

Impact of rehabilitation on self-concept following traumatic brain injury: An exploratory systematic review of intervention methodology and efficacy

Tamara Ownsworth<sup>1</sup> & Catherine Haslam<sup>2</sup>

<sup>1</sup>School of Applied Psychology and Griffith Health Institute, Griffith University, Mt Gravatt, Australia

<sup>2</sup>School of Psychology, The University of Queensland, St Lucia, Australia

Contact for correspondence:

A/Prof Tamara Ownsworth  
School of Applied Psychology  
Griffith University  
Mt Gravatt, 4122  
Australia  
Email: [t.ownsworth@griffith.edu.au](mailto:t.ownsworth@griffith.edu.au)  
Ph: +61 73735 3307  
Fax: +61 73735 3388

### **Abstract**

To date, reviews of rehabilitation efficacy after TBI have overlooked the impact on sense of self, focusing instead on functional impairment and psychological distress. The present review sought to address this gap by critically appraising the methodology and efficacy of intervention studies that assess changes in self-concept. A systematic search of PsycINFO, Medline, CINAHL and PubMed was conducted from inception to September 2013 to identify studies reporting pre- and post-intervention changes on validated measures of self-esteem or self-concept in adults with TBI. Methodological quality of randomised controlled trials (RCTs) was examined using the Physiotherapy Evidence Database (PEDro) scale. A total of 17 studies (10 RCTs, 4 non-RCT group studies, 3 case studies) were identified, which examined the impact of psychotherapy, family-based support, cognitive rehabilitation or activity-based interventions on self-concept. The findings on the efficacy of these interventions were mixed with only 10 studies showing some evidence of improvement in self-concept based on within-group or pre-post comparisons. Such findings highlight the need for greater focus on the impact of rehabilitation on self-understanding with improved assessment and intervention methodology. We draw upon theories of identity reconstruction and highlight implications for the design and evaluation of identity-oriented interventions that can supplement existing rehabilitation programs for people with TBI.

Key words: traumatic brain injury, rehabilitation, self-concept, systematic review, self-identity

## **Introduction**

Traumatic brain injury (TBI) is a leading global cause of disability that affects approximately 200 per 100,000 people annually (Bryan-Hancock & Harrison, 2010). More common in males than females (i.e., 3:1), TBI is most prevalent for those aged 18-25 years (Corrigan, Selassie & Orman, 2010). This age period marks the transition from adolescence to adulthood and is the peak time for establishing one's career, independence and relationships; all of which contributes to development of one's overall sense of self (Harter, 2012). Although the consequences of TBI vary, most individuals experience impairments in physical, cognitive and behavioral functioning and changes in meaningful activities and roles (e.g., ability to drive, work, live independently). TBI can fundamentally alter people's life course and their sense of who they are and might become (Evans, 2011; Ownsworth, 2014). The experience of "loss of self" and changes in personal and social identity following brain injury has received increased empirical attention over the last three decades (e.g., Gracey & Ownsworth, 2012; Haslam, Holme, Haslam, Iyer, Jeyyen & Williams, 2008; Nochi, 1998; Ownsworth, 2014; Tyerman & Humphrey, 1984). While all forms of brain injury rehabilitation that support people to adapt to their functional impairments contribute in some way to rebuilding sense of self, the focus of outcome evaluation is typically on functional status and psychological distress, rather than changes in self-understanding in response to trauma and rehabilitation. Accordingly, the main aim of this study was to conduct an exploratory systematic review of the impact of brain injury on self-concept after TBI.

## **Conceptions of Self-Identity Change after TBI**

Although terminology differs in the field, self-identity broadly refers to a person's self-understanding of his or her own potential, qualities and inner sameness over time (Ownsworth, 2014). Such perceptions are typically informed by, or derived from,

psychological and physical attributes, activities and roles, and one's social connections with others (Allport, 1961; Tajfel & Turner, 1979; Wilcock, 1998). In the TBI literature, the impact of injury on self-understanding has predominantly been investigated using qualitative methodologies that include life history, narrative and ethnographic approaches (e.g., Douglas, 2013; Gelech & Desjardins, 2011; Krefting, 1989; Muenchberger, Kendall & Neal, 2008; Nochi, 1997; 1998; 2000). Where quantitative studies have been undertaken, the focus is on measurement of self-concept or self-esteem, which are constructs closely related to self-identity (Ownsworth, 2014; Tyerman & Humphrey, 1984). Here, measures of self-concept have been used to capture one's overall perception of self (i.e., general self-concept) and self-perceived attributes or competency across different domains (e.g., physical, academic, social, emotional; Marsh, Byrne & Shavelson, 1992). Self-esteem provides an evaluative component of self-concept, or overall judgment of one's own worth or value (Rosenberg, 1965). Studies have found that TBI negatively affects global self-concept and self-esteem (e.g., Cooper-Evans, Alderman, Knight & Oddy, 2008; Kelly, Ponsford & Couchman, 2013; Ponsford, Kelly & Couchman, 2014) and domain-specific self-perceptions, including body image and physical self-concept (Howes, Edwards & Benton, 2005), social identity and social self-concept (Gracey et al., 2008; Jumisko, Lexell & Soderberg, 2005; Nochi, 1998), emotional and behavioural self-concept (Tyerman & Humphrey, 1984; Wright & Telford, 1996), and work and academic self-concept (Kelly et al., 2013; Ponsford et al., 2014).

Focusing on emotional and behavioural self-concept, Tyerman and Humphrey (1984) found that people with severe TBI rated their present self as vastly different from past (pre-injury) self and they perceived themselves as more bitter, dependent, frustrated and irritable and of less worth. Positive changes were also evident whereby people perceived themselves as more mature, appreciative and responsible than in the past. Overall, 72% felt they had changed significantly "as a person" as a result of the injury and comparisons between their

past and current selves (i.e., self-discrepancies) were predominantly unfavorable. Such negative self-discrepancies have also been reported following mild TBI and were found to be related to greater psychological distress (Wright & Telford, 1996). While people with mild TBI predicted at 6-months post-injury that they would return to their premorbid selves one-year later, negative self-discrepancies persisted at the three-year follow-up (Wright & Telford, 1996).

Clearly, these discrepancies make forming a coherent sense of self following injury challenging. In TBI, identity reconstruction aimed at gaining self-coherence is characterized as the process of re-establishing one's sense of self and place in the world. Through this process, it has been argued that those able to form a sense of self that is both *realistic* and *adaptive* are more likely to experience positive long-term adjustment (Feeney & Capo, 2010; Ylvisaker, McPherson, Kayes & Pellet, 2008). For most, this process involves a relative balance between identity maintenance (i.e., self-continuity) and change (i.e., self-discontinuity). Self-continuity is often achieved in the course of re-connecting with one's values, activities (e.g., hobbies), and social networks and roles (e.g., as a parent); many of which are closely tied to one's self-understanding (Haslam et al., 2008; Turner, Ownsworth, Cornwell & Fleming, 2009). However, confronted with various functional impairments and activity limitations (e.g., inability to drive or work), identity reconstruction ultimately involves coming to terms with an altered lifestyle and change in future goals (Klonoff, 2010; Ownsworth, 2014). People may positively redefine themselves by forming new priorities and interests after TBI (e.g., joining support groups, advocacy, volunteering), which can restore self-esteem and enhance satisfaction with life (Douglas, 2013; Haslam et al., 2008; Nochi, 2000).

### **Addressing Self-Identity Change in Rehabilitation**

Identity reconstruction is the cornerstone of holistic neuropsychological rehabilitation or intensive centre-based multi-disciplinary programs which integrate cognitive rehabilitation and psychotherapy interventions within a structured and supportive therapeutic milieu (e.g., Ben-Yishay & Diller, 2011; Prigatano, 1999; Wilson, Gracey, Evans & Bateman, 2009).

These programs aim to foster a realistic and adaptive post-injury identity through multiple interacting elements that include: a shared understanding and close collaboration between clients, family members and staff, psychoeducation, goal setting, psychotherapy, cognitive rehabilitation, peer feedback, group therapy and collaborative projects, family counselling and multi-disciplinary therapies to maximise home independence, work/study re-entry and social re-engagement (Ben-Yishay & Diller, 2011; Trexler, 2000; Wilson et al., 2009).

To date, empirical evaluation of holistic programs has predominantly involved case series and quasi-experimental designs. One exception is a randomised controlled trial (RCT) of post-acute TBI rehabilitation conducted by Cicerone et al. (2008). These researchers found that the holistic program was associated with significantly greater gains in community functioning, employment, self-efficacy (i.e., perceived ability to manage symptoms) and life satisfaction than standard neurorehabilitation (i.e., individual, discipline-specific therapies). Systematic reviews by Cattelani, Zettin and Zoccolotti (2010) and Cicerone et al. (2011) concluded that holistic programs yield greater overall improvements in psychosocial functioning relative to other interventions.

Given the combined and intensive focus on psychotherapy, neurorehabilitation and occupational re-engagement, holistic neuropsychological rehabilitation offers a strong basis for facilitating identity transition after TBI. However, due to the multi-faceted nature of these programs (i.e., combination of group and individual therapies), it is not possible to determine the active components of intervention. Further, despite clear descriptions of the theory-

derived elements of the program (e.g., Ben-Yishay & Diller, 2011; Wilson et al., 2009), evidence of the impact of the holistic approach on traditional measures of self-identity in the TBI field (i.e., self-concept or self-esteem) is lacking. One might also question whether the intended psychosocial outcomes of these programs are achievable for, or generalisable to, other brain injury rehabilitation contexts. In particular, the rigorous criteria applied to determine suitability for holistic neuropsychological rehabilitation tend to differ from more standard referral criteria in other rehabilitation settings. Finally, program characteristics of high intensity (i.e., 4-6 hours per day for 4-5 days per week), extended duration (i.e., 3-7 months) and low client to staff ratio are not feasible in many rehabilitation contexts.

If the broad aim of brain injury rehabilitation is to help people live fulfilled lives that hold meaning, purpose and value, then its success will depend in large part on its capacity to support people to redefine themselves in response to the changes that TBI imposes. There are various forms of brain injury rehabilitation that range from intensive and holistic approaches to those focusing on development of specific skills and competencies. All are relevant to consider, as in the course of facilitating adjustment to TBI they contribute to the reconstruction of one's broader conceptualization of self. Yet, the impact of brain injury rehabilitation on self-concept or self-identity has not been the primary focus of investigations. Moreover, it is currently unknown how many TBI intervention studies have assessed changes to sense self following brain injury rehabilitation. To address this knowledge gap, we conducted an exploratory systematic review to investigate the impact of brain injury rehabilitation on self-concept. This included examination of the quality of methodology used and measurement of self-concept changes following rehabilitation. As the first review with this focus, the evidence was examined using the Oxford Centre for Evidence-Based Medicine (OCEBM, 2011) framework, thus encompassing n-of-1 trials, RCTs, non-randomized group studies and case studies with a pre-post design.

## Methods

### Search Strategy

A systematic search of PsycINFO, Medline, CINAHL and PubMed was conducted from inception to September 2013. The search strategy involved a combination of three sets of terms relevant to: a) the clinical population (TBI); b) type of study (intervention); and c) intervention outcome (measures of self-concept, self-esteem or equivalent). For the first two sets, we applied the following terms in searching titles and abstracts: a) brain injury(ies), TBI, brain damage, head injury(ies), head trauma, neuro trauma, cerebral trauma, and b) intervention, therapy, rehabilitation, program(me), treatment, trial. As the outcomes of interest — self-esteem and self-concept — were not typically used in titles or abstracts, full text searches were conducted including the following terms: self-esteem, self-concept, self-worth, self-image, and identity. The search field was limited to humans, adults, and peer-reviewed articles written in English.

Studies were eligible for the review if they reported pre- and post-assessment outcomes of a rehabilitation intervention for adults with TBI and employed a validated measure of global self-concept or self-esteem and/or relevant subdomains (e.g., physical, social, academic). Studies were excluded if the intervention lacked uniformity across participants (e.g., the content of sessions varied according to clinical need) or was part of a broader rehabilitation program (e.g., hospital outcome data). For studies comprising people with brain injury of mixed aetiology (e.g., TBI, stroke, hypoxia), we applied the eligibility criterion that at least 70% of the sample had sustained TBI.

### Process of Review

The review was conducted in accordance with PRISMA guidelines for systematic reviews (Liberati et al., 2009). To determine eligibility for inclusion both authors (TO and CH) independently reviewed full text papers that described an intervention for adults with TBI in



which outcomes relevant to self-concept were reported. Initial level of agreement concerning inclusion of studies for the review was high (Kappa = .78). There was disagreement over inclusion of four studies, which was resolved through discussion. Three studies were excluded because outcome measures did not index self-concept or self-esteem, assessing self-perceived changes in functioning (i.e., self-awareness) or self-perceived ability to cope (Backhaus, Ibarra, Klyce, Trexler & Malec, 2010; Brenner et al., 2012; Hsei, Ponsford, Wong, Schönberger, Taffe, & McKay, 2013), and the fourth study was excluded because self-esteem was measured using a single item and non-validated scale (Lemmon, LaTourrette & Hauver, 1996). Studies that evaluated the impact of an intervention on self-awareness, self-efficacy or related coping constructs were deemed outside the scope of this review. The reason for this decision is that measures of self-awareness are typically based on discrepancies between self and significant other ratings, which are used to infer accuracy of self-appraisal rather than the person's overall subjective perception of self or perceived attributes across different domains. Additionally, measures of self-efficacy, whilst related to emotional and behavioural domains of self-concept, focus on one's perceived ability to cope within specific situations (e.g., to manage cognitive deficits or to perform health practices).

### **Methodological Quality and Risk of Bias**

Studies were classified using the OCEBM framework (OCEBM, 2011), which specifies the level of evidence concerning treatment benefits. Within this framework, systematic reviews of RCTs or n-of-1 trials represent Level 1 evidence, and individual RCTs constitute Level 2 evidence. Non-randomised controlled cohort or follow-up studies comprise Level 3 evidence. Case-series, case-control studies or historical controls provide Level 4 evidence. Expert clinical opinion without critical appraisal constitutes Level 5 evidence (OCEBM, 2011).

The quality of methodology of RCTs was independently rated by both authors using the PEDro scale (Maher, Sherrington, Herbert, Moseley & Elkins, 2003). A score out of 10

was derived for each study based on the number of criteria satisfied. These include random allocation, concealed allocation, baseline comparability, blinding (subject, therapists, and assessors), attrition or dropout, use of intention-to-treat analysis, between-group statistical comparisons and reporting point measures and variability (Maher et al., 2003). Level of inter-rater agreement was satisfactory ( $Kappa = .64$ ), and differed by 1 point for two studies and 2 points for two studies. Consensus was reached on a final rating through involvement of a third independent rater and further discussion.

## Results

### Study Description

As shown in Figure 1, the search strategy identified 17 studies that met review criteria and these comprised 10 RCTs, four non-randomised group studies (one with a non-clinical control group) and three case studies or case series with pre- and post-measurement. Table 1 provides the classification of these studies according to the OCEBM framework in addition to the type and focus of intervention. There were four main intervention types: psychotherapy, family-based support, cognitive rehabilitation and activity-based interventions. The focus of intervention differed across studies but addressed predominantly issues of emotional adjustment (e.g., anger, hopelessness, coping), interpersonal skills, memory, problem-solving strategies and health behaviours. Self-concept or self-esteem was identified as the main focus of intervention in only two studies (i.e., Kelly et al., 2013; Vickery, Gontkovsky, Wallace & Caroselli, 2006), and was more commonly characterised as a secondary outcome or 'subsidiary measure' in the context of considering the generalisability of treatment (e.g., Hodgson, McDonald, Tate & Gertler, 2005; Medd & Tate, 2000; Simpson, Tate, Whiting & Cotter, 2011). Due to substantial variability in the sample characteristics, assessment methods, and the type, focus and intensity of intervention for the RCTs (see Table 2) meta-analysis was not used to synthesize the data.

As shown in Table 2, an appraisal of the methodological quality of the RCTs yielded PEDro scores ranging from 1-8 ( $M = 4.1$ ,  $SD = 2.1$ ). Methodological quality was strongest for the RCTs by Simpson et al. (2011), Blake and Batson (2009), and Medd and Tate (2000). Only 20% of studies employed blinding of assessors and intention-to-treat analysis. Concealed allocation and baseline comparability of groups was reported in less than half of studies (40% and 30% respectively).

### **Study Outcomes and Methodological Quality**

An examination of the results of each RCT (see Table 3) identified significant positive effects on self-concept for the experimental intervention in five RCTs (Blake & Batson, 2009; Driver, O'Connor, Lox & Rees, 2006; Helffenstein & Wechsler, 1982; Rath, Simon, Langenbahn, Sherr & Diller, 2003; Sinnakaruppan, Downey & Morrison, 2005). Of the five studies reporting significant effects for self-concept, only Blake and Batson (2009) used concealed allocation and conducted intention-to-treat analyses. Further, only one study, conducted by Helffenstein and Wechsler (1982), reported blinding of assessors. There was no indication in any of the studies with significant findings, that groups were comparable at baseline. Outcome assessment was adequate (i.e., obtained from >85% of participants allocated) for two of the five RCTs with a significant increase in self-concept (Blake & Batson, 2009; Helffenstein & Wechsler, 1982). Reported improvement in self-concept was based on within-group analyses in four of the five studies with significant results (Blake & Batson, 2009; Driver et al., 2006; Helffenstein & Wechsler, 1982; Rath et al., 2003). In the RCT by Blake and Batson (2009), between group analyses were conducted, but not found to be significant. Only one study by Sinnakaruppan et al. (2005) reported significant between-group differences in self-concept following the intervention. However, these groups also differed in self-concept at baseline, which was not controlled for in statistical analysis.

Therefore, most of the evidence, albeit based on only half of the RCTs, showing a positive impact of rehabilitation on self-concept was based on within-group comparisons.

### **Findings as a Function of Intervention Type**

#### *Psychotherapy*

As indicated in Table 1, four RCTs, one pre-post group study, one case study and one case series evaluated the impact of cognitive and behavioural therapy on emotional adjustment and self-esteem. In the RCT by Anson and Ponsford (2006), a 10-session coping skills group was found to significantly increase use of adaptive coping strategies, but no significant changes in self-esteem were evident on the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965) relative to wait list controls. Similarly, other psychotherapy intervention studies found significant effects for primary outcomes of anger (Medd & Tate, 2000), hopelessness (Simpson et al., 2011) and anxiety (Hodgson et al., 2005), but no significant gains in self-esteem as measured by the RSES or Coopersmith Self-Esteem Inventory (CSEI; Coopersmith, 1989).

In a pilot study with a pre-post design ( $n = 18$ ), Vickery et al. (2006) evaluated the impact of group psychotherapy (6 x 1 hour sessions) that focused on changes in self-identity. Sessions were designed to increase participants' awareness of different aspects of their selves (i.e., expanding self-views) and to recognize the influence of personal attributes to perceptions of overall happiness (i.e., self-differentiation). The sessions also aimed to promote a sense of self-continuity by encouraging participants to consider negative changes (e.g., cognitive deficits) associated with the TBI alongside ongoing or new positive self-attributes (e.g., sense of humour). A significant overall improvement in self-concept was found on the Head Injury Semantic Differential Scale (HISD; Tyerman & Humphrey, 1984) between sessions 1 and 6, with changes most evident for the attributes of attractive, interested, hopeful, self-confident, and cooperative. This study is noteworthy as the first to

specifically evaluate the impact of a self-concept intervention for brain injury. However, in addition to having no control group comparison, self-concept was evaluated as part of the final therapy session, and hence improvements may be the result of the positive feedback participants had just received from their peers. With no follow-up data, it is not possible to determine whether these effects were maintained beyond therapy and reflect durable changes in self-concept.

A case series conducted by Manchester, Wall, Dawson and Jackson (2007) examined the impact of group psychotherapy on development of prosocial skills in three young males with TBI who presented with a premorbid and/or post-injury history of anti-social behaviour. Their intensive 24-session group intervention (4 days per week, for 6 weeks) was found to alter beliefs about anti-social behaviour in two of the three participants, but there was no evidence of any marked improvement in self-esteem across the pre-intervention, post-intervention and 3-month follow-up periods. Interestingly, pre-intervention self-esteem ratings on the CSEI were very high for two participants (80<sup>th</sup> & 90<sup>th</sup>), leaving little room for improvement, but very low for the third participant (5<sup>th</sup> percentile).

Using case study methodology, Ashworth, Gracey and Gilbert (2011) assessed the effectiveness of compassion focused therapy (CFT) delivered as part of a 24 week holistic neuropsychological rehabilitation program. CFT was incorporated six weeks into the client's individual cognitive behavioural therapy program after she expressed that she was "feeling worse in herself" (i.e., more self-critical). The remaining 18 sessions involved developing a CFT-based formulation, psychoeducation on the CFT model and training to self-soothe using compassionate mind training. Her score on the Robson Self-concept Questionnaire (RSCQ; Robson, 1989) reliably moved from the clinical range (score = 97) pre-program to the normal range (score = 124) post-program, and there was a reliable decrease in levels of anxiety and depression. However, given that there were multiple interacting components of therapy in the

context of an intensive holistic program, it is unclear which aspects of the intervention contributed to the client's improved self-concept.

### *Family-based support*

Only two studies evaluated the impact of family-based support on self-concept, including one RCT (Sinnakaruppan et al. 2005) and a non-randomised group study (Kelly et al., 2013).

Sinnakaruppan et al. (2005) evaluated the efficacy of an 8-session group educational program run separately for participants with TBI and their family members. The programs for both focused on understanding and managing memory and executive impairments and emotional changes (anger, depression and anxiety) following TBI. Other issues that may have impacted on the relationship between participants with TBI and their caregivers were not concurrently addressed. Nevertheless, participants with TBI in the group educational program displayed significantly higher self-esteem (RSES) at post-intervention than wait list controls. Further, significant improvements in emotional functioning and self-esteem between pre-assessment and 3-months follow-up were found for participants with TBI in the educational program group but not controls. However, self-esteem was significantly lower at baseline for the educational program group relative to controls, and this difference was not controlled for in the analysis.

Kelly and colleagues (2013) evaluated the efficacy of a family-based group intervention aimed at improving self-concept in people with brain injury ( $n = 41$ ). The inclusion of an age and gender matched healthy control group was designed to monitor stability in self-concept over the intervention period. The McFarlane Multifamily Group intervention was conducted over 12 weeks with 6-8 caregiver and patient dyads per group. The sessions combined psychoeducation on the effects of brain injury and its impact on families with coping and problem-solving skills training for both people with brain injury and their family members. Self-concept was assessed pre- and post-intervention using both a multi-domain measure

(Tennessee Self-Concept Scale [TSCS]; Fitts & Warren, 1996) and a global scale (RSES).

Adopting a rigorous statistical approach (two-way MANOVA), the authors identified no significant group-by-time interactions for domain-specific or global self-concept.

### *Cognitive rehabilitation*

Two RCTs (Helffenstein & Wechsler, 1982; Rath et al., 2003) and one pre-post group study (McGuire & Greenwood, 1990) assessed the impact of cognitive rehabilitation on self-concept. Rath et al. (2003) compared the efficacy of a 24 session problem-solving skills group ( $n = 27$ ) with conventional group rehabilitation ( $n = 19$ ) for people with mild to severe TBI. The intervention intensity was controlled, with a combination of two hours of group therapy and one individual support session each week for each group. Within-group analyses indicated that only those in the problem-solving group showed significant gains in global self-esteem (RSES) and problem-solving skills. However, the change in self-esteem represented a very small effect (Cohen's  $d = .22$ ) in the context of numerous methodological weaknesses (PEDro rating = 1/10; see Table 2).

Helffenstein and Wechsler (1982) evaluated the effectiveness of 20 individual sessions of “interpersonal process recall” (IPR) or feedback on videotaped social interaction and strategy development relative to an attention control condition. Only the IPR group reported significant improvements in global self-concept and social and moral self-concept (as measured by the TSCS) in addition to greater interpersonal and communication skills. Although blinding of assessors was conducted, the study is limited by key methodological weaknesses (i.e., lack of baseline comparability and between-group analyses; see Table 2).

McGuire and Greenwood (1990) used a pre-post design to investigate the efficacy of an individual memory retraining program ( $n = 18$ ). The six week program involved a combination of computerized memory games and “one-to-one work and attention”. The authors reported a significant improvement in self-esteem (RSES) and objective memory

performance and a significant reduction in relative's burden following the intervention. Aside from the lack of control group, participants were concurrently receiving nootropic medication, thus making it difficult to establish the contribution of the cognitive intervention to these findings.

#### *Activity-based intervention*

Three RCTs, one pre-post group study and a case series evaluated the impact of activity-based interventions. Driver et al. (2006) evaluated the impact of tri-weekly sessions of aquatic exercise (aerobic and resistance training) for eight weeks. The intervention targeted health promoting behaviours and commenced with a pre-program assessment to identify participants' exercise preferences and intensity. Within-group analyses identified significant improvements in self-esteem and physical self-concept on the Physical Self-Description Questionnaire (PSDQ; Marsh, 1996) for the aquatic exercise group only. However, there was no follow-up assessment to investigate maintenance of these gains. Further, between-group analysis of baseline and post-intervention differences was not conducted and assessors were not blind to intervention condition.

Gemmell and Leathem (2006) evaluated the efficacy of traditional Tai Chi exercise undertaken over 12 sessions for 45 minutes each. Instructors were positioned around the room to help participants learn the breathing and stepping techniques. Results of within-group analysis showed significant improvement in mood, assessed using the Visual Analogue Scales, after the intervention for those in the Tai Chi group. However, there was no significant change in self-esteem on the RSES or physical and mental health on the MOS SF-36. Focusing on lower intensity exercise, Blake and Batson (2009) evaluated the efficacy of a brief (8 hours) Tai Chi Qigong intervention — a Chinese mindfulness-based exercise program (relaxation, mind and breathing exercises, body posture and movement) that is less physically and cognitively demanding than Tai Chi. Although there was no significant



difference in self-esteem between the Tai Chi Qigong group and active control condition (i.e., non-exercise based social and leisure activities) at post-assessment, secondary analyses identified significant within-group improvements in self-esteem (PSDQ) and mood for the Tai Chi Qigong group only.

Two Level 4 studies provide some further evidence of the beneficial effects of exercise and active recreation for self-concept. Fines and Nichols (1994) conducted a 12 week kayaking program (1 x 60-90 minute session per week) for 8 participants with TBI. Kayaking was chosen due to its potential to improve neuro-muscular skills, range of motion, strength, endurance, self-esteem and behavioural control. After the program participants reported significantly higher self-concept across all scales of the TSCS (e.g., Physical Self, Social Self, Behavior and Identity) and enhanced leisure satisfaction. However, the lack of control group and absence of a follow-up assessment limit the utility of these findings. In a recent case series ( $n = 4$ ), Schwandt, Harris, Thomas, Keightly, Snaiderman and Colantonio (2012) examined the efficacy of an intensive aerobic exercise program (3 sessions x 12 weeks). Participants chose one type of aerobic exercise (treadmill, stepping, cycle ergometer) which was undertaken for 30 minutes after which they engaged in cool down exercises. All four participants reported an improvement in self-esteem after the intervention, with a 3 to 15 point reduction in RSES scores (where higher scores reflect poorer self-esteem), in addition to improved fitness, mood and social contact.

### **Review Summary**

While 17 studies met eligibility criteria, only 10 studies were found to be associated with improvement in self-concept; albeit from less rigorous within-group analysis or pre-post comparisons. The review yielded mixed findings on the whole, limiting the strength of conclusions that can be drawn on the impact of brain injury rehabilitation on self-concept. There are various factors that might account for these inconsistent findings. First, as the

PEDro ratings in Table 2 indicate, the differences in methodological quality across studies were numerous. Second, the sample characteristics were relatively heterogeneous and participant numbers differed markedly across the studies. Notably, among the RCTs, sample sizes ranged from 16 to 60 participants and TBI severity and chronicity varied both within and across studies. To illustrate, in Blake and Batson's (2009) study, TBI severity ranged from mild to severe and chronicity varied between 2 and 40 years, while Anson and Ponsford's (2006) sample included only participants with severe TBI, and the majority (i.e., 74%) had sustained their injuries within the previous two years. Third, despite the majority of the RCTs including a follow-up assessment, which ranged from three weeks (Gemmell & Leathem, 2006) to between 6 months and two years (Anson & Ponsford, 2006), this rarely included measurement of self-concept.

Perhaps most noteworthy was the lack of consistency in self-concept measures employed. Six different measures of self-concept were employed across the 17 studies reviewed; namely, the RSES, CSEI, TSCS, PSDQ, HISD and RSCQ. As shown in Table 4, these tools differ in both format and the aspects of self-concept assessed (i.e., global self-concept, multi-dimensional or domain-specific). Although most of these are generic measures that are well validated for the general population, only the HISD was specifically designed, and has undergone rigorous psychometric analysis, for the TBI population (see Table 4). The present review provides evidence from two RCTs to support the sensitivity of the PSDQ, including the full 11 subscale version (Blake & Batson, 2009) and modified six subscale version (Driver et al., 2006) for detecting changes in self-esteem in response to intervention after TBI. However, evidence of sensitivity is mixed for the RSES, and insufficient for the CSEI, TSCS, HISD and RSCQ.

## Discussion

In general, bearing in mind the variable methodological quality, there was some support for the effectiveness of cognitive rehabilitation (interpersonal feedback, problem-solving skills training and memory rehabilitation) for improving self-concept from two RCTs (Helffenstein & Wechsler, 1982; Rath et al., 2003) and one pre-post group study (McGuire & Greenwood, 1990). For activity-based interventions specifically, there was evidence from two RCTs (Blake & Batson, 2005; Driver et al., 2006), one pre-post group study (Fines & Nichols, 1994) and a case series (Schwandt et al., 2012) that exercise and active leisure were helpful in improving self-concept after TBI. There was also some evidence of improvement in self-concept in an RCT of family-based support (Sinnakaruppan et al., 2005), and a case study of psychotherapy (Ashworth et al., 2011). While another five RCTs found positive effects in the functional domain targeted by the intervention (Anson & Ponsford, 2006; Gemmell & Leathem, 2006; Hodgson et al., 2005; Medd & Tate, 2000; Simpson et al., 2011), this did not generalize to global self-concept.

Importantly, evidence of significant improvement in self-concept was often domain-specific, found on measures such as the PSDQ, which assesses multiple domains of physical self-concept (Blake & Batson, 2009; Driver et al., 2006), and the TSCS (Helffenstein & Wechsler, 1982) which maps more directly onto the skill domains and competencies targeted in those particular interventions. Further, interventions associated with significant gains often involved more intensive training over a lengthy period, such as tri-weekly sessions for 8 weeks (i.e., Driver et al., 2006) or 48 sessions combining group and individual training to enable wider skills application in different contexts (Rath et al., 2003). Such rigorous training may have facilitated and reinforced a shift in more global perceptions about the self. Yet, the durability of these post-treatment changes in self-concept is unknown due either to the lack, or insufficient reporting, of follow-up assessment data.

### **Review Limitations**

A major limitation of this review is that most studies examined self-concept as a distal outcome measure for purposes of generalisability, rather than as the primary outcome or domain of intended focus. Whether it is reasonable to expect changes to global or even domain-specific self-concept measures following such interventions targeting other skills and behaviours (e.g., training in anger management) can certainly be questioned. Furthermore, only studies that employed a validated quantitative measure of self-concept were eligible for review. Such measures focus on perceived competencies or attributes which, arguably, provide a somewhat narrow characterisation of the self which fails to recognise contextual influences on the dynamic interrelationships between self-understanding and perceived competencies. Related to this point, the review focused on studies that employed quantitative methods to evaluate rehabilitation outcomes. Qualitative approaches, such as guided self-reflection within therapy sessions (e.g., Ownsworth, Turpin, Andrew & Fleming, 2008) and in-depth interviews (e.g., Dirette, 2002; Kristensen, 2004), may provide greater scope to explore changes to self-understanding in the context of rehabilitation. The application of mixed methods (i.e., qualitative and quantitative approaches) to outcome evaluation in brain injury rehabilitation is relatively uncommon (see Kreutzer, Stejskal, Godwin, Powell, Arango-Lasprilla, 2010; Turner-Stokes, 2008), and represents a promising approach to investigating changes to sense of self in future intervention studies.

Given these limitations the present review findings regarding the impact of brain injury rehabilitation on self-concept should be viewed as preliminary. Nonetheless, the review raises some important clinical implications; key among these being the need for greater attention to identity change processes in response to rehabilitation. However, to succeed in this endeavour, there is a need for theory-derived approaches to assessment and intervention. We

consider both these points in the next section in the course of providing some new directions for assessing and facilitating identity change after TBI.

### **Theory-derived Approaches to Identity-Oriented Assessment and Intervention**

Despite the review's mixed findings, there was some evidence that brain injury rehabilitation enhanced people's feelings of self-worth and perceived competence in domain-specific areas (e.g., Blake & Batson, 2009; Driver et al., 2006; Helffenstein & Wechsler, 1982). However, the implications of these domain-specific changes for identity reconstruction following TBI are unclear. Theoretically, Marsh and colleagues (Marsh, Byrne & Shavelson, 1992) have suggested that sense of self develops in a hierarchical and multi-dimensional manner with lower level self-evaluations (e.g., self-perceptions of behaviour in specific situations) having a bottom-up influence on domain-specific subareas and self-concepts, which in turn contribute to higher-level self-representations (see Figure 2). Drawing on this model, it could be argued that where rehabilitation helps people to develop their sense of competence in multiple domains (e.g., physical, social, behavioural, cognitive, academic) this might offer an initial base from which to enhance one's global self-concept (Harter, 2012). Clearly, the range of factors that contribute to overall self-evaluation goes well beyond these particular domains of competence. Moreover, due to their subjective weighting of importance, there is a need to understand how different domains of competence contribute to global self-understanding (Ownsworth, 2014; Vickery et al., 2006). Qualitative research by Douglas (2013) conceptualised self-concept after TBI as an ongoing process of appraising the outcomes of self-defined goals. Therefore, sense of self is closely tied to one's capacity to gain competence sufficient to meet personally meaningful goals.

As shown in Figure 2, we have extended the hierarchical model of self-concept (Marsh et al., 1988), to recognise the bi-directional influences of bottom-up and top-down processes in identity reconstruction. As Marsh and colleagues argue, lower level self-

evaluations of behaviour or task performance have a bottom-up influence on domain-specific self-concepts, which in turn inform one's global self-concept. However, higher level self-representations also have a top-down influence on self-understanding, because these shape and guide lower level thoughts and behaviours in salient situations. For example, a higher level representation of self as someone who is *strong and resilient as an oak tree in a storm* is likely to encourage increased effort and persistence during a challenging task. Similarly, seeing oneself (or self-categorizing) as someone with a brain injury, is likely to influence thoughts and behaviour when facing a stressful situation; for example, the decision to seek support from one's brain injury rehabilitation team or a brain injury support group. In turn, the self-appraised outcomes of these situations (e.g., perceptions of coping efforts) may serve to strengthen or consolidate one's global self-concept (Douglas, 2013; Ownsworth, 2014).

Particularly relevant to conceptualisation of self in the wider brain injury literature is recent work on the impact of brain injury **on** one's social identity (Jones, Haslam, Jetten, Williams, Morris, & Saroyan, 2010; Walsh, Fortune, Gallagher, & Muldoon, 2012) — that part of the self derived from one's membership of meaningful social groups (e.g., family, work, community, sporting, and leisure groups). A key notion in Social Identity Theory (Tajfel & Turner, 1979; Turner, 1982) is that we define ourselves not just in personal (as “I” and “me”), but also in social (as “us” Taylors or cyclists) terms. These social group memberships are important for a range of reasons, and most notably because they inform our values and behaviour, and provide a valuable source of health-enhancing support under conditions of life change (Haslam, Jetten, & Haslam, 2012; Jetten, Haslam, Haslam, Dingle & Jones, 2014). It is well recognised that brain injury can lead to significant loss and change in social relationships, and it is only when we understand how central they are to self-definition, that we can start to understand why such loss affects people so deeply.

Interestingly, while socially derived identity was not the focus of any of the studies reviewed, there is some indirect evidence that social identity may have played a role in producing changes in self-concept. The RCT by Sinnakaruppan et al. (2005) highlights the importance of incorporating people's social network — in this case the family — in their intervention of psycho-education. Although not couched in social identity terms, the focus on increasing both self-understanding and family caregivers' understanding of cognitive and emotional changes that result from TBI may have created a more supportive social environment from which to build one's self-esteem and self-concept. Klonoff (2010) similarly highlighted the importance of involving the family in rehabilitation to reinforce people's "renewed sense of identity, hope and meaning" (p. 2). From a social identity perspective, though, it may not simply be supportive reinforcement that the family provide, but a sense of self-continuity that is gained from maintaining important relationships. Indeed, such social identity continuity has been shown to be an important factor in recovery from stroke (Haslam et al., 2008).

The above analysis raises an important question. As the majority of studies reviewed delivered interventions in a social context, one might reasonably ask what the contribution of social factors was to these self-concept outcomes. Identification with others that develops through joining new social groups can provide a positive means to redefine the self after brain injury (see Jones, Jetten, Haslam & Williams, 2012). It can also provide motivation to change behaviour and contribute to the welfare of others in the group. Nevertheless, it is difficult to establish the role of social processes here given the methodologies used, and future research directly comparing individual and group delivery of brain injury rehabilitation would help to determine the importance of social factors. What is evident in the RCT data in particular, is that 57% of interventions delivered in a social context (either because the intervention was group-based or involved an activity that occurred in a wider social context

e.g., Tai Chi Qigong, kayaking) produced an improvement in self-concept, whereas only 33% of individually delivered interventions achieved the same outcome.

Designing interventions to facilitate identity reconstruction and improve self-concept after TBI is complex because the injury itself can disrupt the neural connectivity and associated cognitive and emotional processes that support the self (Feinberg, 2011). The ability to reflect on one's current self and perceived changes to self over time is supported by an integrated neural circuitry involving subcortical and cortical midline structures (i.e., anterior cingulate, insula and medial prefrontal cortex; D'Argembeau et al., 2008). Cognitive deficits that arise from TBI, particularly impairments in attention, memory, language, online monitoring and control processes, affect people's ability to attend to, make sense of, and assimilate their everyday experiences into their self-concept (Ownsworth, 2014).

Technological aids are increasingly being used in brain injury rehabilitation to support people to remember and act upon their intentions, achieve their goals and recall salient experiences (e.g., Berry et al., 2009; Brindley, Bateman & Gracey, 2011; Culley & Evans, 2010).

External cueing devices (e.g., mobile phones and paging systems) and retrospective memory aids such as SenseCam (Berry et al., 2009) have been found to support prospective remembering and autobiographical recall. These may offer an important advance on existing interventions to help re-build sense of identity after TBI, but they have yet to be evaluated in this context.

Consistent with the notion of bi-directional influences in identity reconstruction depicted in Figure 2, Gracey, Evans and Malley (2009) proposed that rehabilitation facilitates identity change through a dynamic process of *updating* one's identity (i.e., recognising both change and continuity with one's pre-injury self) and *consolidating* the new identity through meaningful activities and social participation (Gracey et al., 2009). Similarly, Ylvisaker and colleagues (Ylvisaker & Feeney, 2000; Ylvisaker et al., 2008) emphasised the importance of



supporting people to re-establish an “organised” and “compelling” identity that is realistic in terms of the person’s brain injury and life situation (Ylvisaker et al., 2008). Here it is argued that rehabilitation goals need to be driven by higher level self-representations that inform who I am and who I want **to be** to be both personally meaningful and worth striving for. The therapeutic technique of metaphoric identity mapping (MIM; see Ylvisaker et al., 2008) has been found to be effective for engaging clients in such goal setting (McPherson, Kayes & Weatherall, 2009). Ylvisaker and Feeney (2000) advocated the combined use of MIM and project-based learning (PBL) as part of their person-centred and context-sensitive intervention approach (Feeney & Capo, 2010). Feedback derived from daily interactions and task performance (see the bottom of Figure 2) can affirm personal abilities and foster a sense of belonging, contribution and self-worth (Gracey & Ownsworth, 2012; Ownsworth, 2014). The use of individual and group projects to apply new skills and gain feedback has been described by many authors (see Feeney & Capo, 2010; Wilson et al., 2009; Ylvisaker et al., 2008), but remains an important area for future controlled intervention studies. The emphasis of MIM and PBL on meaningful engagement and improving functionality is consistent with positive psychology principles and other values-based interventions which also have the potential to support identity reconstruction for this population (see reviews by Evans, 2011; Kangas & McDonald, 2011).

Social identity mapping (SIM) offers another intervention that targets the social aspects of self directly (Jetten, Haslam, Iyer, & Haslam, 2009; Best et al., 2014). Theoretically, it draws on social identity frameworks, and the Social Identity Model of Identity Change in particular (Iyer, Jetten, Tsivrikos, Postmes, & Haslam, 2009; Jetten et al., 2009; Jetten & Pachana, 2012), which recognises the importance of people’s multiple group memberships, their continuity and basis for development of new groups to maintain a coherent sense of self when experiencing life change. The mapping process involves people

identifying the social groups that they belong to, their importance and their compatibility. This information is then used to illustrate the person's social group networks to raise awareness of those groups that contribute most to a person's self-definition — through illustrating which have the most capacity for influence, and from whom support is most likely to be sought and given. SIM has been used therapeutically to help people understand identity changes arising from stroke (by comparing before and after maps, see Jetten et al., 2009) and in recovery from substance dependence (Best et al., 2014). It has yet to be trialled in other populations and in TBI specifically, but offers a theoretically-derived approach that directly addresses the social self.

This systematic review clearly highlights the need for well-designed controlled intervention studies with a primary focus on improving self-concept. As represented in Figure 2, such studies need to take into account the hierarchical and dynamic relationships between lower- and higher-level self-representations in identity reconstruction and design rehabilitation approaches according to the levels on which the intervention is aiming to facilitate change. This may relate to self-perception of behaviour in specific situations, domain-specific self-concepts (e.g., abilities, attributes or group memberships), or global self-concept and higher level self-representations. Further, the ability to detect meaningful changes in response to intervention depends on reliable and validated tools for this population. Currently, the RSES is the most commonly employed measure of global self-esteem (e.g., Anson & Ponsford, 2006; Kelly et al., 2013; Ponsford et al., 2014) and has demonstrated reliability and construct validity for this population (see Table 4). However, to date, there has been little support for the tool's sensitivity to change in the context of intervention. The HISD has most frequently been used to assess pre- and post-injury changes in emotional and behavioural self-concept (i.e., self-discrepancy), and can depict patterns of stability (self-continuity) and change (discontinuity of self) across different psychological

attributes. Douglas's (2013) research on identity change following TBI highlights the need to examine both self-knowledge (who I am) and self-evaluation (how I feel about myself) components of the self-system and how these perceptions are influenced by goal attainment. For a more comprehensive representation of self, there is also a need to acknowledge and measure changes that TBI produces in the socially derived self and how these impact on adjustment, for which SIM provides a possible direction and solution.

### **Conclusions**

This review highlighted how facilitating self-identity reconstruction is an integral process in rehabilitation to support people with TBI to live fulfilled and meaningful lives. Our exploratory systematic review found generally mixed evidence concerning the benefits of brain injury rehabilitation for improving self-concept after TBI. There were a number of limitations to the review, most notably with measurement of self-concept and its use as a secondary outcome measure, which impacts on the strength of the conclusions that can be drawn. Nevertheless, with some evidence of positive change in response to rehabilitation, there is a case to prioritise identity change processes and investigate these more systematically. Drawing on theories of identity development and reconstruction, we provide some novel directions to pursue this agenda in facilitating identity change after TBI. Well designed and controlled evaluation of identity-oriented interventions represents a priority for future research in TBI.

## References

- Allport, G. W. (1961). *Pattern and growth in personality*. New York: Holt, Rinehart and Winston.
- Andrews, T. K., Rose, F. D., & Johnson, D. A. (1998). Social and behavioural effects of traumatic brain injury in children. *Brain Injury, 12*, 133-138.
- Anson, K., & Ponsford, J. (2006). Evaluation of a coping skills group following traumatic brain injury. *Brain Injury, 20*, 167-178.
- Ashworth, F., Gracey, F., & Gilbert, P. (2011). Compassion focused therapy after traumatic brain injury: Theoretical foundations and case illustration. *Brain Impairment, 12*, 128-139.
- Backhaus, S. L., Ibarra, S. L., Klyce, D., Trexler, L. E., & Malec, J. F. (2010). Brain injury coping skills group: A preventative intervention for patient with brain injury and their caregivers. *Archives of Physical Medicine and Rehabilitation, 91*, 840-848.
- Ben-Yishay, Y., & Diller, L. (2011). *Handbook of holistic neuropsychological rehabilitation*. New York: Oxford University Press.
- Berry, E., Hampshire, A., Rowe, J., Hodges, S., Kapur, N., Watson, P., ... Owen, A. (2009). The neural basis of effective memory therapy in a patient with limbic encephalitis. *Journal of Neurology, Neurosurgery, and Psychiatry, 80*, 1202-1205.
- Best, D., Lubman, D., Savic, M., Wilson, A., Dingle, G., Haslam, S.A., Haslam, C., & Jetten, J. (2014). Social and transitional identity: Exploring social networks and their significant in a therapeutic community setting. *Therapeutic Communities: The International Journal of Therapeutic Communities, 35*, 10-20.
- Blake, H., & Batson, M. (2009). Exercise intervention in brain injury: a pilot randomized study of Tai Chi Qigong. *Clinical Rehabilitation, 23*, 589-598.

- Bowen, C., Yeates, G., & Palmer, S. (2010). *A Relational Approach to Rehabilitation: Thinking about Relationships after Brain Injury*. London: Karnac Books.
- Brenner, L. A., Braden, C. A., Bates, M., Chase, T., Hancock, C., Harrison-Felix, C., ... Staniszewski, K. (2012). A health and wellness intervention for those with moderate to severe traumatic brain injury: a randomized controlled trial. *Journal of Head Trauma Rehabilitation, 27*, 57-68.
- Bryan-Hancock, C. and Harrison, J.E. (2010). The global burden of disease project 2005 methods utilised by the injury expert group for estimating world-wide incidence and prevalence rates. In *Injury Prevention*. Buxton, UK: BMJ Publishing Group. Safety 2010 World Conference: 10th World Conference on Injury Prevention and Safety Promotion. London. Sep 2010, pp. A99-A99. [[doi: 10.1136/ip.2010.029215.356](https://doi.org/10.1136/ip.2010.029215.356)]
- Brindley, R., Bateman, A., Gracey, F. (2011) Exploration of use of SenseCam to support autobiographical memory retrieval within a cognitive behavioural therapeutic intervention following acquired brain injury. *Memory, 19*, 745-757.
- Carroll, E., & Coetzer, R. (2011). Identity, grief and self-awareness after traumatic brain injury. *Neuropsychological Rehabilitation, 21*, 289-305.
- Cattelani, R., Zettin, M. & Zoccolotti, P. (2010). Rehabilitation treatments for adults with behavioral and psychosocial disorders following acquired brain injury: A systematic review. *Neuropsychological Review, 20*, 52-85.
- Cicerone, K. D., Langenbahn, D. M., Braden, C., Malec, J. F., Kalmar, K., Fraas, M., ... Ashman T. (2011). Evidence-based cognitive rehabilitation: updated review of the literature from 2003 through 2008. *Archives of Physical Medicine and Rehabilitation, 92*, 519-530
- Cicerone, K. D., Mott, T., Azulay, J., Sharlow-Galella, M. A., Ellmo, W. J., Paradise, S.,

- Friel, J. C. (2008). A randomized controlled trial of holistic neuropsychologic rehabilitation after traumatic brain injury. *Archives of Physical Medicine Rehabilitation, 89*, 2239-49.
- Cooper-Evans, S., Alderman, N., Knight, C., & Oddy, M. (2008). Self-esteem as a predictor of psychological distress after severe acquired brain injury: An exploratory study. *Neuropsychological Rehabilitation, 18*, 607-626.
- Coopersmith, S. (1989). *Self-esteem inventories*. Palo Alto, CA: Consulting Psychologists Press.
- Corrigan, J. D., Selassie, A. W., & Orman, J. A. (2010). The epidemiology of traumatic brain injury. *Journal of Head Trauma Rehabilitation, 25*, 72-80.
- Culley, C., & Evans, J. J. (2010). SMS text messaging as a means of increasing recall of therapy goals in brain injury rehabilitation: A single-blind within-subjects trial. *Neuropsychological Rehabilitation, 20*, 103–119.
- D'Argembeau, A., Feyers, D., Majerus, S., Collette, F., Van der Linden, M., Maquet, P., & Salmon, E. (2008). Self-reflection across time: cortical midline structures differentiate between present and past selves. *Social Cognitive and Affective Neuroscience, 3*, 244-252.
- Dirette, D. (2002). The development of awareness and the use of compensatory strategies for cognitive deficits. *Brain Injury, 16*, 861–871.
- Doering, B. K., Conrad, N., Rief, W., & Exner, C. (2011). Living with acquired brain injury: Self-concept as a mediating variable in the adjustment process. *Neuropsychological Rehabilitation, 21*, 42-63.
- Douglas, J.M. (2013) Conceptualizing self and maintaining social connection following severe traumatic brain injury. *Brain Injury, 27*, 60-74.
- Driver, S., O'Connor, J., Lox, C., & Rees, K. (2003). Effect of an aquatics program on

- psychosocial parameters of individuals with brain injuries. *Journal of Cognitive Rehabilitation*, 21, 22–31.
- Driver, S., Rees, K., O'Connor, J., & Lox, C. (2006). Aquatics, health-promoting self-care behaviors and adults with brain injuries. *Brain Injury*, 20, 133-141.
- Evans, J. (2011). Positive psychology and brain injury rehabilitation. *Brain Impairment*, 12, 117-127.
- Feeney, T. J., & Caporaso, M. (2010). Making meaning: The use of project-based supports for individuals with brain injury. *Journal of Behavioral and Neuroscience Research*, 8, 70-80.
- Feinberg, T. E. (2011). Neuropathologies of the self: Clinical and anatomical features. *Consciousness and Cognition*, 20, 75-81.
- Fines, L., & Nichols, D. (1994). An evaluation of a twelve week recreational kayak program: effects on self-concept, leisure satisfaction and leisure attitude of adults with traumatic brain injuries. *Journal of Cognitive Rehabilitation*, 12, 10-15.
- Fitts, W. H., and Warren, W. L. (1996). *Tennessee self-concept scale, TSCS:2 (2nd edition)* [manual]. Los Angeles: Western Psychological Services.
- Gelech, J. M., & Desjardins, M. (2011). I am many: The reconstruction of self following acquired brain injury. *Qualitative Health Research*, 21, 62-74.
- Gracey, F., Evans, J. J., & Malley, D. (2009). Capturing process and outcome in complex rehabilitation interventions: A "Y-shaped" model. *Neuropsychological Rehabilitation*, 19, 867-890.
- Gracey, F., Ownsworth, T. (2012). The experience of self in the world: the personal and social contexts of identity change after brain injury. In J. Jetten, C. Haslam & S.A. Haslam (Eds.), *The Social Cure* (pp. 273-295). London: Psychology Press.

- Gracey, F., Palmer, S., Rous, B., Psaila, K., Shaw, K., O'Dell, J., Cope, J., & Mohamed, S. (2008). "Feeling part of things": Personal construction of self after brain injury. *Neuropsychological Rehabilitation, 18*, 627-50.
- Harter, S. (2012). *The construction of the self* (2<sup>nd</sup> edition). New York: The Guilford Press.
- Haslam, C, Holme, A, Haslam, S. A, Iyer, A, Jeyyen, J, & Williams, W. H. (2008). Maintaining group memberships: Social identity continuity predicts well-being after stroke. *Neuropsychological Rehabilitation, 18*, 671-691.
- Haslam, C., Jetten, J., & Haslam, S.A. (2012). Advancing the social cure: Implications for theory, practice and policy. In J. Jetten, C. Haslam & S.A. Haslam (Eds.), *The social cure: Identity, health and well-being* (pp. 319-343). London: Psychology Press.
- Hawley, C. A. (2012). Self-esteem in children after traumatic brain injury: An exploratory study. *NeuroRehabilitation, 30*, 173-181.
- Helffenstein, D. A., & Wechsler, F. S. (1982). The use of interpersonal process recall (IPR) in the remediation of interpersonal and communication skill deficit in the newly brain-injured. *Clinical Neuropsychology, 4*, 139-43.
- Hodgson, J., McDonald, S., Tate, R., & Gertler, P. (2005). A randomised controlled trial of a cognitive-behavioural therapy program for managing social anxiety after acquired brain injury. *Brain Impairment, 6*, 169-80.
- Howes, H., Edwards, S., & Benton, D. (2005). Male body image following acquired brain injury. *Brain Injury 19*, 135-47
- Hsieh, M., Ponsford, J.L., Wong, D.K., Schönberger, M., Taffe, J.R., McKay, A.J.D., (2012) Motivational interviewing and cognitive behaviour therapy for anxiety following traumatic brain injury: a pilot randomised controlled trial, *Neuropsychological Rehabilitation, 22*, 585-608.
- Iyer, A., Jetten, J., Tsivrikos, D., Postmes, T., & Haslam, S.A. (2009). The more (and the



more compatible) the merrier: Multiple group memberships and identity compatibility as predictors of adjustment after life transitions. *British Journal of Social Psychology*, 48, 707-733.

Jetten, J., Haslam, C., Haslam, S.A., Dingle, G., & Jones, J.J. (2014). How groups affect our health and well-being: The path from theory to policy. *Social Issues and Policy Review*, 8, 103-130.

Jetten, J., Haslam, S.A., Iyer, A., & Haslam, C. (2009). Turning to others in times of change: Social identity and coping with stress. In S. Stürmer, & M. Snyder, M. (Eds.), *The psychology of prosocial behavior: Group processes, intergroup relations, and helping* (pp. 139-156). Oxford, UK: Blackwell.

Jetten, J., & Pachana, N.A. (2012). Not wanting to grow old: A Social Identity Model of Identity Change (SIMIC) analysis of driving cessation among older adults. In J. Jetten, C. Haslam & S.A. Haslam (Eds.), *The social cure: Identity, health and well-being* (pp. 97-114). London: Psychology Press.

Jones, J. M., Jetten, J., Haslam, S. A., & Williams, W. H. (2012). Deciding to disclose: The importance of maintaining social relationships for well-being after acquired brain injury. In J. Jetten, C. Haslam, & S. A. Haslam (Eds.), *The social cure: Identity, health and well-being* (pp. 255-272). London: Psychology Press.

Jones, J.M., Haslam, S.A., Jetten, J., Williams, W.H., Morris, R., & Saroyan, S. (2010). That which doesn't kill us can make us stronger (and more satisfied with life): The contribution of personal and social changes to well-being after brain injury. *Psychology and Health*, 26, 353-69.

Jumisko, E., Lexell, J., & Soderberg, S. (2005). The meaning of living with traumatic brain injury in people with moderate or severe traumatic brain injury. *Journal of Neuroscience Nursing*, 37, 42-50.

- Kangas, M., & McDonald, S. (2011). Is it time to act? The potential of acceptance and commitment therapy for psychological problems following acquired brain injury. *Neuropsychological Rehabilitation, 21*, 250-276.
- Kelly, A., Ponsford, J., & Couchman, G. (2013). Impact of a family-focused intervention on self-concept after acquired brain injury. *Neuropsychological Rehabilitation, 23*, 563-579.
- Klonoff, P. S. (2010). *Psychotherapy after brain injury*. New York: The Guilford Press.
- Kreutzer, J., Stejskal, T., Godwin, E., Powell, V., & Arango-Lasprilla, J. (2010). A mixed methods evaluation of the brain injury family intervention. *NeuroRehabilitation, 27*, 19-29.
- Krefting, L. (1989). Reintegration into the community after head injury: The results of an ethnographic study. *Occupational Therapy Journal of Research, 9*, 67-83.
- Kristensen, O. S. (2004). Changing goals and intentions among participants in a neuropsychological rehabilitation programme: An exploratory case study evaluation. *Brain Injury, 18*, 1049–1062.
- Lemmon, J., LaTourrette, D., & Hauver, S. (1996). One year outcome study of outward bound experience on the psychosocial functioning of women with mild traumatic brain injury. *Journal of Cognitive Rehabilitation, 14*, 18-23.
- Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., ... Moher, D. (2009). The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. [PLoS Med 6\(7\): e1000100. doi:10.1371/journal.pmed.1000100](https://doi.org/10.1371/journal.pmed.1000100)
- Longworth, C., Deakins, J., Rose, D., & Gracey, F. (2012). Exploring the nature of self-

esteem after Acquired Brain Injury. Paper presented at the 9<sup>th</sup> Annual Conference of the Neuropsychological Rehabilitation Special Interest Group of the World Federation of Neurorehabilitation, July 2-3, Bergen, Norway.

- Maher, C. G., Sherrington, C., Herbert, R., Moseley, A., & Elkins, M. (2003). Reliability of the PEDro scale for rating quality of randomized controlled trials. *Physical Therapy*, 83, 713–721.
- Manchester, D., Wall, G., Dawson, P., & Jackson, H. (2007). A forensic peer group approach to bullying after traumatic brain injury. *Neuropsychological Rehabilitation*, 17, 206-229.
- McGuire, B. E., & Greenwood, R. J. (1990). Effects of an intervention aimed at memory on perceived burden and self-esteem after traumatic head injury. *Clinical Rehabilitation*, 4, 319-323.
- McPherson, K., M., Kayes, N., & Weatherall, M. (2009). A pilot study of self-regulation informed goal setting in people with traumatic brain injury. *Clinical Rehabilitation*, 23, 296-309.
- Marsh, H. W. (1996). Physical self-description questionnaire: Stability and discriminant validity. *Research Quarterly for Exercise and Sport*, 67, 249–264.
- Marsh, H. W., Byrne, B. M., & Shavelson, R. J. (1992). A multi-dimensional, hierarchical self-concept. In T. M. Brinthaupt & R. P. Lipka (Eds.), *The self: Definitional and methodological issues* (pp. 44-95). Albany: State University of New York Press.
- Medd, J., & Tate, R. (2000). Evaluation of an anger management therapy programme following acquired brain injury: A preliminary study. *Neuropsychological Rehabilitation*, 10, 185-201.
- Muenchberger, H., Kendall, E., & Neal, R. (2008). Identity transition following traumatic

- brain injury: A dynamic process of contraction, expansion and tentative balance. *Brain Injury*, 22, 979-992.
- Nochi, M. (1997). Dealing with the "Void": Traumatic brain injury as a story. *Disability & Society*, 12, 533-555.
- Nochi, M. (1998). "Loss of self" in the narratives of people with traumatic brain injuries: A qualitative analysis. *Social Science and Medicine*, 7, 869-78.
- Nochi, M. (2000). Reconstructing self-narratives in coping with traumatic brain injury. *Social Science and Medicine*, 51, 1795-804.
- OCEBM Levels of Evidence Working Group (2011). The Oxford 2011 Levels of Evidence. Oxford Centre for Evidence-Based Medicine.  
<http://www.cebm.net/index.aspx?o=5653>
- Owensworth, T. (2014). *Self-identity after brain injury*. Hove, UK: Psychology Press.
- Owensworth, T. L., Turpin, M., Andrew, B., & Fleming, J. (2008). Participant perspectives on an individualised self-awareness intervention following stroke: A qualitative case study. *Neuropsychological Rehabilitation*, 18, 692-712.
- Prigatano, G.P. (1999). *Principles of neuropsychological rehabilitation*. New York: Oxford University Press.
- Ponsford, J., Kelly, A., & Couchman, G. (2014). Self-concept and self-esteem after acquired brain injury: A control group comparison. *Brain Injury*, 28, 146-154.
- Rath, J. F, Simon, D, Langenbahn, D. M, Sherr, R. L, & Diller, L. (2003). Group treatment of problem-solving deficits in outpatients with traumatic brain injury: A randomised outcome study. *Neuropsychological Rehabilitation*, 13(4), 461-488.
- Riley, G. A, Dennis, R. K, & Powell, T. (2010). Evaluation of coping resources and self-esteem as moderators of the relationship between threat appraisals and avoidance of

activities after traumatic brain injury. *Neuropsychological Rehabilitation*, 20, 869-882.

- Robson, P. (1989). Development of a new self-report questionnaire to measure self-esteem. *Psychological Medicine*, 19, 513-518.
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, N J: Princeton University Press.
- Schwandt, M., Harris, J. E., Thomas, S., Keightly, M., Snaiderman, A., & Colantonio, A. (2012). Feasibility and effect of aerobic exercise for lowering depressive symptoms among individuals with traumatic brain injury: A pilot study. *Journal of Head Trauma Rehabilitation*, 27, 99-103.
- Simpson, G., Tate, R., Whiting, D., Cotter, R. (2011). Suicide prevention after traumatic brain injury: a randomized controlled trial of a program for the psychological treatment of hopelessness. *Journal of Head Trauma Rehabilitation*. 26, 290-300.
- Sinnakaruppan, I., Downey, B., Morrison, S. (2005). Head injury and family carers: A pilot study to investigate an innovative community-based educational programme for family carers and patients. *Brain Injury*, 19, 283-308.
- Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In W.G. Austin & S. Worchel (Eds.), *The social psychology of intergroup relations* (pp. 33-47). Monterey, CA: Brooks/Cole
- Tate, R.L. & Broe, G.A. (1999). Psychosocial adjustment after traumatic brain injury: What are the important variables? *Psychological Medicine*, 29, 713-725.
- Trexler, L. E. (2000). Empirical support for neuropsychological rehabilitation. In A. Christensen & B. Uzzell (Eds.). *International Handbook of Neuropsychological Rehabilitation: Critical Issues in Neuropsychology* (137-150). New York: Kluwer Academic/Plenum Publishers.

- Turner, J. C. (1982). Towards a cognitive redefinition of the social group. In H. Tajfel (Ed.), *Social identity and intergroup relations* (pp. 15-40). Cambridge: Cambridge University Press
- Turner, B., Ownsworth, T., Cornwell, P., & Fleming, J. (2009). Reengagement in meaningful occupations during the transition from hospital to home for people with acquired brain injury and their family caregivers. *American Journal of Occupational Therapy, 63*, 609-620.
- Turner-Stokes, L. (2008). Evidence for the effectiveness of multi-disciplinary rehabilitation following acquired brain injury: A synthesis of two systematic approaches. *Journal of Rehabilitation Medicine, 40*, 691-701.
- Tyerman, A. (1997). *The Head Injury Semantic Differential - III*. Community Head Injury Service Camborne Centre. Bucks, UK.
- Tyerman, A., & Humphrey, M. (1984). Changes in self-concept following severe head injury. *International Journal of Rehabilitation Research, 7*, 11-23.
- Vickery, C. D, Gontkovsky, S. T, & Caroselli, J. S. (2005). Self-concept and quality of life following acquired brain injury: A pilot investigation. *Brain Injury, 19*, 657-665.
- Vickery, C. D., Gontkovsky, S. T., Wallace, J. J., Caroselli, J. S. (2006). Group psychotherapy focusing on self-concept change following acquired brain injury: A pilot investigation. *Rehabilitation Psychology, 51*, 30-35
- Walsh, S., Fortune, D. G., Gallagher, S., & Muldoon, O. T. (2012). Acquired brain injury: combining social psychological and neuropsychological perspectives, *Health Psychology Review, 1-15*, first preview.
- Wilcock, A. A. (1998). Reflections on doing, being, and becoming. *Canadian Journal of Occupational Therapy, 65*, 248 - 257.

- Wilson, B. A., Gracey, F., Evans, J., & Bateman, A. (2009). *Neuropsychological rehabilitation: Theory, models, therapy and outcome*. New York: Cambridge University Press.
- Wright, J. C., & Telford, R. (1996). Psychological problems following minor head injury: a prospective study. *British Journal of Clinical Psychology, 35*, 399-412.
- Ylvisaker, M., McPherson, K., Kayes, N., & Pellet, E. (2008). Metaphoric identity mapping: Facilitating goal setting and engagement in rehabilitation after traumatic brain injury. *Neuropsychological Rehabilitation, 18*, 713-741.