Decisions to assess global self-esteem (e.g., using the RSES) were not made explicit by authors of any included studies. Even amongst the six studies which explored state self-esteem, no critical engagement with the theoretical literature around self-esteem was evident.

Drawing on contemporary models of self-esteem may require new or revised assessment tools, suitable to examine contemporary constructs (e.g., fragile self-esteem) within an ABI population. The interaction between fragile self-esteem and cognitive awareness could be a particularly useful direction for future research, given that many people are left with impairments in executive functioning following ABI and commonly lack insight into the nature of their difficulties or are less able to self-monitor when doing a task.

Additionally, no research to date has employed methods to assess implicit self-esteem in ABI population. Though it is recognised that research into implicit self-esteem remains in its infancy (Dijksterhuis, Albers & Bongers, 2009), there is potential utility in identifying discrepancies between implicit and explicit self-esteem in highlighting fragility (Zeigler-Hill, 2011). As commonly used measures use response time to assess non-conscious or implicit beliefs, preferences or associations which people hold about themselves (Buhrmester et al., 2011), the presence of physical disability or cognitive impairment may complicate

assessment of these response times. However, conceptualising and measuring self-esteem in a narrow way which does not embrace the complexity of current theoretical and empirical understanding limits the value of research into how self-esteem is affected by ABI and the role it might play in psychological wellbeing and rehabilitation. Therefore, research exploring the validity and reliability of implicit self-esteem measures within an ABI population may be a useful next step.

Furthermore, a wide range of factors relating to self-esteem are examined. Most are only explored by a relatively small number of studies, making it difficult to draw strong conclusions about how specific variables relate to self-esteem following ABI. The varied and conflicted findings of the review reflect a lack of theoretical consistency, with disparate individual studies testing uncoordinated hypotheses which are not underpinned by a clear, consistent conceptualisation of self-esteem and how it relates to ABI. There is a clear need for a solid theoretical model, linking current perspectives on self-esteem to the challenges of ABI in terms of mood, cognitive and physical impairment and social functioning. This is particularly pertinent in relation to psychological factors, which may go some way to explaining the conflicting findings observed in relation to other demographic and clinical variables. Further research is required to clarify exactly how self-esteem relates to factors relevant to rehabilitation and wellbeing, with further studies needed which are designed to test hypothesised relationships between those variables suggested by contemporary theoretical developments. By carefully justifying the choice of hypothesised variables, theoretical and empirical understanding of the role of self-esteem following ABI will be improved.

Further research is also required to guide the development of psychological and psychosocial interventions which incorporate self-esteem as a factor contributing to our understanding of underlying difficulties and change processes of rehabilitation. This is in

keeping with advocates of bio-psychosocial approaches to rehabilitation, which draw on multiple models to guide effective interventions (Gracey et al., 2009; Wilson & Gracey, 2009). A stronger evidence base around the effectiveness of psychological interventions following ABI will help improve guidance for professionals working in these settings. For example in the UK, guidance for stroke rehabilitation (NICE, 2013) highlights the need for NHS services to provide emotional support, however the guidance only links to the recommendations made for managing depression in people with long-term physical health conditions, with no specific recommendations around how this should be done within an ABI population. Further research is required to support the development of internationally relevant guidelines for professionals and services which integrate a focus on psychological outcomes.

In terms of methodology, although all studies were rated as being of high quality (in terms of population, methods, analysis, results and generalisability), few provided information regarding a priori or post hoc power calculations or adjustments made for multiple comparisons (e.g., Bonferroni corrections). Despite many studies in the review having relatively small or modest sample sizes, most used *p* values to determine significant results instead of discussing effect sizes which allow for more meaningful interpretation of the relative magnitude of the findings (Sullivan & Feinn, 2012). A reliance on correlational methods, which do not provide directional or predictive information, limits the usefulness of many studies in understanding relationships between self-esteem and associated variables. Additionally most studies failed to take into account the heterogeneous nature of ABI, often integrating people with a range of very different diagnoses into one sample.

Therefore, future research must be supported by more complex research methods, which go beyond correlational techniques to allow for assessment of directional relationships between variables to determine if self-esteem can predict or be predicted by other factors.

Many of the included studies used designs and analysis techniques which did not allow for examination of the process of non-linear change in self-esteem over time following ABI, or how such variations might correlate with or contribute to changes in outcomes. For example, improvement in a person's medical condition may lead to bi-directional change with better engagement in rehabilitation leading to self-esteem and better physical, emotional and psychosocial outcomes.

Advanced techniques such as multi-level modelling, as employed by Vickery et al. (2009a), are potentially useful in this respect as individual change and its correlates can be examined, as opposed to relying on average, group-level change as examined by difference scores (e.g., the difference between self-esteem at rehabilitation admission and discharge). A more developed understanding of how demographic, situational, psychological and injury factors might contribute to or correlate with trajectories of self-esteem change following ABI would enable services to incorporate individual differences into ABI rehabilitation (Jackson, 2010). Additionally, qualitative research which builds on the small amount of existing work (e.g., Morris et al., 2005) to specifically explore perspectives of self-esteem change following ABI, perhaps including both people who have experienced ABI and their carers, partners or families, would be useful in building on existing knowledge in this area.

Recent commentaries have also highlighted the need to incorporate social models of disability to challenge the notion that the severity of an individual's problems are the sole cause for disability and distress, with greater attention on economic, cultural and environmental barriers (Simpson & Thomas, 2014). Similarly, Kendall and Terry's (1996) model highlights the importance of situational factors in psychosocial wellbeing following ABI. Few studies in the review examined the impact of environmental variables and this is an important direction for future research if such factors can be targeted for intervention.

The findings have implications for professionals who work with people who have experienced ABI. As discussed, the results of this review indicate it is difficult to define specifically how self-esteem is affected by ABI, or how self-esteem is predictive of further problems. However, there does seem to be potential value in considering self-esteem in assessment, formulation and intervention throughout the rehabilitation process following ABI. Though further examination is required, the available research suggests that self-esteem is lower following ABI. It is possible that low self-esteem could be a consequence of the challenges and psychosocial changes associated with ABI, thereby increasing the risk of emotional problems and highlighting the potential predictive utility of self-esteem in identifying people who may be less able to engage in rehabilitation effectively. Whether considered as an outcome affected by ABI or as a factor which might predict emotional and functional problems, self-esteem is associated with a range of variables relevant to ABI rehabilitation and may be a useful aspect of a person's presentation to consider.

Psychological interventions can play a useful role here in supporting awareness and the development of accurate and positive appraisals of the self, alongside the process of adjusting to life after a brain injury. The "recalibration" (Klonoff, 2010 p. 77) of a person's sense of self (in line with their values and social roles) is vital in supporting people to derive meaning from their experiences following ABI, alongside the acceptance of limitations or impairments to allow for functional adjustment, adaptation and compensation (Klonoff, 2010; Ownsworth, 2014; Gracey et al., 2009).

Additionally, self-esteem may be an important mediating variable to consider as people adjust to loss (Nochi, 1998). Low self-esteem may put people at greater risk of overcoming negative psychosocial outcomes if they are less able to focus on competence or manage the demands and consequences of the ABI due to a lack of adaptive coping strategies which help them move through stages of adjustment (Kendall & Terry, 1996; Moore &

Stambrook, 1995). While further research is required, self-esteem may be a useful factor to consider as the complex factors surrounding ABI are integrated into effective rehabilitation programmes which support psychological wellbeing.

Furthermore, while the disparate results across the included studies may be clarified through additional research, this may also reflect the complexity and heterogeneity of ABI. The varied results of the included studies could be suggestive of a need to build individualised programmes of care, taking a holistic approach to rehabilitation given the complex relationships between neurological and psychological factors. Additionally, there is strong evidence to suggest that higher levels of physical health problems and lower levels of functional independence are associated with and predictive of lower self-esteem following ABI. This highlights the importance of rehabilitation which focuses on meaningful activities of daily living in addition to physical ability, with practitioners providing support which enhances people's self-esteem in addition to their physical skills.

Conclusion

The current review aimed to identify, synthesise and appraise the available quantitative research to identify predictors or correlates of self-esteem following ABI in adulthood. In total, 27 papers were included in the review and considered good quality. Despite limitations in how the included studies conceptualised and measured self-esteem, a reliance on research designs which did not allow for analysis of complex relationships and a lack of a strong theoretical grounding underpinning the choice of hypothesised variables, a range of factors were identified as being related to self-esteem after ABI. These include psychological variables, in addition to the degree of physical, functional and cognitive impairment. Self-esteem also appears to be strongly related to psychological outcomes following ABI. Further research is required to examine the role of self-esteem in rehabilitation and psychological wellbeing following ABI, however this must be integrated

with and supported by developments in how self-esteem is conceptualised and measured over time in an ABI population. A more developed understanding of self-esteem post-ABI will inform the development of individualised rehabilitation interventions which take into account biological, social and psychological factors to support the physical, social and psychological wellbeing of people who have experienced ABI.

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