Psychological Interventions in Acquired Brain Injury

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Systematic Review: Is Imagery an Effective Method of Intervening Psychologically with Acquired Brain Injury (ABI) Groups?

Background

An acquired brain injury (ABI) is any damage to the brain that occurs after birth. The two main causes of an ABI are a stroke (when a blood vessel in the brain bursts or is blocked) and a traumatic brain injury (when sudden trauma causes damage to the brain). After an injury, individuals can experience different symptoms including physical problems and changes in their thinking, behaviour, and mood. Mental imagery refers to mental representations and sensory experiences without a direct external stimulus (i.e., asking individuals to imagine something: 'seeing in the mind's eye', 'hearing in the head', 'imagining the feel of' and so on). In individuals without an ABI, imagery-based interventions have positively impacted mood and thinking skills, and successfully increased motivation across a range of behaviours. The aim of this review was to explore the influence of imagery-based approaches on psychological outcomes (thinking, mood, or behaviour) in individuals with an ABI.

Method

A systematic search of research databases was conducted to find published studies that looked at imagery-based interventions for adults (18+) after an ABI. Studies were required to examine the effect of imagery on participants thinking skills (e.g., memory, attention), mood (e.g., depression, anxiety), and/or behaviour (e.g., disinhibited behaviour). Only quantitative studies (those looking at numerical data)

were included. Studies had to be written in English and published after 2010. Nine studies were included in the review and the quality of each study was evaluated.

Results

The exact use of imagery varied across studies. Seven studies primarily explored the effect of an imagery intervention on participants thinking skills: one examined the influence of imagery on navigational abilities and spatial awareness (e.g., the participant imagined map-like representations), and six examined it's influence on memory and new learning (e.g., participants imagined future planned events with as much sensory details as possible). The remaining two studies explored the effect of either compassion or relaxation-based imagery exercises on mood (i.e., on levels of relaxation, empathy, and self-compassion). No study specifically targeted behaviour with its intervention, though one study measured disinhibited behaviour before and after treatment. Imagery was found to:

- Improve prospective memory (i.e., a participant's ability to remember to carry out intended actions in the future) in three studies that ranged in quality.
- Improve new learning and memory in three studies; however, two of these studies were low in quality.
- Improve participants memory for everyday things (e.g., names and faces) in two studies of moderate to strong quality.
- Improve navigational abilities in one case study of moderate quality.
- Have an inconsistent effect on anxiety, depression, and levels of relaxation and empathy, and no effect on self-compassion, across four studies that ranged in quality.
- Show some improvements in disinhibited behaviour on questionnaires completed by family or staff members, but not on self-report, in one study of strong quality.

Conclusions

Overall, this review tentatively suggested that imagery is an effective way of working psychologically with ABI groups, particularly when addressing changes in thinking skills. Despite promising findings in non-ABI populations, studies examining the impact of imagery on mood and behaviour are exceptionally sparse within ABI, and those that have report mixed results. It would be beneficial for future studies of higher quality to explore the use of imagery interventions that specifically target these outcomes.

Empirical Study: A Values-based Intervention for Neurorehabilitation Inpatients with an Acquired Brain Injury (ABI) and Symptoms of Depression

Background

Psychological distress such as depression is common following ABI and is often more debilitating than changes experienced in thinking and physical abilities. Distress can impact negatively on long-term outcomes including social and occupational functioning, quality of life and adjustment to the injury and its consequences. It is suggested that interventions focusing on an individual's values (what is truly important to them) can improve mood and adjustment, and lead to increased meaningful behaviours despite their injury. However, depression can reduce motivation for engaging in valued activities. In individuals without an ABI, imagery has been shown to increase engagement and motivation for planned activities. The current study therefore explored the use of a values-based intervention for individuals with an ABI and symptoms of depression. Mental imagery was optional and added to the intervention for instances where participants experienced reduced motivation to engage in the values-based activities discussed during therapy sessions.

Method

The study aimed to recruit six individuals with an ABI who were undergoing inpatient neurorehabilitation at one of two London hospitals. All participants were over the age of 18 and experiencing symptoms of depression, and were not of high risk (i.e., they did not present with suicidal intent or substance misuse). Participants took part in a values-based intervention, which aimed to increase their engagement in

activities that were personally meaningful to them. Measures of psychological distress and values-based behaviour were completed as close to daily as possible during the baseline period of two, three or four weeks, the intervention stage (consisting of five to seven sessions) and the two-week follow-up. Throughout the study participants were also assessed using standardised questionnaires of mood, quality of life, adjustment, future thinking, and behaviour. Data was analysed by comparing participant's scores on each measure to their scores at earlier time points.

Results

Four individuals completed the intervention, with three completing follow-ups. The following was found:

- All individuals demonstrated an increase in values-consistent behaviour when tracking specific values that were identified in early sessions (i.e., they engaged with more things that mattered to them).
- Most participants reported engaging in additional values-based behaviours in addition to those discussed with the therapist.
- Three out of four participants improved on at least one questionnaire post-intervention, with the most improvement made in depression. However, findings were not always maintained at follow-up and were inconsistent across measures (e.g., participants often demonstrated a reduction in depression on standardised questionnaires but not on daily ratings of low mood).
- The intervention was feasible and deemed acceptable by all participants.

Conclusions

This was the first study to explore the use of a values-based intervention for neurorehabilitation inpatients with an ABI and symptoms of depression. The flexible nature of the research therapy meant that participants physical and thinking abilities could be considered when establishing value-based activities within sessions, encouraging them to engage in meaningful behaviours despite their injury. Most participants reported increased values-consistent behaviours and reduced symptoms of depression over the course of therapy. However, results were inconsistent across participants and measures. Additionally, study limitations including not reaching the desired number of participants, the sole use of self-report and the uncontrollability of the rehabilitation environment during COVID-19, are likely to have impacted on findings.

Chapter II: Is Imagery an Effective Method of Intervening Psychologically with Acquired Brain Injury (ABI) Groups?

Abstract

Individuals with an acquired brain injury (ABI) often experience a complex presentation of symptoms that impact on their recovery. These include physical and cognitive disability, reduced engagement in meaningful activities, and psychological distress such as depression. Supporting individuals to adjust psychologically is therefore likely to aid the recovery process. However, depression is associated with a negative bias for imagining future events, which is likely to affect the successful implementation of psychological and rehabilitative interventions for this group. In non-ABI populations, imagery is shown to be an effective way of offsetting this negative bias, in addition to assisting in the management of various other emotional or cognitive difficulties. The exploration of imagery use with ABI groups is therefore likely to yield multiple benefits. This review aimed to explore the effect of imagery-based interventions on psychological outcomes of cognition, mood, and/or behaviour after an ABI. A literature search conducted using PsychINFO, PubMed and Web of Science identified 617 articles, nine of which are included in this review. The total sample size was 244, and a male majority was found. A narrative synthesis of findings tentatively showed that imagery is an effective way of working psychologically with individuals post-ABI, particularly when used as a cognitive strategy in Traumatic Brain Injury (TBI). However, research exploring its use in wider ABI populations (e.g., post-stroke) is lacking. Additionally, it would be beneficial to further explore the use of imagery interventions that target mood and behaviour related outcomes, which is exceptionally sparse within ABI despite promising findings in non-ABI groups.

Multi-centre RCTs or randomised SCEDs are recommended to establish effects through adequate sample sizes and power.

Introduction

Acquired Brain Injury

An acquired brain injury (ABI) is damage to the brain that occurs after birth and is not hereditary, congenital, degenerative, or induced by birth trauma. Possible causes include a traumatic brain injury (TBI) caused by an external force or non-traumatic injuries resulting from anoxic or hypoxic events and infection-related diseases such as encephalitis, septicaemia, or meningitis. The causes and outcomes of an ABI are therefore heterogeneous in nature (Ditchman, 2017). Impairments can be 'temporary or permanent and cause physical, functional disability, or psychosocial maladjustment' (World Health Organization, WHO; Geneva, 1996). Most ABI result from a TBI or stroke (Mozzafarian et al., 2016); hence, these will form the focus of the present review.

A TBI occurs when a sudden trauma causes damage to the brain. They can result when the head suddenly and violently hits an object, through acceleration or deceleration or when an object pierces the skull and enters the brain tissue (NINDS, 2019). The most common causes of TBI are road traffic accidents (RTA) and falls (Peeters et al., 2015). Following a TBI, an individual may experience alterations in consciousness, memory loss and/or neurological symptoms such as visual changes or weakness in one side of the body (Diagnostic and Statistical Manual of Mental Disorders v; DSM-V, 2013). Studies exploring the epidemiology of TBI report a male predominance in cases across Europe (Anke et al., 2015; Numminen et al., 2011; Perez et al., 2012), the USA (Corrigan, Selassie & Orman, 2010), Australia and New Zealand (Myburgh et al., 2008). TBI is also reported to be more prevalent in adults under the age of 25 or over the age of 75 (Peeters et al., 2015). However, these

estimates are based on records of emergency department visits, hospital admissions and discharge registries, within which TBI is identified using codes of the International Classification of Diseases (ICD). Such classifications are pathologically based and are primarily intended for administrative use; consequently, their applications in epidemiological research are limited and incident rates are likely to be underestimated (Roozenbeek, Maas & Menon, 2013).

A stroke can be caused in one of two ways: (1) an ischaemic stroke when a blood vessel that carries oxygen and nutrients to the brain is blocked and (2) a haemorrhagic stroke when the blood vessel ruptures and bleeds into the brain. In both cases, the blood and oxygen supply to the brain is interrupted leading to cell death (Stroke Association, 2018). Most strokes (87%) are ischaemic, though haemorrhagic strokes are reported to be most fatal (Stroke Association, 2018). Depending on the severity and brain regions affected by a stroke, individuals can experience changes in behaviour and/or a loss of function in mobility, speech and/or cognition. Predominantly, strokes affect older adults with an average age of 72 for men and 78 for women. However, in the UK a quarter of strokes are experienced by working age adults (Stroke Association, 2018). Although some recover well from a stroke, a third of survivors will experience depression post-stroke and two thirds of survivors will leave hospital with a disability (Stroke Association, 2018).

In the UK, an ABI is graded as mild, moderate, severe, or extremely severe based on measures such as the level of consciousness or Glasgow coma scale (GCS) (Ghajar, 2000). In most cases, a mild brain injury (GCS 13–15) is caused by a concussion where there is full neurological recovery, although many of these patients experience short-term memory and concentration difficulties. In moderate ABI (GCS

9–13) the patient is often lethargic or stuporous, and in severe injury (GCS 3–8) the individual is often comatose, unable to communicate with their environment (Ghajar, 2000). Individuals with severe or extremely severe injuries are likely to be hospitalised. Those with moderate to extremely severe injuries may receive neurorehabilitation if there is a likelihood of neurological growth and functional repair (Headway, 2019).

Consequences of ABI

Many individuals with an ABI, particularly those with moderate to very severe injuries, experience significant temporary or permanent alterations in cognition (McAllister, 2011), behaviour, emotional regulation, mobility, and function (Gertler, Tate & Cameron, 2015). Cognitive changes can affect the domains of memory, attention, vision, visuospatial awareness, executive functioning (e.g., planning and organisation; problem solving; self-awareness and social behaviour) and processing speed (Arciniegas et al., 2002; Barman, Chatterjee & Bhide, 2016). Additionally, individuals may experience physical symptoms ranging from headaches, fatigue and nausea to weakness or paralysis in parts of the body (Head, 1993; Mathias & Alvaro, 2012).

Post-ABI, an array of behavioural and emotional changes (e.g., irritability, frustration, and aggression) reflect a combination of organic damage and psychological reactions to the injury and its consequences (Tyerman, 2016). Such changes vary significantly across individuals; however, a growing body of research outlines a general reduction in mood and quality of life (QOL) post injury (Bryant et al., 2010). Reported difficulties include increased lability (a loss of emotional control) and post-traumatic stress disorder (PTSD), with up to 40% of mild to moderate ABI

patients also experiencing clinical levels of anxiety and/or depression (Seel & Kreutzer, 2003; Wellisch, Kaleita, Freeman, Cloughesy, & Goldman, 2002). Additionally, post-injury, individuals often experience feelings of loss and denial, negative changes in self-concept and difficulties accepting their new circumstances (Beadle, Ownsworth, Fleming, & Shum, 2016; Carroll & Coetzer, 2011). Impaired insight into their difficulties is likely to further hinder recovery and community reintegration (Ownsworth et al., 2007).

The combined effects of cognitive, physical, sensory, behavioural, and emotional changes mean that many individuals with an ABI face significant challenges in their work, leisure and social activities, and in their relationships. Individuals frequently struggle to engage in activities of daily living (ADLs) or enjoyed activities (Ditchman, 2017), reintegrate into the community, and return to employment (Yeates, 2018). For instance, stroke survivors are reported to be two to three times more likely than the general population to be unemployed eight years post-injury (Stroke Association, 2018). Furthermore, unemployment is substantially higher after a TBI for people who were employed when injured than in the general population, with the literature reporting a 42% unemployment rate versus an expected 9% risk of unemployment (Machamer, Temkin, Fraser, Doctor & Dikmen, 2005).

Recovery Journey

Generally, ABI outcomes are assessed six months post injury as this is the most opportune time for progress to be made due to brain plasticity (Sohlberg & Mateer, 2001). However, whilst approximately 85% of recovery occurs within this period,

further recovery may occur later (Maas, Stocchetti & Bullock, 2008) depending on injury factors (e.g., injury type and severity) and demographic influences such as pre-morbid functioning, personality, and age (Brown & Nell, 1992; Maas, Stocchetti & Bullock, 2008). Hence, recovery is an idiosyncratic journey that varies widely between individuals.

For numerous reasons psychological interventions play an important role throughout the recovery journey. Firstly, because the effects of ABI are long-lasting and, in some cases, permanent (WHO, 1996); and secondly, because psychological distress, such as depression, is common following ABI (Juengst, Kumar, & Wagner, 2017), which can negatively impact long-term functional outcomes (Cullen et al., 2018). However, research exploring the effectiveness of existing psychological interventions often produces mixed findings (Gertler et al., 2015; Wiart, Luaute, Stefan, Plantier & Hamonet, 2016). For instance, Gertler et al. (2015) reviewed RCTs for non-pharmacological interventions for adults with depression and TBI, within which four studies explored the use of various psychological therapies: CBT (Ashman, 2014; Fann, 2015; Simpson et al., 2011); mindfulness-based cognitive therapy (Bedford et al., 2013), and psychotherapy (Ashman, 2014). Interventions were found to be no more effective than no treatment. Similar findings are also reported in the treatment of post-stroke depression: interventions including CBT (Lincoln & Flannaghan, 2003), motivational interviewing (Watkins et al., 2007) and psychotherapy with psychoeducation (Zhao, 2004) were not found have a significant effect on depressive symptoms (Cochrane systematic review; Hackett, Anderson, House & Xia, 2008). Conversely, CBT has shown some value in reducing symptoms of depression (Fann, Hart & Schomer, 2009) and anxiety (Soo & Tate, 2007) following

TBI, as well as both depression and anxiety post-stroke (Waldron, Casserly & O'Sullivan, 2013).

Such mixed findings may be explained by methodological limitations within studies such as small sample sizes and high dropout rates, in addition to the questionable suitability of certain approaches for individuals with a brain injury. For instance, it has been argued that cognitive impairment, common within ABI, may make it difficult for individuals to engage with the cognitive restructuring component of CBT (Cullen et al., 2018; Kangas & McDonald, 2011; Soo, Tate & Lane-Brown, 2011). Furthermore, depression is associated with a negative bias for imagining future events (Murphy et al., 2019), which, along with the discussed cognitive limitations, likely impacts on the successful implementation of psychological and rehabilitative interventions. For example, depressed individuals may be less motivated to engage in behavioural interventions, predicting negative results and withdrawing from rehabilitation and previously enjoyed activities. In non-ABI populations, imagery is shown to be an effective way of offsetting the impact of this negative bias, motivating people to partake in desired behaviours (Renner et al., 2019). Moreover, as outlined below, imagery-based approaches are reported to be effective in the management of various other emotional (e.g., PTSD, social anxiety) or cognitive (e.g., memory, learning and planning) difficulties. Thus, the exploration of imagery use with ABI groups is likely to yield multiple benefits.

Mental Imagery Interventions: Non-ABI Population

Imagery is defined as the 'simulation or re-creation of perceptual experience across sensory modalities' (Pearson, Deeprose, Wallace, Heyes & Holmes, 2013). This

definition is broad and can encompass a range of psychological and non-psychological interventions (e.g., motor imagery in physiotherapy). However, the present review will focus on imagery as utilised within psychological interventions (i.e., those focusing on either cognition, mood, or behaviour).

Imagery and Cognition

Mental imagery underlies numerous cognitive skills, including the ability to remember, plan, navigate and make decisions (Pearson, Naselaris, Holmes & Kosslyn, 2015). It is argued that mental images can also replace perceptual stimuli during learning tasks. Typically, perceptual learning requires an individual to repeatedly perform a perceptual detection or discrimination task; however, research has demonstrated that imagining each component of a given task, without physical enactment, can also enhance learning and later performance (Tartaglia, Bamert, Mast & Herzog, 2009). It is therefore reasoned that mental imagery functions similarly to sensory perception (Pearson et al., 2015; Tartaglia et al., 2009) and can generalise from the imagined to the perceptual content (e.g., Lewis, O'Reilly, Khuu & Pearson, 2013). Furthermore, when assessed on tasks of visual working memory, participants reported using one of two methods to complete a memory task: (1) picking out details of the presented stimuli and encoding them phonologically or verbally (e.g., Keogh & Pearson, 2014), and (2) creating a mental image of the presented stimuli that is then compared to the subsequent test stimuli (e.g., Harrison & Tong, 2009). However, individuals with stronger mental imagery skills demonstrated increased precision and higher capacity on assessment of visual working memory only, not on tasks of verbal working memory (Keogh & Pearson, 2014).

Imagery and Mood

Images can evoke powerful emotional states (Holmes & Matthews, 2010), evidenced by their role in numerous psychological disorders: PTSD, whereby potent emotions are induced by imagery in the form of flashbacks to a traumatic event (Holmes, Grey & Young, 2005); social phobia (Hirsch et al., 2006); schizophrenia (D'Argembeau, Raffard & Van der Linden, 2008); bipolar disorder (Holmes, Geddes, Colom & Goodwin, 2008), and depression (Wheatley et al., 2007). Mental images are widely believed to contribute to the onset and maintenance of these diagnoses (e.g., Clark & Wells, 1995; Ehlers & Clark, 2000), and hence, mental imagery underlies many of the available clinical treatments. This includes, but is not limited to, 'imagery rescripting' in CBT (e.g., Holmes, Arntz & Smucker, 2007) and schema focussed therapy (e.g., Giesen-Bloo et al., 2006), as well as relaxation and compassionate imagery. For example, a transdiagnostic therapy group for self-critical individuals who experienced low self-esteem utilised imagery exercises, such as the 'safe place' and 'compassionate self', reporting significantly reduced symptoms of depression and heightened self-esteem on post-group measures (Andersen & Rasmussen, 2017).

Imagery and Behaviour

Motivating engagement in specific behaviours is often challenging. Cognitive interventions are frequently adopted in attempt to elicit behaviour change, providing individuals with the risks and benefits of various alternative actions, and hoping that this will inform their decisions (Renner, Murphy, Ji, Manly & Holmes, 2019). However, such cognitive analysis often fails (Marteau, Holland & Fletcher, 2012). Instead, it is argued that using mental imagery to "pre-experience" future planned

behaviours, and the emotional experience associated with them, can increase motivation and subsequent engagement (Holmes, Blackwell, Burnett Heyes, Renner & Raes, 2016; Renner et al., 2019). Imagery-based interventions have been shown to positively impact motivation across a range of maladaptive behaviours and psychological disorders (e.g., May, Andrade & Kavanagh, 2015). In one study, 72 healthy individuals identified six activities they wanted to complete over the following week, before being randomly assigned to either a session of motivational imagery, an activity reminder control condition, or a no-reminder control condition. Relative to control groups, the motivational imagery group reported higher levels of motivation as well as anticipated pleasure and reward for their planned activities (Renner et al., 2019).

Mental Imagery Interventions: ABI Population

The literature exploring the use of imagery is currently limited in the ABI population; however, findings suggest that when utilised as a cognitive strategy, imagery can lead to increased skill generalisation to novel environments (Liu et al., 2009) and positively impact attentiveness (Liu et al., 2004), creativity, planning and self-monitoring (Braun et al., 2008). Nevertheless, no reviews have explored the use of mental imagery in ABI and its impact on psychological outcomes specifically. The present review therefore aimed to systematically review if imagery is an effective method of intervening psychologically with ABI groups. To be considered a psychological intervention, primary outcome measures had to cover the domains of cognition, mood and/or behaviour. Mood was classified broadly (e.g., depression, anxiety, stress, negative affect, emotional distress); hence, clinical criteria did not need

to be met for eligibility. This was in accordance with recommendations that advocate for a transdiagnostic approach when working with ABI (Robinson et al., 2019).

Method

Search Strategy

A comprehensive search of both psychological and medical literature was conducted using three electronic databases: Psychinfo (from 1986-present), PubMed (from 1975-present) and Web of Science (from 1970-present). All searches were informed by PRISMA guidelines and completed in consultation with a library search expert. The search terms (see Table 1) were applied to titles and abstracts using the filters of 'Adults', 'Humans' and 'English' for PsychINFO and PubMed. 'Peer-reviewed' was also selected for PsychINFO. The filter 'English' was used for Web of Science and the psychology databases were searched. For all databases, a 'not' search term excluded physiotherapy papers exploring 'motor-imagery' and medical literature around brain imaging (i.e., magnetic resonance imaging, MRI, or positron emission tomography, PET). To ensure that this did not screen out eligible studies, an initial search was conducted including these search terms and their titles were reviewed. On initial review, older studies (i.e., those published prior to 2010) were often unavailable despite multiple attempts to access them. Therefore, only papers published from 2010 onwards were included as these could most thoroughly be reviewed. The final search was run in January 2021.

Table 1

Search Terms for Electronic Databases

Search Terms
"TBI" or "ABI" or "Brain injur*" or "Head injur*" or "Stroke" or "Cerebrovascular accident" or "CVA" or "Cerebrovascular apoplexy" or "Vascular accident" or "Brain haemorrhage"
AND
"mental imagery" or "imagery" or "imagine" or "imagination" or "visualisation" or "visualise" or "self-imagination"
NOT
"MRI" or "magnetic resonance imaging" or "imaging" or "PET" or "Positron Emission Tomography" or "motor imagery"

In addition to these searches, the relevant reference lists of retrieved publications were examined for further eligible studies.

Study Eligibility Criteria

Studies were required a) to have samples of adults over the age of 18 with a diagnosed ABI b) to evaluate a psychological intervention that included mental imagery c) to utilise outcome measures specific to psychological interventions (i.e., cognition, mood, or behaviour) d) to use quantitative data analysis e) to have been published in a peer-reviewed journal f) to be available in English and g) to have been published post 2010. Studies were excluded if they did not meet the outlined criteria, for example studies that used qualitative methodologies or described non-

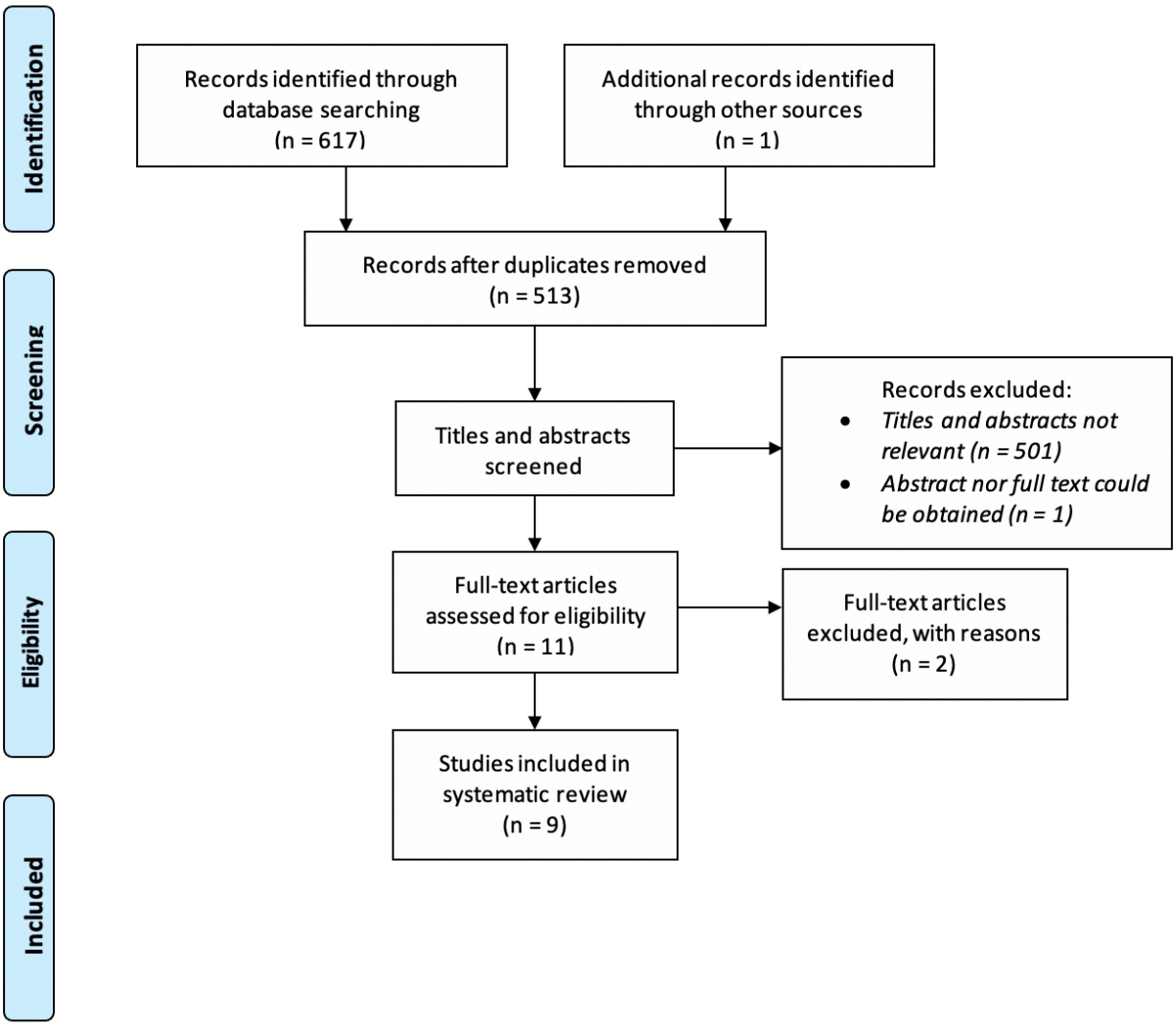
psychological imagery interventions. There were no restrictions on country of publication.

Study Selection

A total of 617 studies were retrieved: 202 from PsychINFO, 205 from PubMed and 210 from Web of Science. One additional study was hand selected. Once duplicates had been removed, 513 titles and abstracts were screened by the primary researcher against the eligibility criteria. Although 12 papers appeared relevant, only 11 full-text papers were fully assessed due to one study being unobtainable. Two studies did not meet inclusion criteria as they contained a non-psychological imagery intervention (i.e., they focused on motor imagery as used in occupational or physiotherapy). Nine were deemed eligible (see Figure 1). A headed table outlining the inclusion criteria was developed to guide data extraction from the full text articles and to assess their eligibility.

Figure 1

PRISMA Diagram Outlining the Screening and Selection Process



Data Extraction

As presented in Table 3 (*Results* section), data was extracted according to study design, participant demographics (e.g., age and cause of ABI), setting, intervention details (e.g., format, duration, frequency, and content), delivery method (e.g., group or one-to-one), control or comparator details, outcome variables, outcome data, quality ratings and follow-up information.

Quality Assessment

To assess study quality, the Quality Assessment Tool for Quantitative Studies (QATQS) was used (Effective Public Health Practice Project; Thomas, Ciliska, Dobbins & Micucci, 2004). This is a standardised tool developed for quantitative studies in health care settings, providing an overall methodological rating of strong, moderate, or weak according to six predefined areas (Table 4, *Results* section). It holds good test re-test reliability (Armijo-Olivo, Stiles, Hagen, Blondo & Cummings, 2012; Thomas et al., 2014) and acceptable content validity (Thomas et al., 2014).

Process of Data Synthesis

Data was synthesised narratively using guidance by Popay et al. (2006). It would have been misleading to attempt an overall calculation of treatment effect as the identified studies varied significantly in design, outcome measures and data analysis; consequently, they did not meet the homogeneity required to complete a meta-analysis (Bundell, 2014). However, where possible, effect sizes (ES) were included using either Cohen's d, Cohen's *w*, eta squared (η2) or partial eta squared (η_p^2), in line with the study's reporting. Typically, in studies using ANOVAs, partial eta squared is reported. Partial eta square partials out the effects of other independent variables and is therefore recommended over eta squared when comparing studies (Cohen 1973; Richardson, 2011). Where a study failed to report ES, despite the available data, Cohen's d was calculated by dividing the mean difference by the pooled standard deviation for group by time calculations, or by baseline standard deviation for pre-post calculations. In some cases, ES could not be calculated due to limitations of reported data (e.g., means or raw scores not being provided). Table 2 outlines effect size classifications; though, whilst these are helpful benchmarks, they should not be interpreted too rigidly (Thompson, 2007).

Table 2

Effect Size Classifications in accordance with Cohen (1988)

Statistic	**Small**	**Medium**	**Large**
Cohen's d	0.20	0.50	0.80+
Cohen's *w*	0.10	0.30	0.50
Eta Squared (η2)	0.02	0.13	0.26
Partial Eta Squared (η_p^2)	0.01	0.06	0.14

Results

As outlined in Table 3, nine studies met inclusion criteria. The studies varied in their design with one case study (Boccia et al., 2019), one randomised controlled trial (RCT) (Chiaravalloti et al., 2016) and one AB-BA crossover design (Raskin et al., 2019). Of the remaining studies, three adopted within-group experimental designs, whereby a participant's performance was compared under different conditions (Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2012); and three used a between-group experimental design, comparing an intervention group to a control/comparator group posttreatment (Campbell et al., 2019; O'Neill & McMillan, 2012; Potvin et al., 2011).

Recruitment

Five studies recruited participants from the USA, two from Scotland, one from Italy and one from Canada (see Table 2). Except for three studies (Boccia et al., 2019; Grilli & Glisky, 2011; Potvin et al., 2011), all studies recruited from multiple recruitment sites. Six studies recruited participants from neurorehabilitation wards or clinics (Boccia et al., 2019; Campbell et al., 2019; Chiaravalloti et al., 2016; O'Neill & McMillan, 2012; Potvin et al., 2011; Raskin et al., 2019), six from brain injury community groups (Campbell et al., 2019; Chiaravalloti et al., 2016; Grilli & Glisky., 2010; Grilli & McFarland, 2011, O'Neill & McMillan, 2012; Raskin et al., 2011) and four from existing databases or laboratory participant pools (Chiaravalloti et al., 2016; Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011). Studies using a between-group design recruited their intervention and control groups from the same sites (Campbell et al., 2019; Chiaravalloti et al., 2016; O'Neill & McMillan, 2012; Potvin et al., 2011). Three studies used the same recruitment site(s) (Grilli & Glisky., 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011), with Grilli and Glisky (2011) including 11 participants who also took part in their 2010 study.

The overall sample size was 244. Study sample sizes varied from one (Boccia et al., 2019) to 69 (Chiaravalloti et al., 2016). Most studies using an intervention and control/comparator group divided their samples evenly (Campbell et al., 2019; Chiaravalloti et al., 2019; Grilli & Glisky, 2010; O'Neill & McMillan, 2012; Raskin et al., 2019), except for one (Potvin et al., 2011) in which two-thirds of participants were allocated to the control group. Most patients were outpatients, with only participants in Campbell et al. residing in hospital. It is not reported whether participants in O'Neill and McMillan were recruited from in- or out-patient neurorehabilitation services.

Participant Characteristics

The mean ages of intervention participants with an ABI ranged from 35 to 49 years. For control participants, mean ages ranged from 30 to 49 years. All studies reported a male majority, representative of TBI which mainly occurs in men (Anke et al., 2015). In terms of between-group (i.e., control versus intervention) gender comparisons at baseline, three studies did not report a significant between group difference (Campbell et al., 2019; Chiaravalloti et al., 2016; O'Neill & McMillan, 2012), one failed to report the percentage of males in the control group (Grilli & Glisky, 2010), and two did not conduct statistical comparison (Potvin et al., 2011; Raskin et al., 2019). In O'Neill and McMillan, more than two thirds (70.8%) of the total sample fell into the three most deprived deciles as measured using the Scottish Index of Multiple Deprivation (Scottish Government, 2009).

Brain Injury

Six studies selectively recruited participants who had received a TBI diagnosis (Boccia et al., 2019; Campbell et al., 2019; Chiaravalloti et al., 2016; O'Neill & McMillan, 2012; Potvin et al., 2011; Raskin et al., 2019). Three studies (Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011) recruited participants with neurological damage of mixed etiology; within these, 70 to 75% of participants had experienced a TBI, and 25 to 30% of participants sustained their ABI due to a tumour, anoxia, an aneurysm, or encephalitis. No study recruited participants who had experienced a stroke.

Across studies, individuals with a TBI were reported to have sustained these following a road traffic accident (RTA), fall or assault, with most participants having

experienced an RTA or fall. This is reflective of previous findings that report RTA's and falls as the most common causes of TBI (Peeters et al., 2015; Corrigan, Selassie & Orman, 2010; Myburgh et al., 2008). TBI was classified as severe in three studies (Boccia et al., 2019; Campbell et al., 2019; O'Neill & McMillan, 2012), and moderate to severe in three studies (Chiaravalloti et al., 2016; Potvin et al., 2011; Raskin et al., 2019). However, the specifications used to classify injuries as 'severe' varied from experiencing post-traumatic amnesia for at least one day (O'Neill & McMillan, 2012) to being comatose for one month (Boccia et al., 2019) to meeting thresholds on the GCS (Campbell et al., 2019; Chiaravalloti et al., 2016; Raskin et al., 2019). Injury severity is therefore likely to be heterogenous across studies, despite the same severity labels being utilised. In three studies using a TBI control or comparator group, no significant differences were noted in injury severity between groups (Chiaravalloti et al., 2016; O'Neill & McMillan, 2012; Potvin et al., 2019). One study failed to report injury severity by group (Campbell et al., 2019). Remaining studies did not specify brain injury severity (Grilli & Glisky., 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011).

In some studies, the cognitive impact of ABI was measured through neuropsychological testing, including assessment of memory using the *Weschler Memory Scale* and the *Weschler Adult Intelligence Scale* (used by Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011), *the Test Ecologique de Memoire Prospective* (TEMP; used by Potvin et al., 2011) and the *Memory Assessment Scales – Prose Memory* (MAS-PM; used by Chiaravalloti et al., 2016). In Grilli and Glisky (2010), all intervention participants demonstrated a memory impairment, scoring at least one standard deviation (i.e., 15 points) below their expected score on the General Memory

Index (GMI). Most participants (57%) were reported to be experiencing a severe memory disorder. Similarly, in Grilli and McFarland (2011) all participants demonstrated memory impairment on the GMI compared to their estimated premorbid functioning, and in Grilli and Glisky (2011), all participants experienced a self-reported decline in memory. In Potvin et al., participants demonstrated reduced performance (>1 standard deviation below their expected score) on tasks of prospective memory (PM), and in Chiaravalloti et al., all participants demonstrated impaired new learning and memory. Further tests of cognitive functioning were reported in most studies. In Raskin et al. (2019), participants performed poorly on tests of complex attention, executive functioning, and retrospective memory pre-treatment; and in Boccia et al. (2019) deficits were found in visuo-spatial learning and delayed recall, and in visual, spatial, and verbal memory in ecological contexts. No studies reported a significant difference between treatment and control groups in terms of baseline cognitive functioning.

In one study (O'Neill & McMillan, 2012), the impact of ABI on empathy was assessed pre-treatment. All participants scored at least one standard deviation below the average for published norms on the *Basic Empathy Scale* (<54.5 for males; <67 for females; Jolliffe & Farrington, 2006) or the *Balanced Emotional Empathy Scale* (total score <23; Mehrabian, 2000).

Table 3

Characteristics of Studies Documenting Cognition, Mood, and/or Behaviour Related Outcomes after Imagery Interventions in ABI

Study	**Design**	**Population** *(e.g., N, brain injury, setting, country)*	**Demographics** *Mean (SD) reported unless stated otherwise*	**Treatment**	**Control/ comparator(s)**	**Outcome measure(s)** *Psychology specific (i.e., mood, behaviour, or cognition)*	**Results**
Boccia et al. (2019)	Case study Facilitator(s): Not reported Follow-up: 8 months	N=1 TBI. Lesion of the right temporal lobe extending to subcortical areas following an RTA. Recruited from IRCCS Santa Lucia, Rome. Italy.	Age: 49 % Male: 100 Months since ABI: 48	8-week imagery-based treatment tailored to participants navigational difficulties. Taught to rapidly generate mental images before generating and retrieving navigational images and	Scores compared to available normative data pre- and post-treatment, and follow-up. *ns* results indicate performance in-line with norms (i.e., they support the effectiveness of the intervention).	*Cognitive measures* (1) Corsi block tapping test (CBTT) (2) Walking Corsi Test (WalCT) (3) Cognitive Map Test (CMT) (4) Navigational tasks in real environment	*(1) CBTT* Posttreatment: Learning *ns* (t=1.07, p=.15) Delayed recall *ns* (t=-.28, p=.39) Follow-up: Learning *ns* (t=.73, p=.24) Delayed recall *ns* (t =.65, p=.26) *(2) WalCT* Posttreatment: Learning *ns* (t =.58, p=.28) Delayed recall *s* (t=-1.65, p=.05) Follow-up:

	map-like representations .	(5) Rivermead Behavioural Memory Test (RBMT) (6) Complete Visual Mental Imagery Battery (CVMIB)	Learning *ns* (*t*=-1.002, *p*=.16) Delayed recall *ns* (*t*=.41, *p*=.34) *(3) CMT* Posttreatment: Learning *ns* (*z*=-0.81, *p*=.46) Recall *ns* (*z*=-1.34, *p*=.44) Follow-up: Learning *s* (*z*=2.18, *p*=.009) Recall *ns* (*z*=-1.565, *p*=.17) *(4) Navigational tasks* Posttreatment: 100% effectiveness on map-following task. Stable at follow-up. *(5) RBMT* Posttreatment: All scores in normal range *(6) CVMIB* Posttreatment: 100% effectiveness on 'Object Generation' and 'Colour'

Campbell, Gallagher, McLeod, O'Neill & McMillian (2019)	Experimental between-group design with randomised allocation Facilitator(s): Clinical Neuropsychologist Follow-up: none	N=24 (Tx: 12; Control: 12). All participants sustained severe TBI. RTA: 9 Fall: 11 Assault: 4 Recruited from two inpatient neurorehabilitation units; an NHS community brain injury service; and a charitable sector community group. Scotland.	Age: 47 (8.9) % Male: 83 Months since ABI: 141 (131)	Compassion focused imagery (CFI): sections on the 'felt sense' of compassion and the 'compassionate calm self'.	Relaxation imagery (RI): sections on 'becoming the calm self' and generating a special 'relaxing place'.	*Self-report scales* (1) The Empathy Quotient (EQ) (2) The Self-Compassion Scale (SCS) (3) State Trait Anxiety inventory (STAI) (4) Relaxation Scale (RS)	*Group differences* Posttreatment: (1) Empathy *ns* (*F*(1,21)=.577, *p*=.46, *d*=.32) (2) Self-compassion *ns* (*F*(1,21)=.426, *p*=.58, *d*=.28) (3) Anxiety *ns* (M-W, U=67.50, *p*= .35, *d*=.31) (4) Relaxation *ns* (*F*(1,21)=.131, *p*=.72, *d*=.15) *Combined groups* (*CFI & RI groups together)* Posttreatment: (1) Empathy *ns* (*t*(23)=-1.945, *p*=.064, *d*=.35) (2) Self-compassion *ns* (*t*(23)=-.189, *p*=.85, *d*=.03) (3) State anxiety *s* (Wilcoxon S-R; T=40, *p*<.05, *r*=.29, *d*=.32) (4) Relaxation *s* (Wilcoxon S-R; T=28.50, *p*< .01, *r*=.41, *d*=.67)

Chiaravalloti, Sandry, Moore & DeLuca (2016)	RCT Facilitator(s): Not reported. Facilitators received training from research coordinator and PHD level Neuropsychologist. Follow-up: 6 months	N=69 (Tx: 35; control: 34). All participants sustained moderate to severe TBI. Recruited from local TBI clinics, consumer newsletters and support groups, the Northern NJ TBI Model System, and the Kessler Foundation database. USA.	Age: Tx: 37.17 (11.24) Control: 40.68 (11.28) Male: Tx: 77% Control: 71% Months since ABI: Tx: 119.97 (128.91) Control: 101.97 (70.78)	Modified Story Memory Technique (mSMT), a behavioral intervention teaching context and imagery to facilitate learning. Booster Sessions: 50% of treatment group. Focused on applying the mSMT to real world situations.	Met 1:1 with therapist at the same frequency as the treatment group, engaging in non– training-oriented tasks.	*Primary outcomes* (1) Memory Assessment Scales, Prose Memory (MAS-PM) (2) CVLT-II Learning Slope. *Secondary outcomes* (1) Rivermead Behavioural Memory Test (RBMT) (2) The Frontal Systems Behaviour Scale (FrSBe) (3) The State-Trait Anxiety inventory (STAI) (4) Chicago Multidimensional Depression inventory (CMDI)	*Primary outcomes* *(1) MAS-PM* Posttreatment: Memory enhanced in Tx vs control ($F(1,69)=4.45$, $p<.05$, $\eta_p^2=.064$) RCI: Tx: 23%; Control: 9% Follow-up: Effect of group (Tx vs control) *ns* ($F(1, 65)=1.85$, $p>.05$, $\eta_p^2=.028$) Effect of time (Posttreatment vs follow-up) *ns* ($F(1, 65)=.33$, $p>.05$, $\eta_p^2=.005$) Interaction *s* ($F(1, 65)=3.92$, $p=.05$, $\eta2=.057$) Booster sessions: Effect of group (Booster vs non-booster) *ns* ($F(1, 31)=.047$; $p>.05$; $\eta_p^2=.002$)

	Effect of time (Posttreatment vs follow-up) *ns* ($F(1, 31)=.186$; $p>.05$; $\eta_p^2=.006$) Interaction *ns* ($F(1, 31)=.428$; $p>.05$; $\eta_p^2=.014$) *(2) CVLT-II* Posttreatment: Learning slope *ns* ($F(1,69)=.686$, $p>.05$, $\eta 2=.001$). *Secondary outcomes* *(1) RBMT* Posttreatment: PM enhanced in Tx relative to control ($x^2(1)=7.36$, $p=.025$, Cohen's $w=.43$) *(2) FrSBe* Posttreatment: Informant-reported improvements in disinhibition in Tx ($F(1, 31)=6.86$, $p<.05$, $\eta 2=.046$) not the control.

							Self-report measures for Tx and control *ns* *(3) STAI* Posttreatment: Anxiety in Tx relative to control *ns* (*F*(1, 57)=.075, *p*>.05, η2=.00) *(4) CMDI* Posttreatment: Depression in Tx relative to control *ns* (*F*(1, 61)=.024, *p*>.05, η2=.00)
Grilli & Glisky (2010)	Experimental within-group design Healthy volunteers formed a control for effects of retesting.	N=28 (Tx: 14; Healthy control: 14). All Tx group sustained ABI and demonstrated a memory impairment on the General	Age: Tx: 47.5 (8.8) Control: 49.1 (11.8) % Male: Tx: 41 Control: Unknown Years since ABI: Tx: 20.5 (7.8)	*Structural-baseline condition:* Counting the number of syllables in target sentences and deciding whether there were more	*Structural-baseline condition.* Then, *Semantic processing condition:* Each of target sentences were preceded by two context-setting sentences. Participants	Number of target sentences recognised under each condition.	*Sentence recognition* Posttreatment: Effect of condition *s* (*F*(3, 39)=43.15, p<.001, η2=.77). Effect of emotion *ns* (F(1, 13)=3.61, p=.08, η2=.27) Interaction *ns* (*F*(3, 39)=2.08, *p*=.12) Self-imagining > elaborated semantic processing

	Facilitator(s): Not reported Follow-up: none	Memory Index. TBI: 10 Tumour: 1 Anoxia: 2 Aneurysm: 1 Recruited from laboratory participant pool and community ABI support groups. USA.	Control: N/A	than 12 syllables. Then, *Self-imagining condition:* Imagining they were at the scene described by 28 (14 neutral and 14 emotional) target sentences including as many sensory details as possible.	decided if the target sentence 'fit in' with the rest of the short story.		(F(1,13)=32.11, p<.001, η2=.71) Elaborated semantic processing > unelaborated semantic processing (F(1,13)=17.72, p<.001, η2=.58) Unelaborated semantic processing > structural baseline (F(1, 13)=4.90, p<.05, η2=.27).
Grilli & Glisky (2011)	Experimental within-group design	N=16 All participants experienced a self-reported	Age: 49.9 (7.4) Male: 56%	*Self-Imagination condition:* Imagined themselves interacting	*Visual imagery condition:* Formed a visual image of the target object in a specified	Proportion of correct word pairs under each condition.	*Correct word pairs* Posttreatment: Effect of condition *s* (F(3, 45)=5.05, p<.01, η2=.25)

	Facilitator(s): Not reported Follow-up: none	decline in memory. TBI: 12 Tumour: 1 Encephalitis: 1 Anoxia: 1 Aneurysm: 1 Recruited from laboratory participant pool, 11 of whom participated in Grilli & McFarland (2011). USA.	Years since ABI: 17.6 (10.6)	with target object in a specified spatial location from a realistic, personal perspective. Included possible thoughts, feelings, and sensory experiences.	spatial location and maintained for the duration of the trial. *Other imagining condition:* Imagined a specified individual interacting with the target object in the spatial location. *Semantic elaboration condition:* Generated a sentence that incorporated the object and spatial location in a meaningful way and said aloud.		Effect of delay time *s* ($F(1, 15)=22.84$, $p<.001$, $\eta 2=.60$) Interaction *ns* ($F < 1$) Self-imagining > visual imagery ($F(1,15)=11.09$, $p<.01$, $\eta 2=.43$) Self-imagining > semantic elaboration ($F(1,15)=6.36$, $p<.05$, $\eta 2=.30$) Self-imagining > other imagining ($F(1,15)=17.94$, $p=.001$, $\eta 2=.55$) Semantic elaboration vs visual imagery ($F < 1$) and other imagining *ns* ($F < 1$). Visual imagery vs other imagining *ns* ($F(1,15)=2.69$, $p=.12$).
Grilli & McFarland (2011)	Experimental within-group design	N=12	Age: 49.42 (15.29)	*Self-Imagining condition:* Imagined, with	*Rote-rehearsal condition:* Rehearsed a PM	Number of completed PM tasks under each condition.	*Completed PM tasks*

	Facilitator(s): Not reported Follow-up: none	All participant's demonstrated memory impairment on the General Memory Index (GMI). TBI: 9 Anoxia: 1 Aneurysm: 1 Tumour: 1 Recruited from laboratory participant pool and brain injury support groups in Arizona. USA.	% Male: 58% Years since ABI: 21.17 (8.18)	as much detail as possible, completing a prospective memory (PM) task from personal perspective prior to completing the task.	task instruction by saying them out loud prior to task.		Self-imagining > rote rehearsal ($F(1,11)=11.52$, $p<.01$, $\eta 2=.51$). 83% participants failed to perform a single PM task in the rote-rehearsal condition. 41% participants failed to complete PM task in either condition.
O'Neill & McMillan (2012)	Experimental between-group design with	N=24 (Tx: 12; Control: 12). All participants sustained a	Age: Tx: 45.33 (15.6) Control: 39.08 (11.08)	Compassion focused imagery (CFI): sections on the	Relaxation imagery (RI): sections on 'becoming the calm self' and	*Self-report scales:* (1) The Empathy Quotient (EQ)	*Group differences* Posttreatment: (1) Empathy *ns* ($F(1, 21)=.12$, $p=.73$, $d=.15$)

	randomised allocation Facilitator(s): Final year clinical psychology trainee. Follow-up: none	TBI and scored at least one standard deviation below the general population mean on empathy. RTA: 13 Fall: 7 Assault: 4 Recruited from voluntary groups and rehabilitation services. Scotland.	% Male Tx: 83 Control: 91.67 Months since ABI (*Median (range) reported):* Tx: 57.5 (4-488) Control: 124.5 (3-468)	'felt sense' of compassion and the 'compassionate calm self'.	generating a special 'relaxing place'.	(2) The Self-Compassion Scale (SCS) (3) The Relaxation Scale (RS)	(2) Self-compassion *ns* (H(1)=.00, *p*= .95) (3) Relaxation *ns* (H(1)=.25, *p*=.62, *d*=.38) *Combined groups* (*CFI & RI groups together)* Posttreatment: (1) Empathy *ns* (*t*(23)=.78, *p*=.45, *d*=.32) (2) Self-compassion *ns* (Wilcoxon T=78.00, *p* = 0.07, r = –.26). (3) Relaxation *ns* (Wilcoxon T=71.00, *p*=.20) *Within-group treatment effects* *CI group:* (1) Empathy *ns* (*t*(11)=1.18, *p*=.13, *d*=.71) (2) Self-compassion *ns* (T=25.50, *p*=.14) (3) Relaxation *ns* (T=27.50, *p*=.62).

							RI group: (1) Empathy *ns* (*t*(11)=.09, *p*=.93, *d*=.05) (2) Self-compassion *ns* (T=17.00, *p*=.15) (3) Relaxation *ns* (T=12.00, *p*=.10)
Potvin, Rouleau, Senechal & Francois (2011)	Experimental between-group design with selective group allocation Facilitator(s): Not reported Follow-up: N/A	N=30 (Tx: 10; Control: 20) All participants sustained moderate to severe TBI. Tx: RTA: 8 Fall: 2 Control: RTA: 15 Fall: 3 Struck by object: 2	Age: Tx: 35.00 (10.82) Control: 30.90 (10.47) % Male Tx: 70 Control: 55 Months since ABI: Tx: 43.40 (23.35) Control: 34.00 (18.17)	Individual rehabilitation sessions including: (1) understanding PM functioning, (2) training to visualise simple images (objects and actions), (3) learning visual imagery techniques, (4) applying visual imagery in PM, and (5) applying visual	Informed of cognitive test results and given brief educational intervention exploring compensatory strategies.	*Prospective Memory* *(*1) Test Ecologique de Memoire Prospective (TEMP). *Neuropsychological assessment* (1) Digit Symbol; (2) Cancellation Task; (3) Trail Making Test – Part A; (4) Digit Span; (5) Rey Auditory Verbal Learning Test; (6) Brief Visuospatial Memory Test; (7) Trail Making Test – Part B; (8)	*Prospective Memory* *(1) TEMP* Posttreatment: Time (pre/post) *s* (*F*(1, 27)=19.94, MSE=42.17, *p*<.05, η2=.43) Group (treatment/control) *ns* (*F*(1, 27)=.00, MSE=662.96, *p*>.05, η2=.00) Time*Group *s* (*F*(1, 27)=13.17, MSE=42.17, *p*<.05, η2=.34) Tx pre- to post-treatment *s* (*t*(9)=-3.46, *p*<.05, *d*=.77)

	Recruited from Sacre-Coeur Hospital in Montreal. Canada.	imagery in everyday situations.	Semantic Verbal Fluency; (9) WISC-III Mazes; (10) Stroop; (11) Visual Discrimination Task; (12) Semantic Association Task; and (13) Letter Visualisation Task. *Questionnaires* (1) Beck Anxiety Inventory (BDI) (2) Beck Depression Inventory (3) Assessment of Prospective Memory (CAPM)	Control pre- to post-treatment *ns* (*t*(18)=-.98, *p*>.05, *d*=.27) *Neuropsychological assessment* Posttreatment: Across groups digit symbol test *s* (*F*(1, 27)=5.64, *p*<.05). All other effects *ns*. *Questionnaires* *(1) BAI* Effect of time *ns* Effect of group *ns* Interaction *ns* (*p*>.10). Pre-post anxiety scores decreased for Tx group (*d*=.54), not the control (*d*=.00). *(2) BDI* Effect of time *s* (*F*(1, 27)= 5.11, MSE=19.57, *p*<.05, η2=.16)

Effect of group *ns* (*F*(1, 27)=0.29, MSE=91.19, *p*>.05, η2=.01)
Interaction *s* (*F*(1, 27)=5.64, *p*<.05, η2=.31)

Pre-post depression scores *s* decreased for Tx group (*t*(9)=3.45, *p*<.05, *d*=.86), not the control (*t*(28)=-1.04, *p*<.05, *d*=.25).

(3) CAPM
Posttreatment Tx:
Decrease in self-reported PM failures *s* (*t*(9)=2.44, *p*<.05, *d*=.63)
Decrease in relative-rated failures *s* (*t*(9)=3.86, *p*<.05, *d*=.80)

Posttreatment Control:
Self-reported failures *ns* (t(18)=1.48, *p*>.05, *d*=.38)
Relative reported *ns* (*t*(18)=1.98, *p*>.05, *d*=.48)

Raskin, Smith, Mills, Pedro & Zamrozie wicz (2019)	AB-BA crossover design (A=active treatment; B=control) Half of ABI participants completed condition A then B, half completed B then A. Healthy volunteers formed a control for effects of retesting. Facilitator(s): Not reported. Follow-up: 12 months	N=40 (Tx: 20; Healthy control: 20) All Tx group diagnosed with moderate to severe TBI. RTA: 12 Fall: 5 Struck by object: 3 Recruited through brain injury alliance of Connecticut, Hartford healthcare head injury clinic and local support groups. USA.	Age: Tx: 42.11 (13.21) Control: 39.15 (14.21) % Male Tx: 60 Control: 50 Time since ABI (Days): Tx: 217.19 (198.45) Control: N/A	Only BI group received training. Condition A: Training of visual imagery - participants imagined themselves completing events using detailed sensory information.	Condition B: no treatment attention control. PM training without imagery.	*Prospective Memory* (1) The Memory for Intentions Screening Test (MIST). *Neuropsychological assessment* (1) Trail Making Test A and B (2) The Brief Test of Attention (3) Hopkins Verbal Learning Test *Generalisation measures* (1) The Prospective Memory Questionnaire (2) The Everyday Memory Questionnaire (3) WHO-QoL-BREF	*Prospective Memory* *(1) MIST* Posttreatment: All participants showed an increase in the length of time that they were able to recall prospective memory tasks (*M* change=2.51 minutes; *SD*=1.85, *d*=1.36). PM improved after active treatment ($p<.001$, *d*=1.52) not the control. Follow-up: Reduced performance relative to post-intervention (*d*=.46) Superior performance relative to baseline (*d*=1.01) *Neuropsychological assessment* Posttreatment: Attention *s* ($p<.01$, *d*=.46)

	(4) Personal diaries	Executive functioning *s* (*p*<.01, *d*=1.60) All other effects *ns*. *Generalisation measures* Post-treatment: (1) Prospective Memory Questionnaire (*d*=.52) (2) Everyday Memory Questionnaire (*p*=.022, *d*=.57) (3) WHO-QoL-BREF (*d*=.62) (4) Diary Measure (*d*=1.12)

Note. ns=non-significant; *s*=significant; RTA=Road Traffic Accident; Tx=Treatment Group; IRCCS=Scientific Institute for Research, Hospitalization and Healthcare; PM=Prospective Memory. Boccia et al. (2019) analysed data using a Crawford analysis (i.e., comparing the participant's baseline, post-intervention, and follow-up results to a normative sample for each of the dependent variables). At baseline, the participant significantly differed from normative samples on all the reported measures, indicating impaired performance compared to their expected abilities. Therefore, in this case, non-significant results at post-treatment and follow-up demonstrate improved performance that was then in line with normative samples, supporting the effectiveness of the intervention. Alternatively, for all other studies, it is significant results that support intervention effectiveness. In their analysis Campbell et al. (2019) and O'Neill and McMillan (2012) compared CFI and RI groups. These results are reported under '*Group differences*'. Both studies also combined the two groups' data, analysing pre- to post-outcomes for CFI and RI groups combined. This was thought to represent the general effect of imagery and is reported under '*Combined groups*'. In Potvin et al. (2011), participants were selectively allocated to either the experimental or control group based on age and education to match the two groups.

Interventions

Intervention duration and frequency ranged from one session (Campbell et al., 2019; Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011; O'Neill & McMillan, 2012) to weekly or bi-weekly sessions over either an 8-week (Boccia et al., 2019), 10-week (Chiaravalloti et al., 2016; Potvin et al., 2011) or six-month period (Raskin et al., 2019). All interventions were provided in a one-to-one format, as recommended in ABI due to differing cognitive impairments (Kangas & McDonald, 2011). The content of imagery interventions varied considerably across studies.

Three studies explored the use of 'self-imagining' as a memory and learning strategy. Participants imagined a scene described by the researcher using as much sensory detail as possible (Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011). Raskin et al. (2019) asked participants to imagine a PM task/event from a personal perspective, using questions to guide imagery such as 'What do you see?', 'What do you hear?' and 'How do you feel?' Similarly, Potvin et al. (2011) utilised a PM intervention, divided into five phases: (1) understanding PM functioning, (2) training to visualise simple images (objects and actions), (3) learning visual imagery techniques, (4) applying visual imagery in PM, and (5) applying visual imagery in everyday situations. Boccia et al. (2019) used an Imagery-Based Treatment (IBT), which was tailored to the participants navigational difficulties. Imagery training was provided, and the participant was taught to rapidly generate mental images before being asked to generate and retrieve navigational images of landmarks and routes, and environmental map-like representations. Chiaravalloti et al. (2016) used the modified Story Memory Technique (mSMT), a highly manualised intervention that

also teaches context and imagery to facilitate new learning. Finally, two studies (Campbell et al., 2019; O'Neill & McMillan, 2012) compared compassion-focused imagery (CFI) to relaxation imagery (RI) using scripted guidance that was designed to support ABI related deficits (e.g., simplified instructions, slowed delivery). Sessions followed a similar format including repetition of the CFI or RI exercises and two guided-reflection components. CFI comprised of sections on the 'felt sense' of compassion and the 'compassionate calm self'. RI comprised of sections on 'becoming the calm self' and generating a 'special relaxing place'.

Control Groups

Three studies used control groups. In Chiaravalloti et al. (2016), the control group met with the therapist at the same frequency as the treatment group and engaged in non-training orientated tasks. In Potvin et al. (2011), participants were informed of their neuropsychological test results and received a brief psychoeducational intervention exploring behavioural and compensatory strategies. Finally, in Raskin et al. (2019), control participants followed PM training without imagery.

Five studies used a comparator condition (Campbell et al., 2019; Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011; O'Neill & McMillan, 2012). As outlined above, Campbell et al. and O'Neil and McMillan compared CFI to RI. In the remaining three studies, a within-group design was utilised (i.e., all participants took part in all conditions). In Grilli and Glisky (2010), individuals' performance under the 'self-imagining' condition was compared to their performance under a 'structural baseline condition' and 'semantic processing condition'. In these

two conditions, participants were asked to remember verbal or written sentences presented to them using strategies such as counting the number of syllables in the sentence or checking if the sentence 'fit' into a story that was presented with it. In Grilli and Glisky (2011), 'self-imagining' was compared to three comparator conditions: (1) 'visual imagery': participants were instructed to form a visual image of the target object in a specified spatial location and maintain the image for the duration of the trial; (2) 'other imagining': participants were instructed to imagine, with as much detail as possible, another individual interacting with the target object in the spatial location, and (3) 'semantic elaboration': participants were instructed to generate a sentence that incorporated the object and spatial location in a meaningful way and to say the sentence aloud. In Grilli and McFarland, 'self-imagining' was compared to a 'rote-rehearsal' condition in which participants rehearsed PM task instructions by saying them out loud prior to completing the task. Boccia et al. (2019) did not use a control or comparator group, instead comparing the participants' pre, post and follow-up cognitive test scores to published neuropsychological norms.

Quality Assessment

Four studies used manualised or scripted interventions (Campbell et al., 2019; Chiaravalloti et al., 2016; O'Neill & McMillan, 2012; Raskin et al., 2019), and four used computerised interventions (Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011; Potvin et al., 2011). Whilst this makes it easier to adhere to protocol, there is no suggestion that adherence was formally monitored in any study. One study (Boccia et al., 2019) based their intervention on cognitive models of spatial navigation (e.g., Siegel & White, 1975; Wang & Spelke, 2002; Wolbers & Wiener, 2014) as well as the imagery intervention used by Kaschel et al. (2002); however, they

failed to monitor consistency between the study treatment and previous models and interventions.

Therapist Training

Facilitator training and expertise was not reported in two studies (Boccia et al., 2019; Raskin et al., 2019). Four further studies also fail to provide training information; however, they describe computerised interventions, less likely to be influenced by facilitators (Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011; Potvin et al., 2011). In one study (Chiaravalloti et al., 2016), specific details about facilitator qualifications were not provided; though, it is reported that all facilitators received training from the study co-ordinator and a PhD level neuropsychologist. A trained clinical neuropsychologist was used in one study (Campbell et al., 2019) and a final year clinical psychology trainee was used in another (O'Neill & McMillan, 2012).

Follow-up

Three studies used follow-up periods. These varied in length: six months (Chiaravalloti et al., 2016), eight months (Boccia et al., 2019) and one year (Raskin et al., 2019). In Chiaravalloti et al. fifty percent of intervention participants were allocated to the 'booster' group and completed follow-up measures. Booster sessions focused on applying participants newly acquired imagery skills to real-world situations. In Boccia et al. neuropsychological outcomes were repeated at follow-up, as well as immediately pre – and post – intervention. Similarly, in Raskin et al., the one-year follow-up allowed an experimenter (with no knowledge of treatment condition) to repeat outcome measures for all participants.

Quality Rating

As outlined in Table 4, the overall quality ratings of studies ranged from *Weak* to *Strong* according to the EPHPP tool (Thomas et al., 2004). To reach these ratings, the tool considers six study factors: selection bias, study design, confounders, blinding, data collection methods, and withdrawals and dropouts. The highest quality studies were (1) Chiaravalloti et al. (2016), an RCT, and (2) Raskin et al. (2019), an AB-BA crossover design. Across studies, main areas of weakness included the study design, blinding and data collection methods, with three studies failing to provide pre-post outcomes and instead comparing participant performance across experimental conditions (Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011). All studies made attempts to reduce selection bias and only two studies reported any participant withdrawals. Attrition rates were reported in terms of the number of dropouts (Grilli & Glisky, 2010), or the number of withdrawals in addition to the reasons associated with them (Chiaravalloti et al., 2016).

The EPHPP tool also provided guidance for the evaluation of intervention integrity and analyses, although these did not contribute to the overall quality ratings (Table 5).

Table 4

Quality Ratings using the EPHPP tool

Study	Selection Bias	Study Design	Confounders	Blinding	Data Collection Method	Withdrawal and Dropouts	Overall Quality Rating
Boccia et al. (2019)	Moderate	Moderate	Moderate	Weak	Strong	N/A	Moderate
Campbell et al. (2019)	Moderate	Strong	Weak	Strong	Moderate	N/A	Moderate
Chiaravalloti et al. 2016)	Moderate	Strong	Strong	Strong	Strong	Moderate	Strong
Grilli & Glisky (2010)	Moderate	Weak	Moderate	Moderate	Weak	Weak	Weak
Grilli & Glisky (2011)	Moderate	Weak	Moderate	Moderate	Weak	N/A	Weak
Grilli & McFarland (2011)	Moderate	Weak	Moderate	Moderate	Weak	N/A	Weak
O'Neill & McMillan (2012)	Moderate	Strong	Strong	Weak	Moderate	N/A	Moderate
Potvin et al. (2011)	Moderate	Moderate	Strong	Weak	Strong	N/A	Moderate
Raskin et al. (2019)	Moderate	Moderate	Strong	Strong	Strong	N/A	Strong

Note. Overall quality rating: Strong = no 'Weak' ratings; Moderate = one 'Weak' rating; Weak = two or more 'Weak' ratings. Not applicable (N/A) ratings made due to these studies reporting no participant withdrawals.

Table 5

Intervention Integrity and Analysis using EPHPP tool

Study	Intervention Integrity			Analysis	
	% pts receiving allocated intervention *80-100%/60-79%/Less than 60%/Can't tell*	**Was the consistency of intervention measured?** *Yes/No/Can't Tell*	**Is it likely that pts received unintended treatment?** *Yes/No/Can't Tell*	**Are stats appropriate for design?** *Yes/No/Can't Tell*	**Intention-to-treat analysis used?** *Yes/No/Can't Tell*
Boccia et al. (2019)	80 – 100%	No	No	Can't tell	N/A
Campbell et al. (2019)	80 – 100%	No	No	Yes	No
Chiaravalloti et al. 2016)	60 – 79%	No	No	Yes	Yes
Grilli & Glisky (2010)	80 – 100%	No	Yes	Yes	No
Grilli & Glisky (2011)	80 – 100%	No	Yes	Yes	No
Grilli & McFarland (2011)	80 – 100%	No	Yes	Yes	No

O'Neill & McMillan (2012)	80 – 100%	No	No	Yes	No
Potvin et al. (2011)	80 – 100%	No	No	Yes	No
Raskin et al. (2019)	80 – 100%	No	No	Yes	No

Intervention Integrity

In most studies all participants completed the intervention. Two studies reported participant withdrawals: Chiaravalloti et al. (2016) acknowledged a 6% attrition rate between baseline and immediate follow-up, and a 19% attrition rate between immediate and long-term follow-ups; and Grilli and Glisky (2010) reported a 6% overall dropout rate. Chiaravalloti et al. used an intention-to-treat analysis (Table 5), reducing the risk of attrition bias; however, Grilli and Glisky (2010) did not, increasing this risk.

No studies measured the consistency of the intervention (see ***Quality Assessment*** section above). For six studies, it was deemed unlikely that study outcomes were influenced by participants receiving an unintended intervention, either via contamination (the control group accidentally receiving the study intervention) or co-intervention (participants receiving an unintended or additional intervention). In the remaining three studies (Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011), the within-group design means that there is no guarantee that improvements in memory encoding were attributable to the 'self-imagining' condition rather than the additional and unintended use of an earlier encoding strategy. This is particularly relevant in Grilli and Glisky (2011), in which 11 participants had recently taken part in the previous study (Grilli & Glisky, 2010) and learnt different encoding strategies. Such limitations are not noted by the authors, perhaps because the order of conditions was counterbalanced across participants, which partially controlled for the potential confound.

The Effectiveness of Imagery Interventions on Cognition

(1) Memory

(1a) Prospective Memory (PM). Three studies explored the effect of imagery on PM (i.e., a participant's ability to remember to carry out intended actions in the future) (Grilli & McFarland, 2011; Potvin et al., 2011; Raskin et al., 2019). In Grilli and McFarland, a study of weak quality, PM was assessed by recording the number of identified PM tasks completed under two experimental conditions: 'self-imagining' and 'rote-rehearsal'. A large effect size was found in favour of self-imagining ($\eta 2$=.51). In Potvin et al., individuals receiving imagery-based rehabilitation sessions performed significantly higher on an assessment of PM posttreatment compared to baseline with medium-large effect (d=.77), unlike the control group (d=.27). Additionally, both self-reported (d=.63) and relative-reported (d=.80) PM failures were significantly lower post-treatment for the intervention group only. Similarly, in Raskin et al., participants improved on a measure of PM following only the active treatment (i.e., training and practice of visual imagery), not the control, and a large effect was found (d=1.52). At one-year follow-up, participants performance worsened compared to post-intervention scores (d=.46); however, performance remained superior to their baseline with large effect (d=1.01). Overall, imagery-based approaches had a medium-large effect on PM.

(1b) Episodic Verbal Learning and Memory. Three studies explored the use of imagery on episodic verbal learning and memory (Chiaravalloti et al., 2016; Grilli & Glisky, 2010; Grilli & Glisky, 2011). In Chiaravalloti et al., two neuropsychological assessments assessed participants immediate and delayed recall of a piece of prose (e.g., a story or list of words). On one assessment, the treatment group demonstrated significant improvements compared to the control post-treatment with

medium effect (η2=.064). 49% of the treatment group showed greater than a 10% improvement versus 18% of the control, and the two groups performed similarly again at 6-month follow-up regardless of whether they attended booster sessions. However, on the second measure, a non-significant and negligible effect was noted in the treatment group post-intervention (η2=.001). In Grilli and Glisky (2010), a study of weak quality, memory was assessed by recording the proportion of correctly recognised sentences under three different encoding conditions (outlined in Table 3: 'self-imagining', 'structural baseline' and 'semantic processing'). Self-imagining led to significantly higher performance than semantic processing with large effect (η2=.71), which in turn led to higher performance than the structural baseline condition with large effect (η2=.27). Likewise, in Grilli and Glisky (2011), a study of weak quality, memory was assessed by recording the proportion of correctly recalled word pairs under four different encoding conditions (outlined in Table 3: 'self-imagining', 'other person imagining', 'visual imagery' and 'semantic elaboration'). Self-imagining again enhanced cued recall significantly more than: (1) visual imagery, with large effect (η2=.43); (2) semantic elaboration with large effect (η2=.30), and (3) other imagining with large effect (η2=.55). However, regardless of encoding condition, performance declined across the retention period. Based on these findings, imagery strategies enhance verbal learning and memory with a medium-large effect; however, two of the three studies are low in quality and the remaining study reports mixed findings.

(1c) 'Everyday' Memory. Two studies looked at participants' ability to remember everyday things such as a name or face (Boccia et al., 2019; Chiaravalloti et al., 2016). In Boccia et al., the participants performance improved posttreatment, falling within the expected range when compared to a normative sample. In

Chiaravalloti et al., the treatment group demonstrated significantly greater improvement compared to the control, and a medium effect was evident (Cohen's *w*=.43).

(2) Navigational and Visuospatial Abilities

Boccia et al. (2019), a study of moderate quality, tested the effect of imagery on navigational and visuospatial abilities. All baseline scores indicated significant impairment compared to a non-BI normative sample and intervention effects were examined by comparing post-treatment scores to the same normative sample (ES has therefore not been computed). On two standardised tasks assessing navigational skills posttreatment, the participant did not significantly differ from norms for learning (i.e., immediate recall); however, treatment effects were maintained at follow-up for only one of the two tasks. In terms of delayed recall, performance significantly differed from norms in one of the two tasks posttreatment, though performance in both tasks was non-significant at follow-up. In an ecologically valid map-following task, performance was errorless posttreatment and at eight-month follow-up, demonstrating 100% effectiveness compared to 75% effectiveness pre-treatment. Similarly, on two tasks assessing visuospatial skills, no significant difference was found between the participant's performance and normative data immediately posttreatment or at follow-up. Findings therefore indicate that imagery-based treatments can lead to improvements in navigational and visuospatial abilities, which are largely maintained at follow-up. However, this is based on a single case-study and should be interpreted cautiously.

The Effectiveness of Imagery Interventions on Mood

(1) Anxiety and Depression

Two studies explored the effect of imagery on anxiety and depression (Chiaravalloti et al., 2016; Potvin et al., 2011). Chiaravalloti et al., a study of strong quality, utilised a behavioural intervention that teaches context and imagery to facilitate new learning. The authors reported no significant differences on anxiety between intervention and control groups posttreatment, and no effect of the imagery intervention was found ($\eta 2$=.00). Similarly, following an imagery-based rehabilitation programme for PM, a study of moderate quality (Potvin et al., 2012), reported no significant main effects of Time (pre/post) or Group (treatment/control) on anxiety nor a significant interaction effect. However, within-group effects demonstrated a pre-post reduction in anxiety for the intervention group only (*d*=.54).

For depression, Chiaravalloti et al. found no significant differences between treatment and control groups pre- to post-intervention and no effect of the imagery intervention was found ($\eta 2$=.00). It is not possible to calculate pre-post ES by group. In Potvin et al., reductions in depression were large for the intervention group (*d*=.86) and small for the control group (*d*=.25).

The non-significant results reported in Potvin et al., despite medium-large ES, may be due to the small sample size in the treatment group (n=10) resulting in inadequate power to show significance (Type II error). Nevertheless, findings conflict between the two studies, likely due to vast differences between the interventions and outcome measures utilised.

(2) Self-compassion, Relaxation, and Empathy

Campbell et al. (2019) and O'Neill and McMillan (2012), studies of moderate quality, explored the effect of CFI and RI on self-compassion, relaxation levels and empathy. The studies compared the effects of CFI and RI as well as exploring their combined effect, thought to represent the general effect of imagery. They differed in that O'Neill and McMillan selectively recruited individuals with low empathy at baseline.

In Campbell et al. (2019), post-treatment self-compassion scores did not significantly differ between groups, but a small ES was reported in favour of RI (*d*=.28). Combined, the interventions did not lead to a significant change in self-compassion (*d*=.03, small effect). ES cannot be computed for O'Neill and McMillan (2012); however, post-treatment self-compassion scores did not significantly differ within or between groups.

Examining relaxation as the outcome, Campbell et al. (2019) found no significant differences between groups posttreatment, reporting a small ES in favour of RI (*d*=.15). However, pre-post treatment effects demonstrated improvement in relaxation levels with large effect for the CFI group (*d*=1.00) and small effect for the RI group (*d*=.36) due heightened baseline scores. Examining the combined effect of RI and CFI, relaxation scores significantly improved over time (*d*=.67, medium-large effect). In O'Neill and McMillan (2012), post-test relaxation scores did not significantly differ within or across groups with a small ES found in favour of RI (*d*=.38).

For empathy, Campbell et al. (2019) reported no significant differences between groups posttreatment, and a small effect was shown in favour of RI (*d*=.32).

When groups were pooled, the authors reported a non-significant trend towards increased empathy posttreatment with small-medium effect (*d*=.35). Pre-post calculations indicate that CFI increased empathy posttreatment with small effect (*d*=.17) and RI with medium-large effect (*d*=.60). In O'Neill and McMillan, no significant differences in posttreatment empathy scores were reported between the two groups. When the groups were combined, a small effect of imagery intervention was found on empathy (*d*=.32). Analysed independently, a medium-large yet non-significant effect was found of CFI on empathy (*d*=.71) and a negligible effect of RI was reported (*d*=.05).

Despite non-significant results, medium-large ES suggest that imagery approaches can enhance levels of relaxation and empathy; though, it is difficult to establish superiority of CFI over RI due to conflicting results between the two studies. It appears less likely that imagery influences self-compassion. However, the authors question whether the outcome measures used were sufficiently sensitive to detect changes within a single session.

(3) Quality of Life (QoL)

Raskin et al. (2019), a study of strong quality, explored the use of a PM rehabilitation programme on QoL. The authors reported no significant pre-post differences in QoL in the intervention group, though, a medium ES was found (d=.62).

The Effectiveness of Imagery Interventions on Behaviour

One study (Chiaravalloti et al., 2016) examined the impact of imagery on disinhibited behaviour. Informant reported improvements in disinhibition were noted in the treatment but not the control group, and a medium ES was found ($\eta 2$=.046). No significant differences were found on self-report measures of disinhibited behaviour for either group.

Discussion

This paper aimed to systematically review the use of imagery-based approaches on psychological outcomes (i.e., cognition, mood and/or behaviour) for adults who have an ABI. Nine eligible papers were reviewed, predominantly including participants who had experienced a moderate to severe TBI following a fall, RTA or assault, and a male majority was found in all studies. Across studies, participants were widely found to have impaired cognitive functioning in domains such as memory, attention, visuospatial and executive abilities when compared to non-ABI normative samples at baseline.

It is therefore unsurprising that seven of the nine papers explored the use of various imagery-based strategies on cognition. Six studies investigated new learning and memory, encouraging participants to use strategies such as imagining themselves completing a future task with as much sensory detail as possible; and one study looked at post-injury navigational and visuospatial abilities, teaching a participant to generate and retrieve mental images of navigational representations. The remaining two studies explored the effect of compassion- and relaxation-based imagery exercises (e.g., the 'compassionate calm self' or 'special relaxing place') on mood outcomes of relaxation, empathy, and self-compassion. No studies specifically targeted behaviour with their

intervention, with only one study examining disinhibited behaviour as a secondary outcome pre- and post-treatment.

Summary of Main findings

(1) Cognitive Outcomes

Of all the DVs included in the reviewed studies, memory was the most common outcome and underwent the biggest post-treatment change when compared to comparator or control groups. For example, imagery yielded medium-large ES on prospective memory (PM) across three studies, ranging in quality from weak to strong (Grilli & McFarland, 2011; Potvin et al., 2011; Raskin et al., 2019). Likewise, imagery strategies were found to have a medium-large effect on episodic verbal learning and memory, which improved posttreatment in three studies (Chiaravalloti et al., 2016; Grilli & Glisky, 2010; Grilli & Glisky, 2011); though, two of the three studies are low in quality and uncontrolled. In two studies, imagery also led to enhanced memory for everyday things (e.g., names and faces) when compared to neuropsychological norms or a control group post-treatment (Boccia et al., 2019; Chiaravalloti et al., 2016). However, Boccia et al. did not report ES so standardised comparisons cannot be made across the two papers. Promising results were also reported for imagery as a treatment for navigational and visuospatial impairments (Boccia et al., 2019); although, findings are tentative and based on a single case study that produced no ES. Overall, findings suggest that imagery is effective when used as a cognitive intervention with ABI samples; however, this conclusion is tentative due to limitations in study designs and possible confounding variables. For example, since the same participants were included in multiple studies (Grilli & Glisky, 2010; Grilli & Glisky,

2011), it is possible that results may reflect a pre-existing idiosyncrasy of the participant sample.

(2) Mood Outcomes

When compared to a control group receiving a brief psychoeducational intervention, one study (Potvin et al., 2011) reported non-significant reductions in anxiety and depression post imagery intervention with medium-large effect. However, another reported no effect of an imagery intervention on either anxiety or depression when compared to a control (Chiaravalloti et al., 2016). Conflicting results may be due to differences between the outcomes and treatments used in the two studies. That is, Chiaravalloti et al. used a behavioural intervention in attempt to improve participant's encoding and recall of a piece of prose, whereas Potvin et al. utilised individual rehabilitation sessions that focused on PM functioning. Moreover, as both interventions primarily aimed to restore cognitive function, changes in mood are arguably secondary to (and less likely than) those in memory. Further research would therefore be helpful in establishing the impact of appropriate imagery-based treatments that specifically target anxiety and depression following ABI.

For the DV of relaxation, two studies found no significant differences pre to post CFI or RI intervention. When data for both groups were combined (i.e., when data for the RI and CFI groups were analysed together), a medium-large effect of imagery intervention was reported in one study (Campbell et al, 2019). However, data were not available to calculate ES for O'Neill & McMillan (2012) and direct comparison was therefore not possible. In terms of empathy, imagery-based interventions did not result in significant changes post-treatment; however, effects

were inconsistent across the two studies. Campbell et al. reported large pre-post effects of RI on empathy (and greater than CFI), whereas in O'Neill and McMillan the reverse was shown. Notably, in O'Neill and McMillan, participants scored at least one standard deviation below the general population mean for empathy at baseline, which was not the case for Campbell et al. Hence, it is possible that pre-existing differences in participant levels of empathy modulated the effectiveness of the interventions (i.e., it may be that individuals with low empathy levels at baseline are more responsive to CFI than RI). Neither of the two studies found an effect of either imagery intervention on self-compassion posttreatment.

Finally, only one study explored the effect of imagery on QoL (Raskin et al., 2019). When compared to a control group who received PM training without imagery, a non-significant improvement in QoL was found in the intervention group with medium effect; though, further research is needed to confirm findings.

(3) Behaviour Outcomes

Behaviour was only examined in one study (Chiaravalloti et al., 2019). Informant-reported improvements in disinhibited behaviour were evident for the treatment but not the control group, and a medium ES was found. Self-report measures did not support this finding; hence, results are promising yet conflicting and limited to one study. Overall, the evidence-base for the use of imagery interventions for both psychological wellbeing and behaviour in ABI is extremely limited.

Findings in Relation to Previous Evidence

In the present review, imagery was found to have significant medium-large effects on cognition, particularly memory. No published reviews have specifically

examined the effects of imagery on cognitive outcomes following brain injury; though, a systematic review by O'Neil-Pirozzi, Kennedy and Sohlberg (2016) examined the use of internal memory strategies (69% of which included visual imagery) on memory and new learning post-ABI. The authors report that in 90% of the 46 reviewed studies, post-intervention improvement or positive change was found on at least one cognitive outcome measure (e.g., the *California Verbal Learning Test* and *Wechsler Memory Scales*), offering tentative support for the current findings. However, for several reasons it is not possible to make standardised comparisons to the findings of the present review. Firstly, O'Neil-Pirozzi et al. do not report ES; and secondly, within their analysis, they did not separate studies that used imagery interventions from those using other forms of internal memory strategies.

In the current review the effect of imagery on mood and wellbeing was variable across studies and often did not reach significance, despite some studies reporting medium-large ES (likely due to small sample sizes). No previously published reviews selectively explore the use of imagery on mood within ABI groups. However, contrary to the present review, reviews have demonstrated significant improvements in QoL and reductions in symptoms of depression and anxiety post imagery intervention in adults with long-term health conditions (e.g., Giacobbi et al., 2015). The RCTs reviewed by Giacobbi et al. found that guided-imagery also led to a reduction in pain (Baird et al., 2010; Baird & Sands, 2004; Fors et al., 2002; Fors & Gotestamm, 2000; Lewandowski, 2004), increased self-efficacy in managing pain and disease-related symptoms (Menzies et al., 2006), as well as improved psychological wellbeing (Baird & Sands, 2004; Menzies et al., 2006). Furthermore, a meta-analysis by Morina et al. (2017) found that in adults living with various mental health

diagnoses, imagery rescripting reduced symptoms of PTSD (*Hedges-g* = 1.48) and social anxiety disorder (*g* = 1.25) with large effect, and depression with medium-large effect (*g* = .61). Such findings suggest that exploration of imagery-based approaches within ABI is likely to be worthwhile. However, Morina et al. note review limitations including a general scarcity of research, as well as small sample sizes and poor study design in the included papers (studies were predominantly of low quality and uncontrolled). As in the present review, findings should therefore be interpreted cautiously.

This review found no effect of an imagery intervention on self-reported disinhibited behaviour, and a medium effect of imagery on informant-reported disinhibited behaviour. No published reviews have specifically examined the effect of imagery-based approaches on disinhibited behaviour in ABI nor non-ABI populations; hence findings cannot be directly compared. However, a meta-analysis (n=1528) looking at 'mental contrasting' for improving health related behaviour in non-ABI groups was conducted by Cross and Sheffield (2017). Mental contrasting involves imagining a desired future and contrasting it with the present circumstances, prompting an individual to realise that action is required to achieve their preferred reality. The imagery-based approach was found to have a significant yet small effect on health behaviours at four weeks (*g* = 0.28) and an increased effect at up to three months (*g* = 0.38). Alternatively, within ABI groups, systematic reviews exploring behavioural outcomes largely focus on the use of pharmacological rather than imagery-based treatments (e.g., Ter Mors et al., 2018; Nash et al., 2019). For example, Ter Mors et al. examined the use of Amantadine, a widely used clinical treatment for behaviours that challenge (e.g., agitation and aggression). Of the 11

reviewed papers, two RCT's and three case-studies indicated a reduction in target behaviours post-intervention; however, results were inconsistent. The authors therefore stated that further research suitable for the heterogeneous ABI population (e.g., randomised SCEDs) is necessary in determining effective approaches to behaviour management post-injury.

Limitations of the Reviewed Studies

The search strategy and application of inclusion criteria produced nine empirical papers that supported this review's aims. Considering the broad definition of imagery used in the review, in addition to the intentional inclusion of multiple outcomes, a key observation is just how little research has examined the potential of imagery for people with ABI. Nonetheless, it is in line with previous systematic reviews conducted within the ABI population that look at outcomes of cognition, mood, and behaviour. For example, in a review of cognitive, emotional, and behavioural care needs of people with TBI, only three studies were included (Jennekens, De Casterlé & Dobbels, 2010); six studies were included in a review of non-pharmacological treatments for depression post-TBI (Gertler et al., 2015), and three were included by Knapp et al. (2017) when exploring multiple interventions for post-stroke anxiety. Unlike the present review, inclusion criteria for these reviews specified that papers must describe randomised studies with adequate control. Instead, for the purposes of this review, grey literature and dissertations were not examined and only studies published in peer-reviewed journals were included. Hence, although not all relevant research was sought, the identified studies were of an acceptable standard to answer the research question.

Only one study used an RCT design (Chiaravalloti et al., 2016). The study outlined relatively good retention, low drop-out and encouraging initial outcomes in everyday memory, showing promise for future research. However, the small sample size within the booster group (n=17) is limiting when examining long-term treatment effects. Therefore, it is recommended that further research includes sufficient follow-up periods and multi-centre RCTs to achieve adequate sample sizes and power. Sample size was also reported as a limitation in four further studies (Boccia et al., 2019; Campbell et al., 2019; Potvin et al., 2011; Raskin et al., 2019). It is suggested that studies with small sample sizes (Slavin & Smith, 2009) and of low quality (A-Tjak et al., 2015) tend to report larger ES; hence, it is possible that treatment effects could be overestimated in these studies.

Except for Boccia et al., ES were provided by or calculated for all papers; however, for two studies, it was not possible to calculate all within-group pre-post effects due to limited reported data (Chiaravalloti et al., 2019; O'Neill & McMillan, 2012). ES was reported in terms of eta squared (η2) for three studies (Grilli & Glisky, 2010; Grilli & Glisky 2011; Grilli & McFarland, 2011), partial η2 for one study (η2p: Chiaravalloti et al., 2019), Cohen's d for three studies (Campbell et al., 2019; O'Neill & McMillan, 2012; Raskin et al., 2019) and a mixture of the Cohen's d and η2 for one study (Potvin et al., 2011). Reporting η2p is preferable to η2 when comparing studies (Cohen 1973; Richardson, 2011) due to η2p partialling out the effects of other independent variables. However, when mixed ANOVAs are used, such as in Potvin et al., the classification of a large ES is less conservative for η2p (Levine & Hullett, 2002); thus, the use of η2 minimises the chance of overestimating the treatment effect.

A further limitation of the evidence is the inadequate use of control groups in most studies, with only three of the nine studies using an ABI control (Chiravallotti et al., 2016; Potvin et al., 2011; Raskin et al., 2019). The use of a control group was noted as problematic in Potvin et al., in which the authors report that the intervention was "probably" efficacious as the frequency and the intensity of the control and the treatment condition were not equivalent (Sohlberg & Mateer, 2001). They therefore suggested that that visual imagery techniques should be compared to an equivalent intervention in future studies. Five of the included studies attempted to do this by using comparator conditions (Campbell et al., 2019; Grilli & Glisky, 2010; Grilli & Glisky, 2011; Grilli & McFarland, 2011; O'Neill & McMillan, 2012). Boccia et al. did not use a control/comparator and consequently recommended that study findings should be interpreted with caution. The authors suggest that further investigations of imagery-based rehabilitation for spatial navigation and memory, particularly by means of RCTs, are needed to draw definite conclusions.

Furthermore, only three studies used a follow-up period (Boccia et al., 2019; Chiaravalloti et al., 2016; Raskin et al., 2019), ranging from 6 to 12 months. Whilst it is promising that no significant deterioration was noted on any measure between post-treatment and follow-up, six of the nine included papers failed to follow participants up at all; thus, it is impossible to know whether treatment effects were maintained. This is especially problematic as delayed treatment effects have been shown within ABI groups, suggesting that it can take up to six months post-intervention for a treatment effect to emerge (Hsieh et al., 2012).

Most studies in this review were classified as *Weak* or *Moderate,* suggesting that further research of higher quality is needed to confirm current findings. However, it is

possible that the quality tool used could have underrated quality due to strict marking of certain categories. For example, despite a 94% retention rate being reported by Grilli and Glisky (2010), they were rated *Weak* on the withdrawal and dropout category due to failing to report the reasons associated with participant withdrawals. Overall, quality ratings indicated that the study design, blinding and data collection methods were key areas of weakness for many studies; it is therefore recommended that these are considered in future research.

Limitations of this Review

Although PROSPERO was searched to ensure that no previous papers had reviewed imagery use in ABI, it is worth noting that prior to conducting the present review, it was not pre-registered. It is also notable that the conclusions of this review are based only on published studies. Therefore, publication bias, whereby studies with significant results or effects are more likely to be published, may mean that review findings show a skewed, overestimated perception of imagery effectiveness. Further bias could have also been introduced through the use of only one reviewer and future reviews should aim for a minimum of two reviewers when assessing study eligibility and quality.

A further limitation is the broad nature of the review question and inclusion criteria. Across studies, the application of imagery is markedly different; hence, it difficult to compare studies and establish overall effectiveness. Additionally, although multiple outcomes were intentionally included, their varied nature further impacts on the comparison of findings. However, at present, research into imagery use within

ABI groups is sparse and more specific reviews are unlikely to yield enough papers to draw definitive conclusions.

For reasons outlined above, it was not valid to combine ES across studies to produce an overall estimated effect of imagery-based approaches within ABI, and meta-analyses could not be conducted. Due to the small number of studies included and their heterogeneous nature, it is also difficult to establish superiority of specific interventions. Nevertheless, the effects of imagery interventions on psychological outcomes for adults with ABI were reviewed, answering the review question with the conclusions outlined below.

Conclusions and Recommendations

Imagery-based interventions had a medium-large effect on cognitive functioning, particularly memory, including participants ability to remember planned future events/tasks and to learn new information. Navigational and visuospatial abilities were also improved post imagery treatment, though ES cannot be calculated. The effect of imagery on mood was variable across studies and did not often reach significance, despite some studies reporting medium-large ES on anxiety, depression, and levels of relaxation and empathy. This may be due to small sample sizes and studies being underpowered in addition to variation in how these constructs were measured. Finally, some improvements in disinhibited behaviour were noted following imagery with medium effect; however, results were mixed and limited to only one study.

Overall, this review tentatively suggests that imagery is an effective way of working psychologically with ABI groups. However, research exploring its use in

wider ABI populations (e.g., post-stroke) is lacking. Additionally, it would be beneficial to further explore the use of imagery interventions that target mood and behaviour related outcomes, which is exceptionally sparse within ABI despite promising findings in non-ABI populations. Multi-centre RCTs or randomised SCEDs are recommended to establish effects through adequate sample sizes and power.

Chapter III: A Values-based Intervention for Neurorehabilitation Inpatients with an Acquired Brain Injury (ABI) and Symptoms of Depression

Abstract

Psychological distress following an acquired brain injury (ABI) is often more debilitating than the physical and cognitive sequalae. It impacts negatively on long-term functional and rehabilitative outcomes including social and occupational functioning, quality of life, and adjustment to the injury and its consequences. Emerging research suggests that Acceptance and Commitment Therapy (ACT) can help to improve mood and psychological adjustment post-ABI. However, depression is often associated with a negative bias in future thinking and may reduce motivation for engaging in valued-based activities. Imagery is shown to be an effective way of offsetting the impact of this negative bias in non-ABI groups. The current study therefore examined the use of a values-based intervention for inpatients with ABI and depression. Mental imagery was optional and added to the intervention for instances where participants demonstrated reduced motivation to engage in values-based activities. A multiple-baseline design (MBD) was used. Treatment response within and across participants (N=4) was evaluated through visual and TAU-U analysis of visual analogue scale (VAS) data. Standardised measures validated for an ABI population were administered pre- (T1) and post-baseline (T2), post-intervention (T3) and at two-week follow-up (T4) and assessed using reliable and clinically significant change analysis. Findings for depression were the most improved after therapy, however findings conflicted across measures and were not always maintained at T4. Values-based behaviour increased for all participants across the course of therapy. Quality of

life and adjustment reliably improved for less than half of the participants. Participants were highly motivated and experienced a positive bias in future thinking at baseline. The intervention was feasible and deemed acceptable by all participants. The strengths and limitations of the study are discussed, and future directions are suggested.

Introduction

The UK Acquired Brain Injury Forum (UKABIF, 2019) reported that in the UK alone 1.3 million people live with the effects of brain injury at a yearly economic cost of fifteen billion (approximately 10% of the annual NHS budget) due to the increased health and social care input, lost work contributions and continuing disability. In 2016/17, this equated to 348,453 new hospital admissions due to an Acquired Brain Injury (ABI); that is, 954 admissions per day or one ABI-related admission every 90 seconds (Headway, 2019). Furthermore, these figures are rising, with a 10% increase in admissions taking place between 2005 and 2017 (Headway, 2019). Psychological distress, such as depression, is common following ABI (Juengst, Kumar & Wagner, 2017), with researchers arguing that it is often more debilitating than the physical and cognitive sequalae (Bertisch et al., 2013; Lishman, 1973). It is reported to impact negatively on long-term functional and rehabilitative outcomes (Cullen et al., 2018) including social and occupational functioning (Daniel et al., 2009; Mateer & Sira, 2006), quality of life (Bryant et al, 2010) and psychological adjustment to the injury and its consequences (Schönberger et al., 2014). Supporting individuals to adjust psychologically is therefore likely to aid recovery and make rehabilitation more beneficial (Whiting et al., 2012).

To date, Cognitive Behavioural Therapy (CBT) is the most heavily researched psychological intervention within ABI groups. However, interventions often aim to ameliorate mental health symptomology that is disorder specific (e.g., targeting specific symptoms of anxiety and depression) and the reported effectiveness of CBT differs across studies. Whilst researchers have demonstrated post-CBT reductions in depression (Bradbury et al., 2008), anxiety (Hsieh et al., 2012), seizure-related panic

attacks (Gracey, Oldham & Kritzinger, 2007), Obsessive Compulsive Disorder (OCD; Williams, Evans & Fleminger, 2003) and Post Traumatic Stress Disorder (PTSD; Bryant, Moulds, Guthrie & Nixon, 2003), others have reported mixed results (e.g., Anson & Ponsford, 2006; Hodgson et al., 2005) or found CBT to be no more effective than control groups or treatment as usual (e.g., Backhaus et al., 2016; Fann et al., 2015; Ashman et al., 2014; Lincoln & Flannaghan, 2003). This not only makes it difficult to interpret findings, but the question remains whether CBT, particularly the cognitive component, is suited to the ABI population (Whiting et al., 2012). For instance, it is suggested that cognitive restructuring is not accessible to some individuals due to the presence of cognitive deficits such as inflexibility and executive functioning difficulties (Blanchet, Paradis-Giroux, Pepin & Mckerral, 2009; Hodgson et al., 2005). Additionally, it is argued that thought challenging is inappropriate for realistic thoughts centred around post-ABI circumstances (Graham et al., 2015; Kangas & McDonald, 2011).

Instead, emerging research demonstrates promising outcomes for third wave approaches such as Acceptance and Commitment Therapy (ACT; Hayes, Luoma, Masuda & Lillis, 2006). ACT is a transdiagnostic, action-oriented approach that aims to increase psychological flexibility through six core processes: (1) acceptance, referring to noticing unpleasant or unwanted internal experiences, without attempting to change or avoid them; (2) cognitive defusion, involving changing the way an individual interacts or relates to their internal experiences, distancing themselves from their thoughts and viewing them as passing events; (3) being present, which promotes an ongoing and non-judgemental awareness of the here and now; (4) self-as-context, allowing individuals to connect with a sense of self that is not defined by certain

internal events but is rather a context in which those events occur; (5) values identification, which encourages the individual to connect with what truly matters to them; and (6) committed action, the process of committing to actions that are value-consistent, even in the presence of difficult internal experiences. Individuals are therefore supported to function in the face of difficulty and distress, which is considered a normal part of the human experience (Hayes, 2004); however, whilst reducing distress is not the primary aim of ACT, this can occur as functionality improves (Hayes et al., 2006).

The principles of ACT arguably fit well within neurorehabilitation, which aims to minimise disability and optimise recovery by supporting individuals to work towards personalised therapeutic goals to rebuild a life that is meaningful to them (Turner-Stokes et al., 2005). In fact, some of the key principles in ACT are inadvertently utilised in the context of certain neurorehabilitation programmes. For instance, the metaphoric identity mapping (MIM) model (Ylvisaker, McPherson, Kayes & Pellet, 2008) draws upon several core ACT processes including, but not limited to, valued goals and committed action. It aims to facilitate identity reconstruction, goal-setting and re-engagement for individuals who have sustained a Traumatic Brain Injury (TBI) by: (1) encouraging the individual to think about the 'actual-self' versus the 'possible/hoped-for-self'; and (2) setting realistic goals that support the individual in living a meaningful life post-injury. Furthermore, elements routinely used within ACT such as metaphors or analogies (Hayes, 2004) are often utilised within ABI groups due to their ability to make difficult-to-understand and abstract concepts accessible (Whiting et al., 2017; Ylvisaker et al., 2008). Nonetheless, although several authors have recommended the direct use of ACT in the ABI

population (e.g., Whiting et al., 2012; Soo, Tate & Lane-Brown, 2011; Kangas & McDonald, 2011), the evidence-base remains in its infancy.

Two published studies have specifically explored the use of ACT within neurorehabilitation. Firstly, Whiting et al. (2019) conducted a pilot-RCT that compared a six-week ACT group-based therapy to an inactive control (Befriending Therapy) for adults with a diagnosed TBI. Pre-intervention, all participants met the clinical threshold for psychological distress on the *Hospital Anxiety and Depression Scale* (HADS-21) or the *Depression Anxiety and Stress Scale* (DASS-9). Post-intervention, significant reductions in symptoms of depression and stress were evident in the ACT group when compared to the control. Such reductions were hypothesised by the authors to have been largely achieved via the values and committed action components of ACT, which rely less on cognitive ability. However, despite mood improvements, no significant changes were evident in the primary outcomes of values-consistent living and psychological flexibility. This was thought by the authors to be due to the small sample size (n=19) and the fact that the study was unpowered. Therefore, to achieve the desired recruitment, it was recommended that future studies deliver ACT in a one-to-one format.

In the second study, Whiting et al. (2017) explored the effectiveness of a seven-session manualised intervention for two participants with severe TBIs using an uncontrolled pre-post design. For one participant reliable and clinical improvements were found on measures of mood, psychological flexibility and quality of life post-intervention, in addition to improvements in values-based living. Similarly, the second participant demonstrated a reduction in negative affect and an increase in values-based behaviour post-treatment. However, measures of committed action did not

reliably change for either participant following the intervention. Similar results have been reported outside of the neurorehabilitation context, whereby participants with an ABI have experienced reductions in psychological distress with medium to large effect following ACT-based treatments (Majumdar & Morris, 2019; Sianturi et al., 2018; Graham et al., 2015). However, limitations around study design persist in these studies, for instance, the lack of appropriate control groups.

Despite a strong evidence-base supporting the use of psychosocial interventions for a diverse range of behavioural and mental health concerns, research frequently fails to address how interventions translate to clinical practice (Fairburn & Wilson, 2013), with therapists reporting that standardised manuals do not meet the needs of real-world clients and settings (Addis & Krasnow, 2000). Instead, modularised treatments can allow for a personalised approach whist remaining grounded in theory and evidence. ACT arguably lends itself well to modularisation with its transdiagnostic approach guiding case formulation and allowing for the flexible selection of therapy tasks from the six complementary treatment components outlined above. Outside of the ABI population, Villate et al. (2016) examined a modular approach to ACT with 15 adults who were experiencing clinically significant psychological distress (predominantly anxiety and depression). Participants were randomly allocated to one of two ACT modules: the ACT OPEN module, consisting of procedures that targeted the acceptance and cognitive defusion processes of the psychological flexibility model; and the ACT ENGAGED module that only targeted the values and committed change processes of the model. According to self-reported feedback, both interventions were deemed acceptable by all participants, with no dropouts nor missed sessions in either module. Additionally, both groups

demonstrated significant improvements in symptom severity and quality of life; however, whilst the ACT ENGAGED group experienced a smaller effect on symptoms than those allocated to the ACT OPEN module, they reported greater quality of life improvements.

In light of the above, the emerging evidence-base for ACT suggests that, despite design limitations, it can be useful when working psychologically with ABI groups. In particular, researchers advocate for the use of the 'behavioural' components of ACT (i.e., values and committed action) within neurorehabilitation (e.g., p.67, Soo et al., 2011). Values are purposefully chosen life directions that guide individuals to live meaningful and fulfilling lives (Hayes et al., 2006); for example, an individual may have a value of friendliness or of feeling connected to others. A value is therefore not something that can be reached (i.e., friendliness is not an endpoint, feeling connected to others is not something that can be achieved and 'ticked off'), but something that an individual can continue to work in a direction towards throughout their life. Nonetheless, setting goals that are value consistent (e.g., saying hello to a neighbour; having a weekly dinner with family) can encourage individuals to engage in concrete and meaningful behaviours, despite the consequences of their injuries (Kangas & McDonald, 2011). As values-based approaches and goals can be tailored to the individual's personal desires, abilities, and circumstances, they are appropriate for use with heterogeneous populations (Hayes, 2004), such as ABI groups.

Sharma (in prep) assessed the effects of the values and committed action components of ACT for six participants undergoing inpatient neurorehabilitation after an ABI. The intervention utilised values-based goal setting, allowing goals to be tailored to each individual and, if necessary, adapted over the course of therapy; thus,

ensuring that cognitive and/or physical limitations could be considered. Sharma found the intervention to be acceptable to all clients. Furthermore, all participants reported increased values-based behaviours post-intervention, with most participants also reporting reductions in symptoms of depression and heightened adjustment at the end of therapy. However, a key limitation was the use of broad inclusion criteria, which did not set any preconditions regarding psychological distress. This resulted in floor and ceiling effects for some clients. Furthermore, it is unclear whether the intervention would be acceptable, feasible, and beneficial for individuals with an ABI plus depression.

In healthy populations, biases in cognitive-affective processes implicated in depression (e.g., lower positive and increased negative thoughts about the future) are central to its onset and maintenance (Matthews & MacLeod, 2005). This has led to the development of novel approaches that target these biases, with subsequent improvements in mood (e.g., Williams, Moore & Blackwell, 2015). Within ABI, Murphy et al. (2019) found that depressed mood is also characterised by a negative bias for imagining future events, which likely impacts on the successful implementation of a values-based intervention for this group. For example, an individual who perceives future events more negatively may be less motivated to engage in the values-based activities identified during therapy. In non-ABI groups, mental imagery is shown to be an effective way of offsetting the impact of this negative bias (e.g., Renner, Murphy, Ji, Manly & Holmes, 2019).

Mental imagery is defined as the 'simulation or re-creation of perceptual experience across sensory modalities' (Pearson et al., 2013). Neural substrates recruited during sensory perception are also activated during mental imagery (Pearson

& Kosslyn, 2015), suggesting that imagery can evoke the perceptual details of possible future events in addition to the experiential correlates of these experiences. An individual can therefore experience mental events as if they are real (Moulton & Kosslyn, 2009). For an individual to plan their behaviour, future cognition is key, with researchers indicating that imagery representations can induce powerful emotional responses at subjective, physiological, and neural levels (Ji, Heyes, MacLeod, & Holmes, 2016). Therefore, whilst mental representations that are perceived as negative may encourage avoidance (Moulton & Kosslyn, 2009), those perceived as enjoyable or fulfilling can increase approach behaviour (Renner, Ji, Pictet, Holmes, & Blackwell, 2017). This may be especially relevant in ABI when damage to key brain structures (e.g., executive prefrontal areas) is common and, in addition to depression, can lead to disruptions in future cognition (Pearson, Naselaris, Holmes, & Kosslyn, 2015).

Taking all of this into consideration, the current study was the first to examine the use of a values-based intervention for inpatients with ABI and symptoms of depression. For instances where participants demonstrated reduced motivation to engage in values-based activities, imagery was added. Given the novelty of the intervention, a single case experimental design (SCED) with baseline randomisation was chosen for cases to be studied individually and in detail, whilst maintaining a level of experimental control (Morely, 1996). The use of a SCED overcame some of the limitations of existing research in this area and allowed participants to act as their own control (Alderman & Wood, 2013), which is appropriate given the heterogeneity of the ABI population. The impact of the intervention was established using dependent

variables that measured meaningful behaviour, depression, quality of life, adjustment, and future thinking.

Based on the previous research outlined above, the following hypotheses were proposed:

1. *The values-based intervention will increase values-based behaviour*
2. *The values-based intervention will lead to lower levels of depression, improved quality of life and increased adjustment to brain injury*
3. *The values-based intervention will decrease the negative bias in prospective cognition associated with depression*

Method

Design

A SCED was used in the form of a nonconcurrent randomised multiple-baseline design (MBD). The design consisted of three stages (A-B + Follow-up), with the randomly selected baseline phase (A) lasting either two, three or four weeks. The intervention phase (B) consisted of five to seven sessions of a values-based therapy and was followed by a two-week follow-up period used to monitor outcomes once the intervention had been withdrawn. The effect of the intervention (the independent variable) was measured in several ways: Firstly, through standardised measures of each participants mood, quality of life, adjustment to brain injury and future thinking at pre- (T1) and post- (T2) baseline, immediately post-intervention (T3) and at follow-up (T4); and secondly, via visual analogue scales (VAS) that examined participant mood and values-based behaviour throughout each of the three phases. Finally, the Values Bullseye was used as a process measure, recording how closely to their values

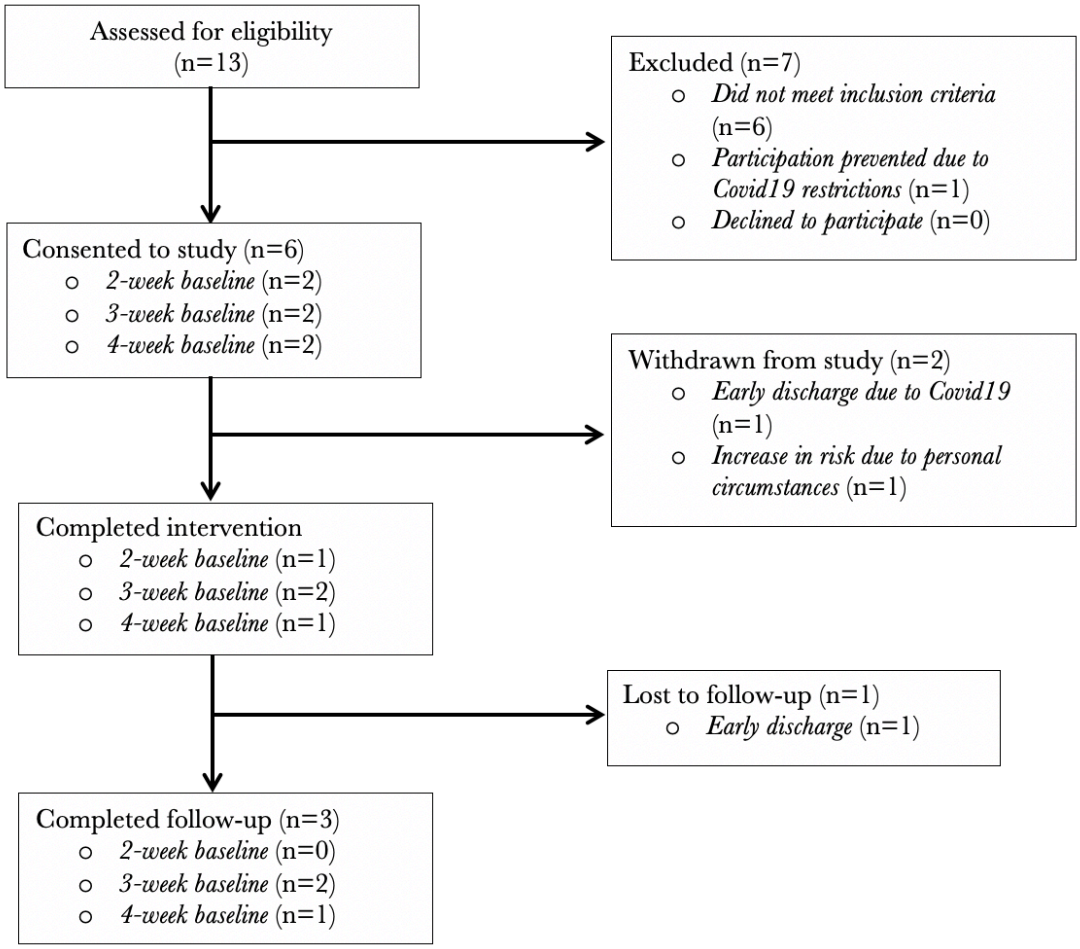
each participant perceived themselves to be living early in therapy, mid-way through therapy, post-therapy and at follow-up.

Participants

Ethical approval (see Appendices 1-2) was obtained to recruit participants from two London hospitals. In MBD, a minimum of three effect replications are required to demonstrate experimental control across participants, behaviours, or settings (Horner et al., 2005). However, a recruitment target of six participants was set for several reasons. Firstly, in attempt to meet the desired baseline power (0.8), whereby VAS data would need to be recorded at 18 timepoints per phase for a sample size of five (Shadish et al., 2014); and secondly, to allow for attrition. As depicted in Figure 2, four participants completed baseline and intervention phases, with three participants also completing follow-up. Previous SCEDs conducted within the ABI population have recruited a varied number of participants. For instance, studies have recruited from one (e.g., McKerracher, Powell & Oyebode, 2003; Lane-Brown & Tate, 2010) to three (e.g., Davies & Rofoth, 2010; Gertler & Tate, 2019), four (e.g., Jameison et al., 2017) or 11 participants (Ouellet & Morin, 2007). To maintain confidentiality, participants are referred to by their participant number throughout this paper. Further information relating to participant demographics can be found in *Results* (see Table 8).

Figure 2

Overview of Recruitment and Retention



Recruitment

For eligibility to be met, participants were required to be at least 18 years old and to have a diagnosed ABI. Additionally, participants needed to score above the cut-off for depression on the HADS (HADS-D>8), have an anticipated admission of at least 10 weeks (due to participation length), and to have sufficient verbal or non-verbal communication and English language skills to understand and communicate information within sessions. Finally, they were required to have capacity to provide informed consent and the cognitive ability to engage in psychological therapy, as determined their psychology team. As the study examined a novel treatment,

participants were excluded if they presented with high levels of risk (i.e., substance misuse or suicidal intent or plans).

Initial assessments exploring psychological needs, capacity to consent, and risk were conducted by qualified psychologists within the service, as per normal practice. Individuals that met inclusion criteria were introduced to the study and, with consent, a meeting was arranged with the Chief Investigator (CI) in which detailed information about the study was provided using the Participant Information Sheet (PIS; Appendix 3). Information was presented at a pace appropriate to each individual using strategies such as repetition, summaries, and images to support ABI related deficits. Various opportunities to ask questions were provided and clients were provided with a copy of the PIS. They were encouraged to take at least one day to consider whether they would like to participate, consulting trusted family, friends, or staff in making their decision. If a second meeting was set up, the CI ensured that clients remembered details of the study and reviewed key information before written informed consent was obtained (PCF; Appendix 4). All participants were recruited between October 2020 and March 2021.

Measures

VAS Measures

A template from the Association for Contextual Behavioural Science website (https://contextualscience.org/acbs) was adapted to generate vertical VAS measures that rated values-based behaviour and psychological distress on a scale of 0-10 (Appendix 5). Although VAS can act as idiosyncratic measures that measure participant-specific symptomology, the included participants struggled to

conceptualise their symptoms at the start of their participation. Therefore, the same scales were used across individuals. As VAS are sensitive over time, appropriate for daily testing and valid measures (when appropriately defined), they are considered appropriate for SCEDs (Klimek et al., 2017). VAS measures were administered as close to daily as possible in attempt to achieve adequate power (Shadish et al., 2014).

Standardised Measures (T1, T2, T3, T4)

The *Hospital Anxiety and Depression Scale* (HADS; Zigmond & Snaith, 1983), a 7-item measure of anxiety and depression, scores each subscale from 0-21, with a cut-off score of eight for mild depression or anxiety (Zigmond & Snaith, 1983). In the present study, only depression scores were considered in accordance with the studies hypotheses. The HADS is deemed appropriate for inpatient settings and has been validated for use in the ABI population (Schönberger & Ponsford, 2010). It is reported to reduce the emphasis on common somatic symptoms experienced in long-term health conditions (e.g., fatigue); thus, enhancing the validity of measurement (Dahm, Wong & Ponsford, 2013). A meta-analysis by Bjelland et al. (2002) found the HADS test-retest reliability to range from adequate to excellent (.68 to .93). The internal consistency of the HADS-D was found to be excellent for depression within TBI (Cronbach's $\alpha = .86$; Schönberger & Ponsford, 2010) and post-stroke populations (Cronbach's $\alpha = .85$; Aben et al., 2002).

The *Quality of Life after Brain Injury* (QOLIBRI; von Steinbüchel et al., 2010), a 37-item measure, covers six QOL domains: Cognition, Self, Autonomy, Social, Emotions and Physical problems. In all domains, items are measured on a scale of 1 to 5. Depending on item, 1 equates to "not at all satisfied" or "very bothered" and 5

equates to either "very satisfied" or "not at all bothered" (Appendix 6). Due to their applicability to the study hypotheses, only the Self and Emotions domains were used. Test-retest reliability and internal consistency is reported to be excellent for both the Self (ICC=.84, Cronbach's α=.90) and Emotions (ICC=.78, Cronbach's α=.88) domains. The QOLIBRI is validated in the ABI population in six languages (von Steinbüchel et al., 2010).

The *Reactions to Impairment and Disability Inventory-Adjustment subscale* (RIDI-A; Livneh & Antonak, 1990; Appendix 7), an eight-item measure, rates adjustment on a scale of 0 ("Never") to 4 ("Often"). There is a maximum combined score of 32, with higher scores indicating increased adjustment. The RIDI is reported to hold good content and construct validity, and internal consistency (Cronbach's α=.70 to .92; Livneh & Antonak, 1990). For the RIDI-Adjustment subscale, Cronbach's alpha is .85 (Livneh & Antonak, 1990).

The *Future Fluency Task* (FFT; MacLeod et al., 1997; Appendix 8) measures biases in prospective cognition. Individuals are given one minute to generate as many likely or plausible self-future experiences as possible for three time periods – next week, next year, and the next five to ten years. The total positive versus negative items are computed for each participant by summing across time periods. The FFT has been used within an ABI population (Murphy et al., 2019), though the reliability of the scale is not reported.

Process Measure

The *Bullseye Values Survey* (BEVS; Lundgren, Luoma, Dahl, Strosahl & Melin, 2012; Appendix 9), a visual analogue scale, was used to assess whether values-based behaviour altered throughout the intervention and follow-up phases. The BEVS is presented as a target with five circles on which participants rated how closely they perceived themselves to be living by their chosen value(s). The BEVS holds good test-retest reliability (ICC=.85), correlating with measures such as the Subjective Well-being Life Scale (r=.47).

Measure of Acceptability

The *Client Satisfaction Questionnaire* (CSQ; Larsen, Attkisson, Hargreaves & Nguyen, 1979; Appendix 10), a self-reported eight-item measure of service satisfaction, assessed the acceptability of the intervention. Each item is rated on a 4-point scale, measuring areas such as the quality of the service, the extent to which it met participant needs and whether the service would be recommended to others. A single score of 8 to 32 is generated, with higher scores indicating greater satisfaction. The reliability and internal consistency of the scale is reported to be excellent (Cronbach's α=.83 to .93; Attkisson, 2012).

Procedure

As outlined above, participation followed three broad stages (baseline, intervention, follow-up), the structure of which are outlined below.

Baseline phase (A)

Participants were randomly allocated to a baseline length of two-, three- or four-weeks using computer generated randomisation. Each participant completed

standardised measures prior to beginning their baseline period (T1), as well as daily VAS throughout. Three participants were supported by staff and caregivers to complete VAS due to memory, visual and physical impairments (Pt1, Pt2 and Pt4).

Intervention phase (B)

The intervention phase began immediately after baseline completion. Standardised measures were collected for the second time at the start of intervention (T2) and VAS were completed throughout. The Values Bullseye was completed on three occasions during the intervention phase – when values were initially established (sessions 1-2), mid-way through treatment (approximately session 4) and at the end of the intervention. Standardised measures were re-collected at the end of treatment (T3).

Follow-up phase

VAS continued throughout the two-week follow-up. Standardised measures and the Values Bullseye were completed for the final time at the end of the follow-up phase (T4). Participants were debriefed and all participants were asked to provide verbal and written feedback on their experience of the intervention (see *Measures*).

Intervention

The intervention was a values-based therapy, delivered by one of two therapists (therapist one, RA, or therapist two, SS; see Table 11). The original intervention protocol, co-created by authors JK and SS, was based on the 'Values' and 'Committed Action' components of Acceptance and Commitment Therapy (ACT; Hayes et al., 2006) and was developed using Villatte's (2016) protocol. It was

adapted to include optional elements of imagery by JK and RA (see Appendix 11 for full protocol). The intervention was designed to support ABI related deficits using simplified information and metaphors, summary sheets, handouts, concrete examples, and the slower presentation of materials. Participants attended an average of six weekly one-hour sessions; however, shorter sessions (30-45 minutes) and more frequent sessions (twice weekly) were offered where necessary to suit individual needs and circumstances. The therapy comprised of three broad stages:

(1) 'Values clarification and reflection': sessions covered the notion of values and participants were supported to consider their personal values before choosing one to three values of most importance to them.
(2) 'Goal-setting': the therapist supported participants in generating goals aligned to their identified value(s). Where appropriate, imagery was used to guide participants in imagining themselves completing their identified goals, incorporating detailed sensory information. Goals were regularly reviewed throughout sessions and value-consistent behaviours were celebrated.
(3) 'Addressing obstacles': participant-reported barriers to valued living were addressed. Chosen values were reviewed to ensure continued personal significance to the participant and, where necessary, goals were modified.

Data Analysis

Analysis of VAS Data

VAS data relating to mood and meaningful behaviour was analysed in two ways: firstly, through visual analysis, and secondly, using TAU-U statistical analyses. Line graphs, the most common format of visual representation in SCED (Lane &

Gast, 2014), were used for the visual analysis of VAS data, providing an overall evaluation of the usefulness of the intervention (i.e., how reliable and consistent treatment effects appeared to be; Morley, 2015). However, as visual analysis can be subjective, criterion outlined by Kazdin (2019) was used to guide data evaluation (see Table 6). This criterion focuses on the proportion and rate of change within and across phases; thus, decreasing bias and ensuring the data analysis process is replicable.

Table 6

Kazdin's (2019) Criterion for Evaluating Change in Visual Analysis

Criterion	**Definition**
Change in central tendency (mean)	The average score of data points across phases differs
Change in trend	A systematic increase or decrease in the trendline
Shift in level	The pattern of the data changes between the last timepoint of one phase and the first timepoint of the next phase
Non-overlap of data	The value of data points in one phase is not replicated in another

For study hypotheses to be accepted, an increase or decrease was firstly necessary in the *mean* of the intervention phase when compared to baseline. The desired direction of change was dependent on the variable (i.e., mood or meaningful behaviour). Secondly, line graphs were expected to show an upward or downward

progression, or *trend*, of data in the intervention phase (Lane & Gast, 2014). To evidence clear treatment effects, baseline phases would have ideally outlined little variability in the data and either no trend or a trend in the opposite direction to the desired change (Kazdin, 2019). Less consideration was given to *level* in the analysis of data. As alterations in level focus only on the pattern of data during the end of one phase and start of the next, the overall pattern of data across phases is lost; hence, trend is considered more important (Gast & Spriggs, 2010). This was particularly pertinent in the present study, in which shifts in either variable were not expected on immediate commencement of the intervention. Instead, shifts were expected from approximately session two of the intervention onwards, following the initial introduction of values-based goal setting. Lastly, the *overlap* of data between phases was considered, with less overlap indicating a stronger effect of intervention. In summary, data with little variability that changes in means, levels, and trends, and that does not overlap between phases is indicative of reliable change.

Additionally, the use of a MBD allowed for comparison of effect across participants. For instance, if at week four of their participation, one participant was in their baseline phase and another participant was in week two of therapy, an effect would be expected only for the second participant as this is when the values-based therapy would likely influence their mood and/or behaviour. Due to the randomised baselines of two-, three-, and four-weeks, effects were therefore expected at either week four, five or six of participation. For causal evidence to be established, such effects had to be replicated a minimum of three times (Horner et al., 2005). Moderate to strong effects were required during visual analysis for effect size to be estimated (Kratchowill et al., 2010).

Finally, TAU-U statistical analyses were conducted (Appendix 12). For a number of reasons, tau-analyses complement visual analysis: Firstly, it allows for increased objectivity and for small treatment effects to be detected (Morley, 2015); secondly, it controls for variability in baseline scores, allowing for increased accuracy when comparing between phases (Manolov, Perdices, Gast & Evans, 2014); and lastly, the proportion of overlap between phases can be assessed, whereby a TAU-U score equal to or close to one indicates no overlap, increasing confidence in causality of the intervention (Morley, 2015).

Analysis of Standardised Data

Standardised data was evaluated using analyses of reliable change (RC) and clinically significant change (CSC). RC differentiates change that is reliable in the statistical sense (i.e., change that is statistically significant) from change that could have occurred due to random fluctuation in measurement, for example, measurement error (Jacobson & Truax, 1991; Maassen, 2004). The Reliable Change Index (RCI) is equal to the individual's pre-intervention score minus their post-intervention score divided by the measures standard error of difference ($RCI=M_1 - M_2 / SE_{diff}$). The standard error of difference is calculated using $SE_{diff} = (\sqrt{(2 \times SE_m^2)}$ and the standard error of mean is calculated using $SE_m=SD \times \sqrt{(1-r)}$, with r referring to reliability. In the present study, the internal reliability of each measure was used (Morley, 2015) as outlined in Table 7. An RCI score greater than +/- 1.96 was required for RC to be met.

Table 7

Reliability and Normative Sample Statistics used to Calculate RC and CSC

Measure	**Reliability Statistic**	**Clinical Norms**	**Non-Clinical Norms**
	Cronbach's alpha (a)	*Mean (SD)*	*Mean (SD)*
HADS-D	.86 [a]	7.80 (4.90) [a]	3.68 (3.07) [a]
QOLIBRI-Self	.90 [b]	60.03 (24.69) [b]	-
QOLIBRI-Emotions	.88 [b]	71.71 (24.69) [b]	-
RIDI	.89 [c]	23.4 (5.3) [d]	-

Note. Non-clinical means are not available for the QOLIBRI or RIDI as these are disability specific measures. [a] Data from Schönberger and Ponsford (2010). [b] Data from Von Steinbüchel et al. (2010). [c] Reliability statistic from Livneh and Antonak (1990). [d] Normative data from Schönberger et al. (2014).

If RC was established, the data was assessed for CSC. CSC was first introduced by Jacobson, Follette and Revenstorf (1984) and was defined as change that moves an individual from the clinical to non-clinical range on a given measure. Jacobson and Traux (1991) offered three ways of establishing CSC: A) the individual must move more than two standard deviations (SD) from the mean of the clinical group; B) they must move to within two SD of the non-clinical population mean; and C) the individual's post-treatment scores must be closer to the mean of the non-clinical than the clinical population (i.e., scores cross the 'cut-off point', midway between the clinical and non-clinical population means). However, depending on the circumstances of the data, others have argued that using one SD (Sheldrick et al., 2001) or 0.5 SD (Norman, Sloan & Wyrwich, 2003) for criterion A and B can be more appropriate.

Criterion C (viewed as the least arbitrary) was used to analyse HADS-D data due to an overlap between clinical and non-clinical populations (Jacobson & Traux, 1991). This meant that for CSC to be met, participants post-intervention scores were required to be closer to the non-clinical mean than the clinical mean (see Table 7). As both the QOLIBRI and RIDI are brain injury and disability specific measures without a non-clinical normative sample, criterion A was chosen; however, when a SD of two was used, this exceeded the upper limit of both measures. Therefore, a SD of one was used to maintain a meaningful criterion. To meet CSC, participants post-intervention scores were therefore required to move more than one SD from the mean of the clinical group (see Table 7).

Results

Results will be presented by outlining: (1) participant information; (2) process measure findings from the Values Bullseye; (3) SCED data; (4) standardised measures completed at T1, T2, T3 and T4; (5) findings related to future thinking, and (6) findings related to acceptability.

Participant Information

Table 8 reports sociodemographic information for each client. Four individuals took part in the study (Pt1, Pt2, Pt3, Pt4 determined in chronological order of participation) with an average age of 51.75 years (*SD*=5.5). Three participants were White British, speaking English as their native language, and one participant was Polish, speaking English as their second language. Pt1 and Pt4 acquired their injuries within six months of starting the study. Pt2 and Pt3 acquired their injuries approximately five and nine years beforehand. Prior to acquiring their injuries, three

participants were in paid employment (Pt1, Pt2, Pt4). At the time of their research involvement, all participants used a wheelchair, required support with activities of daily living (e.g., washing and dressing), and were undergoing differing levels of neurorehabilitation. All participants were receiving pharmacological treatment, with two individuals taking psychotropic medication for low mood and reduced engagement (Pt2, Pt4: Sertraline). Pt2 received therapy alongside the values-intervention. This focused on managing COVID-19 anxiety and overlapped with the final session of the values intervention. Pt1 and Pt3 contracted COVID-19 during their participation. Throughout the study there were strict restrictions in place due to COVID-19. At times, this meant that participants could not leave their ward or bays. Additionally, hospital and home visits were not possible throughout; thus, participants were unable to see friends or family. Such factors are discussed below in relation to individual VAS outcomes.

Table 8

Participant Information

Pt	Gender *(M/F)*	Age *(Years)*	Ethnicity	ABI diagnosis	Date of ABI	Key deficits after ABI	MH history	Social support	Occupation
1	M	53	White British	Right middle cerebral artery aneurysm and haemorrhage	September 2020	Left side weakness. Severe left-sided hemiplegia and hemianopia. Cognitive communication disorder. Moderate dysphasia. Impaired memory and executive functioning (planning,	None reported	Long-term partner 2 adult children Previously lived with partner and children	Salesman

						problem-solving, self-monitoring, emotional lability). Disinhibited and impulsive behaviour.		Large social network	
2	M	48	White British	Diffuse hypoxic brain injury following a cardiac arrest	September 2015	Cortical blindness. Severe muscle spasticity. Impaired memory and executive functions (planning, problem-solving, initiation). Mood and behavioural difficulties	Depression, anxiety	Divorced 2 young children In daily contact with sister and a previous colleague	Engineer

						(e.g., irritability and angry outbursts).			
3	F	59	White British	Central nervous system vasculitis – giant cell angiitis of the brain and spinal cord	November 2011	Muscle weakness and impaired mobility. Fatigue. Moderate to severe dysphasia. Executive functioning difficulties, reduced processing speed.	None reported	Divorced 2 adult children Limited social network	None
4	F	47	White Polish	Haemorrhagic stroke (large pontine haemorrhage,	January 2021	Ophthalmology issues (exposure keratopathy, rotatory nystagmus, right eye congestion).	None reported	Long-term partner 1 young child	Banking

	right midbrain & small left parietal haemorrhage)	Dysphasia. Impaired attention and memory (long-term and working memory). Mild executive functioning difficulties.	Previously lived in house share In daily contact with mother in Poland

Note. Pt=participant.

Values Bullseye

The Values Bullseye was used to examine hypothesis one (i.e., that the intervention would increase valued behaviour). This recorded how closely aligned to their values each participant believed themselves to be living in the early stages of therapy (session 1 or 2), midway through therapy, post-therapy and at follow-up. As hypothesised, self-reported values-based behaviours increased for all participants over the course of therapy (Table 9).

Table 9

Findings from the Values Bullseye

Pt	Value	Early-therapy	Mid-therapy	Post-therapy	Follow-up
1	Love	3.5	1.5	0.5	0
	Fun	1.75	1.75	0.5	0.5
2	Connection	2.5	1.5	1	1
	Love & sexuality	4	3.5	3.5	3.5
3	The environment	2.5	1.75	1.5	1.5
4	Courage	3.5	-	2.5	-

Note. 0-4 scale where 0 indicates living completely in line with the value. Pt4 completed the Values Bullseye on two occasions due to shortened therapy involvement and being discharged prior to follow-up.

Analysis of SCED data

Each participant's self-reported mood and meaningful behaviour was measured using VAS throughout the three study phases. It was hypothesised that as the intervention progressed, participants would report increased meaningful behaviour and a reduction in low mood when compared to baseline. Below, each participants VAS data is discussed in turn by firstly outlining their therapeutic engagement and extraneous factors that were relevant during the different treatment stages; and secondly, by reporting visual and Tau-U statistical analysis. VAS data is presented visually using line graphs (Figures 4-11), on which raw data is depicted in blue. Lines denoting the central tendency and overlap of data are included (see Figure 3), and a series of black dots mark trendlines. Black vertical lines indicate the change between phases (i.e., from baseline to intervention, or from intervention to follow-up).

Figure 3

Key for Central Tendency and Overlap Ranges Indicators used for Participants VAS graphs

Participant 1 (Pt1)

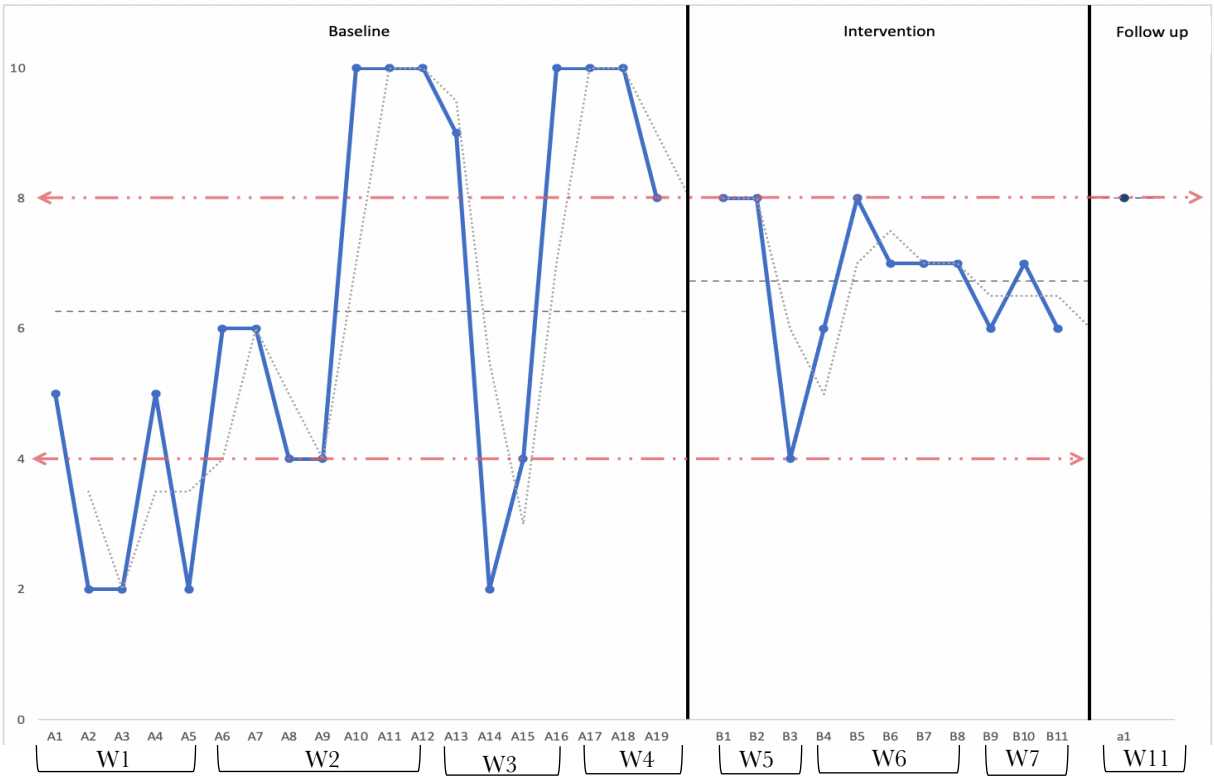
Therapeutic Engagement. Pt1's involvement began three weeks into his admission. He was randomised to a four-week baseline before attending five sessions across three weeks. He attended all planned sessions. During this time, he was undergoing intensive rehabilitation including daily physiotherapy, occupational therapy, and speech and language therapy sessions. In the first stage of the intervention (i.e., values clarification and reflection), he was able to quickly grasp the idea of values, identifying two values of most importance to him, which he hoped to move closer towards during his admission (love and fun). In stage two of the intervention (i.e., goal setting), he was able to generate many values-based goals to work towards. For example, he wanted to make his children a Christmas present and to host a Christmas party for the ward. As therapy progressed, he also began to engage in self-directed values-based behaviours; for instance, he decided to write a love letter to his wife and began to have conversations with other patients about their shared values. In stage three of the intervention (i.e., addressing obstacles), he required increased support due to his cognitive difficulties (e.g., reduced problem solving). Barriers that could obstruct him from living by his values once discharged were considered and he decided to share his values with his partner who could support him at home. His VAS data are depicted in Figure's 4-5.

Notable Extraneous Factors. During his baseline, Pt1 experienced frequent periods of low mood, which he attributed to being away from his family. This was exacerbated by his cognitive difficulties. For example, his concrete state thinking and inability to think flexibly meant that he could become stuck in negative automatic thoughts (e.g., thoughts that his wife might leave him due to his stroke) and

was very focused on being 'home for Christmas'. Towards the end of his baseline, he received upsetting news from his family, which made him feel 'very worried and weepy'. At this time, he also experienced fleeting suicidal thoughts (without intent). At the end of the intervention (point B11, Figures 4-5) he contracted COVID-19, delaying his discharge by two weeks, and meaning he could not go home for Christmas. Due to COVID-19 restrictions, it was not possible to attain VAS measures whilst he was infected (weeks seven to nine of his participation). In week nine, Pt1 was discharged. His follow-up therefore took place at home two weeks post-discharge (one month after his final research therapy session). Being at home helped him to feel more connected to his family but also triggered worry and low mood due to the challenges of living more independently and having to rely more on others.

Figure 4

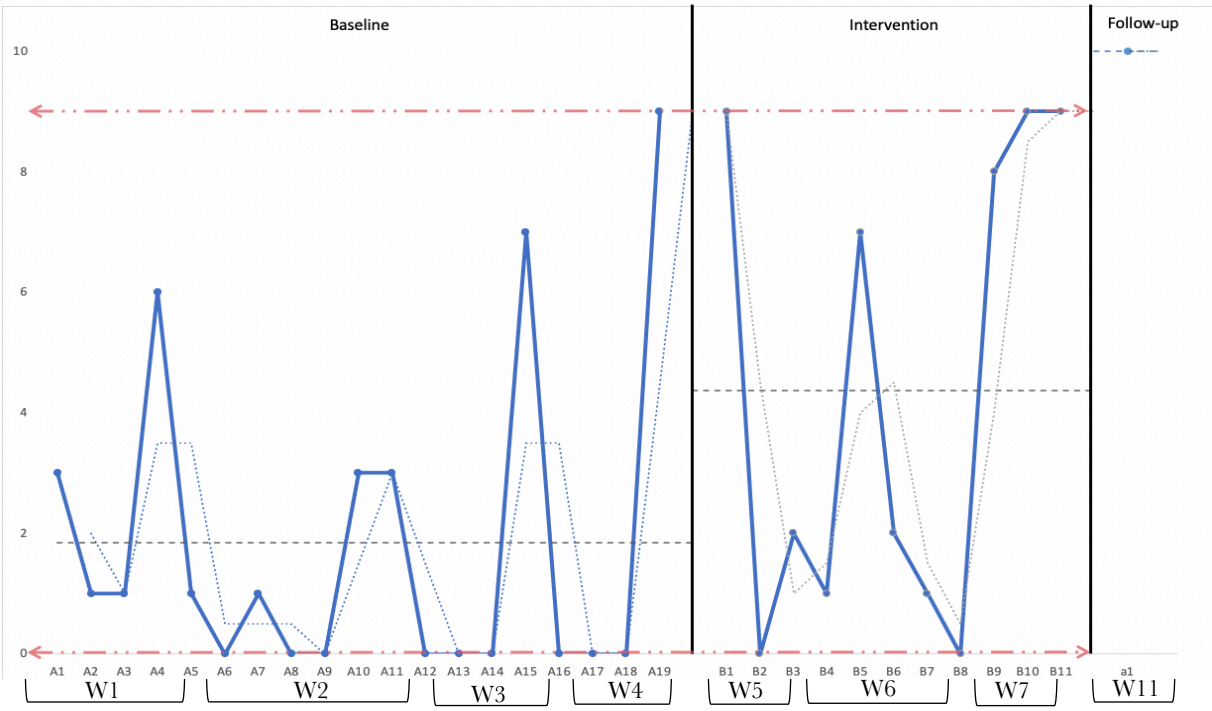
Pt1: Raw VAS Data for Low Mood



Note. W=Week. Each data point represents his self-rating from 0-10 over 24-hours.

Figure 5

Pt1: Raw VAS Data for Meaningful Behaviour



Note. W=Week. Each data point represents his self-rating from 0-10 over 24-hours.

Visual and Tau-U Analysis. Tau-U confirmed a significant upward trend in Pt1's baseline for low mood (Tau-U=.50, p<.01). This was corrected for in comparison analyses. His mood deteriorated towards the second half of baseline (coinciding with difficult news from his family), but this trend reversed during the intervention phase, demonstrating a slight reduction in depression on starting therapy. However, there is little overall change in the means between phases. Tau-analysis indicated no significant differences in low mood between baseline and intervention with a large degree of overlap (Tau-U=-.22, p=.32), suggesting that the interventions influence on this variable was small.

Pt1's baseline for meaningful behaviour fluctuated markedly, with no clear trend. Whilst the deterioration seen in the first week of his intervention may relate to the start of treatment, such fluctuations were also present during his baseline phase, making it less likely that the intervention influenced this reduction. In weeks five and six of his participation, two upwards trends are noted in meaningful behaviour, coinciding with the values-based goal setting phase of the intervention. As depicted in Figure 5, the means across phases show an increase in meaningful behaviour during the intervention, which approached significance (Tau-U=.42, p=.06). During his follow-up, Pt1 scored at ceiling for meaningful behaviour. This coincided with him returning home, which increased opportunities to connect with his values. TAU-U analysis outlines a significant difference in meaningful living when baseline is compared to intervention and follow-up combined (Tau-U=.53, p=.03).

Participant 2 (Pt2)

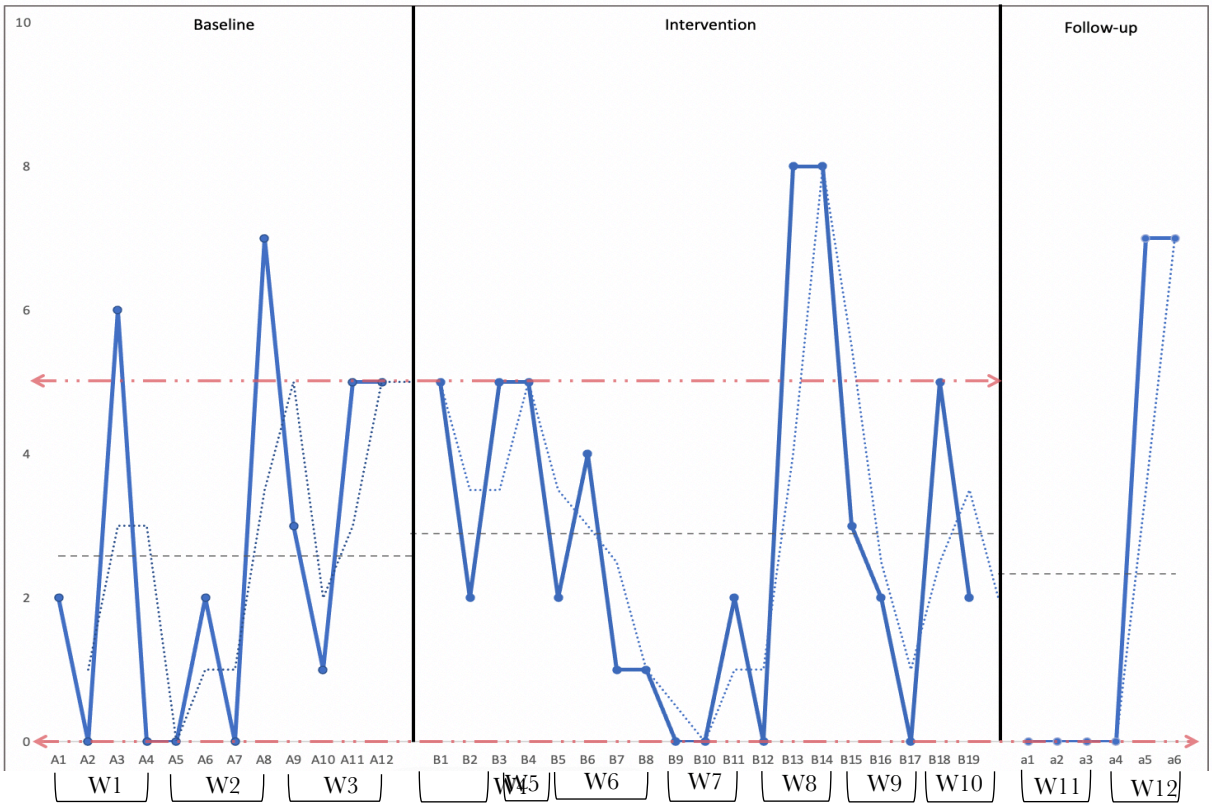
Therapeutic Engagement. Pt2 was an inpatient in long-term care. His participation in the study began two years into his admission when he was randomised to a three-week baseline. He attended seven sessions over seven weeks with no sessions declined. During this time, he was receiving less intensive rehabilitation (i.e., less physiotherapy and speech and language therapy) than usual, due to COVID-19 restrictions. Also due to COVID-19, the values intervention took place over videocall. He engaged well with the intervention, quickly identifying 'connection', 'love' and 'sexuality' as important values to him. He identified many ways in which he already connected to others, despite the barriers associated with being in hospital, and was able to generate future goals that aligned to this value (e.g., to join an online brain injury forum). As with other participants, he also began to engage in self-directed

behaviours in addition to those discussed in sessions (e.g., he initiated a telephone call with a different friend every week). VAS graphs outlining his research involvement are presented in Figure's 6-7.

Extraneous Factors. Week six of his involvement (third intervention week) fell between Christmas and New Year's Eve. This meant that there was a week break between sessions and less opportunities to engage in activities on the ward (see Figure 7 for a reduction in meaningful behaviours), mostly due to COVID-19 restrictions. In weeks seven to nine, he began to experience severe spasms, leaving him bed bound. This created challenges for engaging with meaningful behaviours. In week eight, Pt2 expected his second COVID-19 vaccine, which he was anxious to receive. However, this was delayed, and he experienced intense worry, anger, and frustration due to his physical vulnerability and necessary dependence on others (see Figure 6). His caregivers and friends described him engaging in frequent rumination about contracting the virus, which began to impact on his ability to concentrate and to engage with the sessions. For this reason, in the penultimate week of his intervention phase (week nine of his research involvement), he began sessions with a member of the hospital psychology team focusing solely on anxiety management. The timings of his antidepressant medication (Sertraline, 125mg) were also amended at this time, though the dose remained consistent. In week 12, the second week of his follow-up, his anxiety management sessions came to an end.

Figure 6

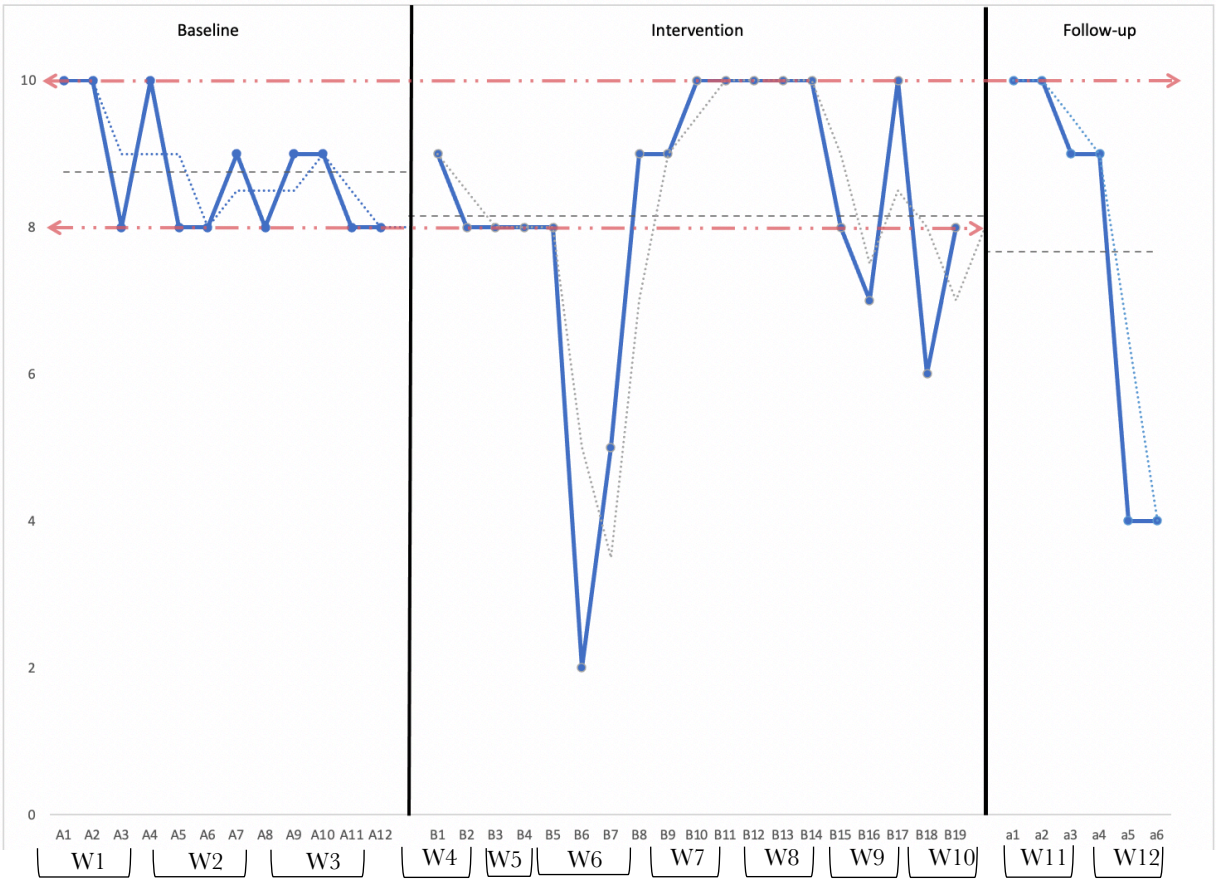
Pt2: Raw VAS Data for Low Mood



Note. W=Week. Each data point represents his self-rating from 0-10 over 24-hours.

Figure 7

Pt2: Raw VAS Data for Meaningful Behaviour



Note. W=Week. Each data point represents his self-rating from 0-10 over 24-hours.

Visual and Tau-U Analysis. Pt2's baseline for low mood was variable, with an upward yet non-significant trend evident (Tau-U=.27, *p*=.22). This trend reversed on commencement of the intervention, and a reduction in low mood was noted between weeks four to seven, corresponding with the values clarification and goal-setting phases of the intervention. However, the trend reversed again in week eight (i.e., week five of therapy) when an increase in depression was consistent with the increase in his spasms and the cancellation of his second vaccine. Overall, there was little change in the mean for low mood between baseline and intervention phases (Tau-U=.07, *p*=.73). During the first week of his follow-up, his mood appeared to improve and stablise; however, by the second week an upward trend in low mood was

evident once more. It is unclear whether this related to the withdrawal of the research therapy and/or another extraneous variable (e.g., his anxiety management sessions ending). No significant differences were found when baseline was compared to intervention and follow-up phases combined (Tau-U=-.02, p=.91)

For meaningful behaviour, a slight downward trend was observed during baseline, though this did not reach significance (Tau-U=-.32, p=.15). Between weeks six to eight, corresponding with sessions focussing on values-based goal setting, an upward trend and stablisation of meaningful behaviour is evident. However, as with depression, this trend reverses in week nine. Overall, there is little change in the mean for meaningful behaviour between baseline and intervention (Tau-U=-.07, p=.73). During his follow-up period, there is a clear downward trend in meaningful behaviour; however, TAU-U analysis again outlines no significant differences and a large overlap between baseline, and intervention and follow-up phases combined (Tau-U=.09, p=.67).

Participant 3 (Pt3)

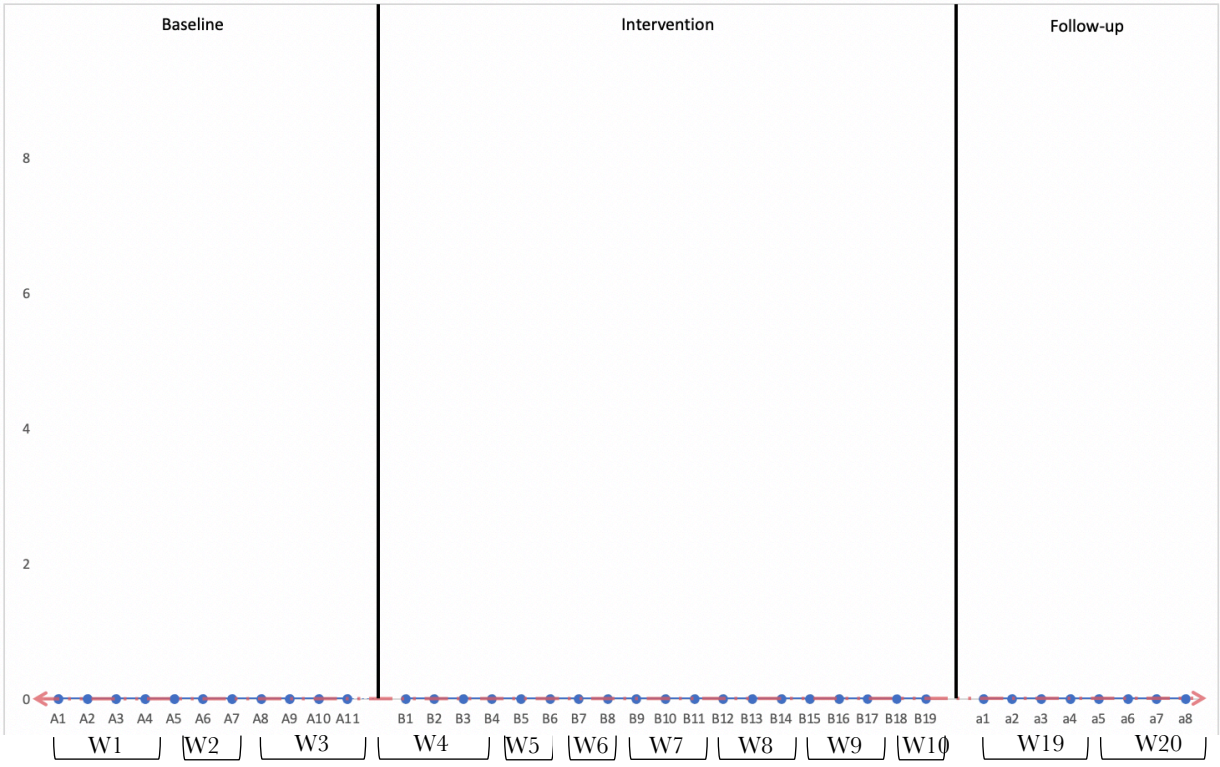
Therapeutic Engagement. Pt3's participation began approximately 18 months after her admission. She was randomised to a three-week baseline before attending seven sessions over seven weeks. No sessions were declined but due to COVID-19 restrictions, sessions were occasionally rescheduled. During this time, she was also receiving less intensive rehabilitation than other participants. In early discussions, she reflected that becoming unwell had encouraged her to think about what really mattered to her. She outlined several ways in which she was living more closely to her values compared to pre-injury (e.g., by staying connected to her children

despite being unable to see them in person). Initially, she found it difficult to identify values that (1) were important to her and (2) she thought there was scope to live more closely to whilst in hospital. However, with support, she identified protecting the environment as being deeply meaningful to her and identified new values-based goals (e.g., to learn more about the environment and to discuss ways of looking after the environment with others). VAS graphs outlining her research involvement are presented in Figure's 8-9.

Extraneous Factors. Approximately one month before her baseline began, Pt3 was diagnosed with basal cell carcinoma. The tumour was operated on and removed prior to her research involvement. Throughout her baseline and intervention phases, she attended several medical appointments to review her progress. As with other participants, COVID-19 restrictions meant she had been unable to see her children for six months prior to her baseline and throughout the study. In the final week of the intervention phase, she contracted COVID-19 and was extremely unwell, meaning that there was a significant gap (12 weeks) between her final two sessions. In her final session, she reported that she was slowly recovering though had not yet returned to her baseline functioning.

Figure 8

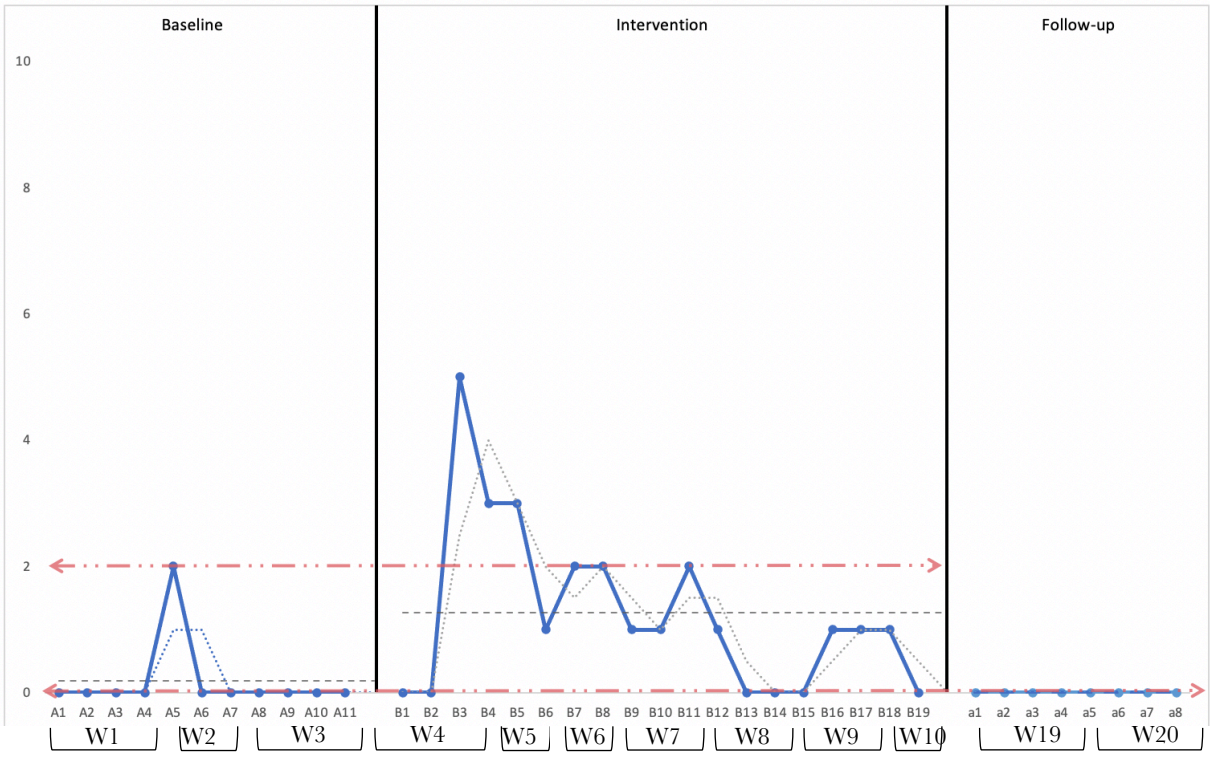
Pt3: Raw VAS Data for Low Mood



Note. W=Week. Each data point represents his self-rating from 0-10 over 24-hours.

Figure 9

Pt3: Raw VAS Data for Meaningful Behaviour



Note. W=Week. Each data point represents his self-rating from 0-10 over 24-hours.

Visual and Tau-U Analysis. Pt3 scored at floor for low mood throughout her baseline. This continued without fluctuation through intervention and follow-up phases, suggesting that the intervention had no impact on this variable. This is contradictory to symptoms reported on standardised measures (see HADS-D results below), and may relate to several factors including issues with measurement, particularly within the ABI population (see *Discussion*).

In terms of meaningful behaviour, an upward trend is evident during the first two weeks of the intervention (weeks four to five of her participation), corresponding to the identification of her values and initial discussions about value-consistent behaviours. A slight downward trend was observed across the remainder of the intervention. However, the mean across phases indicates an overall increase in

meaningful behaviour in the intervention phase compared to baseline, which was confirmed by TAU-U analysis (Tau-U=.57, $p<.01$). The fact that this was not maintained at follow-up may relate to the withdrawal of the intervention. However, her follow-up took place three months after her research involvement when she was recovering from COVID-19, which significantly impacted her day-to-day functioning.

Participant 4 (Pt4)

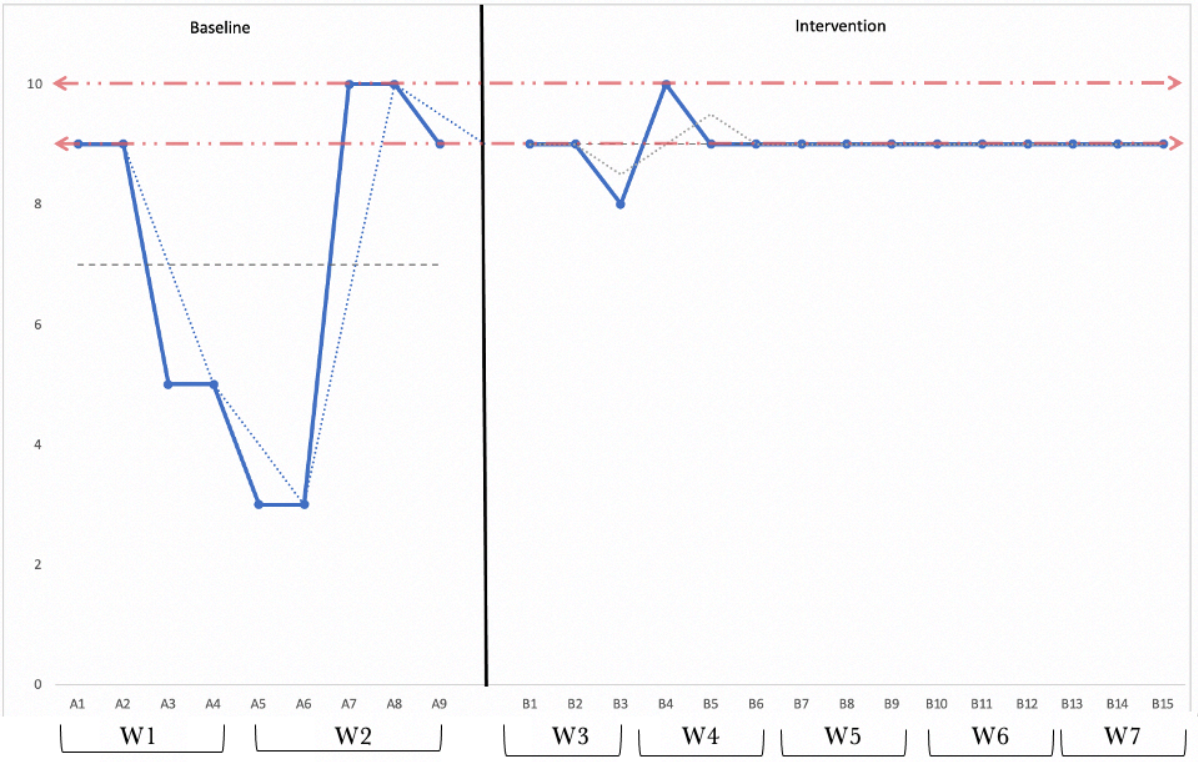
Therapeutic Engagement. Pt4's research involvement began five weeks into her admission when she was randomised to a two-week baseline. She attended five sessions across five weeks, with sessions coming to an end the week of her discharge. No sessions were declined. In the early stages of the intervention, she identified 'courage' as a value that she hoped to work towards, stating "you have to live with your fears" and "find the courage to smile again". In the goal-setting stage of therapy, she was supported to develop specific goals that aligned to her value of courage (e.g., to show her face on videocall to her partner, and to tell her family how she felt). Although the idea of carrying out these goals caused her to feel anxious, she was encouraged to approach things that were meaningful to her, considering how she might prevent the anxiety from 'squashing' her courage. In later sessions, she began to think about how she could continue to live by her values in the future. She started to engage in self-directed values-based behaviours; for instance, she decided to move back to Poland on discharge, reporting that this was a huge act of courage. VAS graphs outlining her research involvement are presented in Figure's 10-11.

Extraneous Factors. In the first week of Pt4's baseline, her tracheostomy was removed. She was worried that this may be reinserted and reported feeling

increasingly low in mood. She began to take antidepressant medication (Sertraline, 50mg) in week three of her participation (first intervention week); however, she continued to experience low mood throughout the intervention and reported that the medication had not helped. In week five of her participation (third intervention week), she explained that due to a language barrier, she was struggling to understand what had caused her stroke and was frequently worrying about why her tracheostomy stoma had not healed. Additionally, she reported feeling low and as though she was no longer the person she once was. Such worries frequently prevented her from sleeping and she began to disengage from all rehabilitation sessions except for the research intervention.

Figure 10

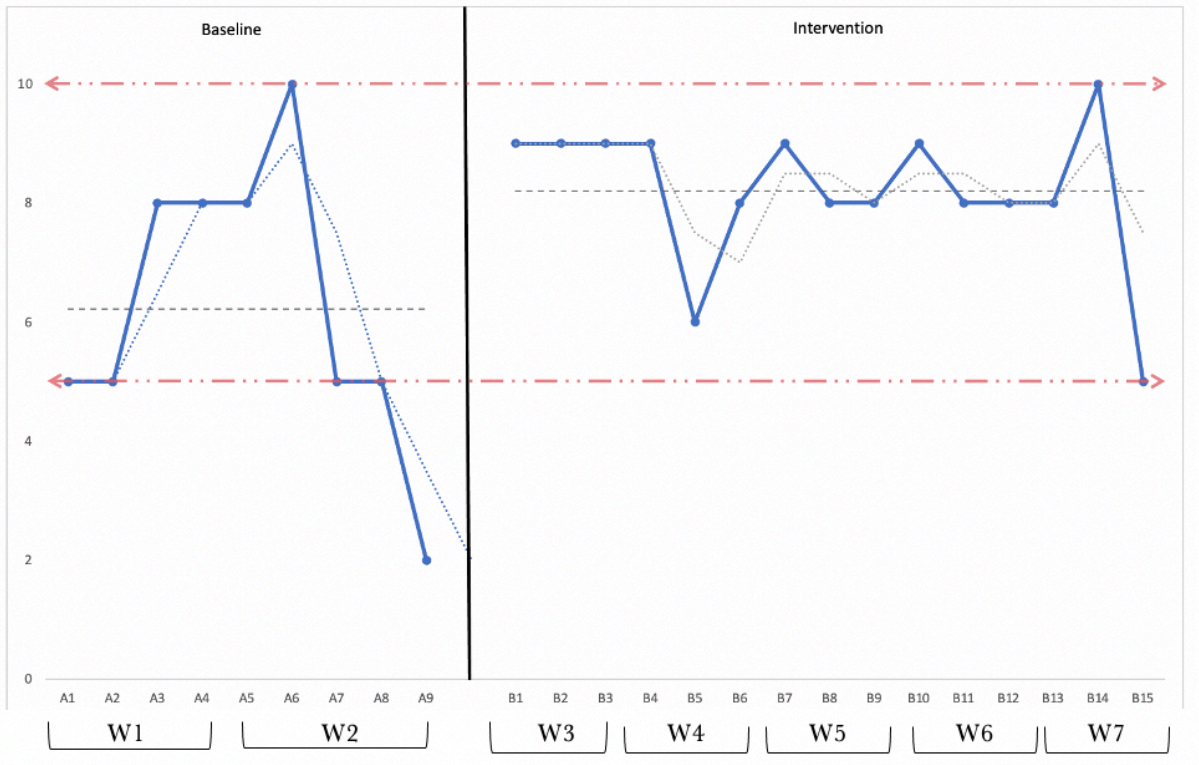
Pt4: Raw VAS Data for Low Mood



Note. W=Week. Each data point represents his self-rating from 0-10 over 24-hours.

Figure 11

Pt4: Raw VAS Data for Meaningful Behaviour



Note. W=Week. Each data point represents his self-rating from 0-10 over a 24-hours.

Visual and Tau-U Analysis. As outlined in Figure 10, a downward trend in low mood is evident during the first week of Pt4's baseline. However, this trend reverses in week two of her baseline, outlining increased low mood that corresponded to her tracheostomy concerns. Throughout the intervention phase, there is no clear trend in low mood. Whilst means outline an increase in low mood during the intervention phase when compared to baseline, TAU-U analysis found no significant differences and a large overlap between phases (Tau-U=.24, p=.34).

Similarly, Figure 11 outlines an upward trend in meaningful behaviour during the first week of her baseline, which reversed during the second week. On the

commencement of therapy, scores for meaningful behaviour appeared to increase and stablise, with small fluctuations evident across the intervention phase. Overall, phase means demonstrate increased meaningful behaviour during the intervention when compared to baseline. This is supported by TAU-U analysis, which confirms a significant increase in meaningful behaviour during the intervention (Tau-U=.53, p=.03).

Summary of SCED Data

For the low mood VAS, none of the participants demonstrated significant change from baseline through to intervention or follow-up. Both Pt1 and Pt2 showed an initial downward trend in low mood between sessions one to four of the intervention (Pt1: weeks 5-6; Pt2: weeks 4-8); however, for both participants this trend reversed briefly, corresponding to changes in personal circumstances. Low mood VAS remained stable for both Pt3 and Pt4 during their participation, with Pt3 scoring at floor and Pt4 close to ceiling throughout.

Contrary to findings from the Values Bullseye, which tracked specific values identified in therapy (and showed steady improvements for all participants), Pt3 and Pt4 were the only participants to show significant increases in meaningful behaviour during the intervention phase when compared to baseline. This was not maintained at follow-up for Pt3, however. Although Pt1 demonstrated an increase in meaningful behaviour during intervention, this fell short of significance when compared to baseline (p=.06), reaching significance when baseline was compared to intervention and follow-up combined (Tau-U=.53, p=.03). No significant differences in meaningful behaviour were observed for Pt2 across phases. As replication of effect was not shown

for either variable across timepoints and participants, effect size was not calculated (Kratchowill et al., 2010).

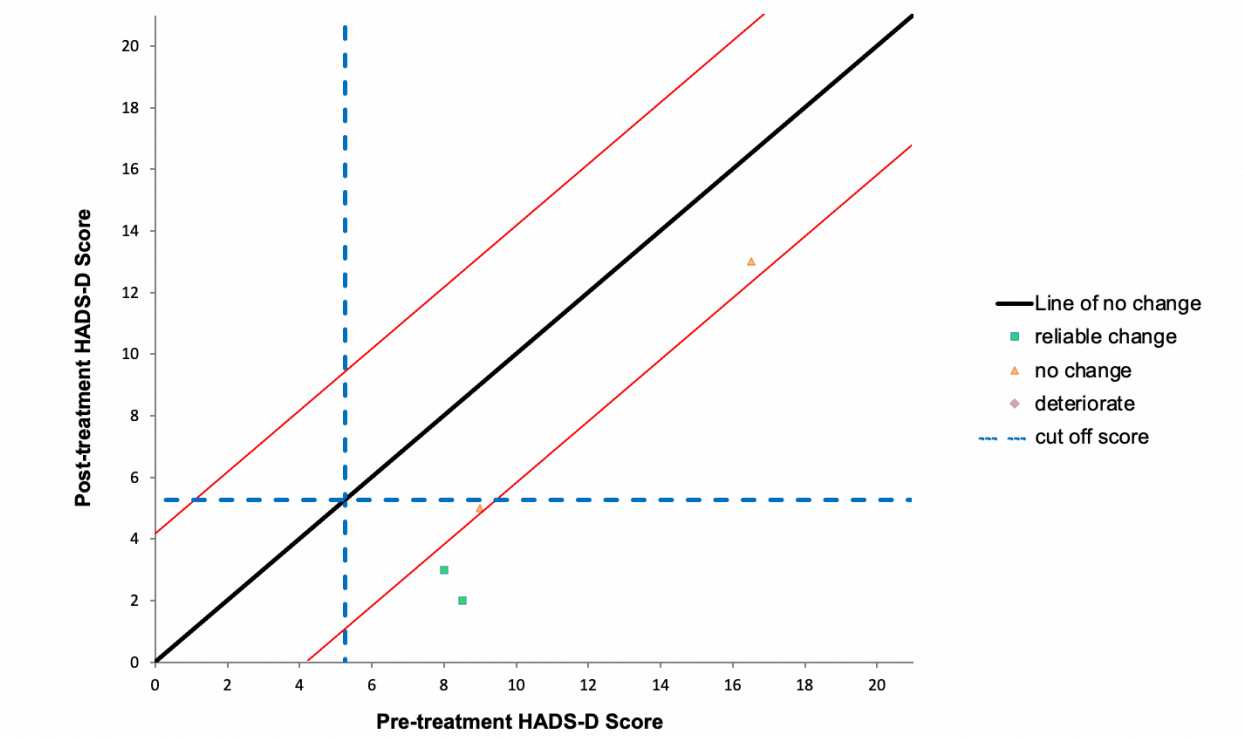
Analysis of Standardised Data

Standardised measures assessed each participants symptoms of depression (using HADS-D), quality of life (using QOLIBRI Self and Emotions) and adjustment (using RIDI – Adjustment) pre-baseline (T1), pre-intervention (T2), post-intervention (T3) and follow-up (T4). It was hypothesised that following the intervention, participants would report lower levels of depression, improved quality of life and increased adjustment to their injury. The Leeds Reliable Change Indicator was used to graph data and to determine whether participant's achieved reliable change (RC) and clinically significant change (CSC) (Morley & Dowzer, 2014). The scatter plots below display each participants' pre to post-intervention scores. For pre-intervention scores, an average was calculated between participant responses at T1 and T2. T4 scores are used as post-intervention scores for all participants except for Pt4 who was discharged prior to follow-up; thus, T3 scores were used in this case. Raw scores can be found in Appendix 13.

Depression (HADS-D)

Figure 12

Comparison between Pre-intervention and Follow-up HADS-Depression Scores (n=4)



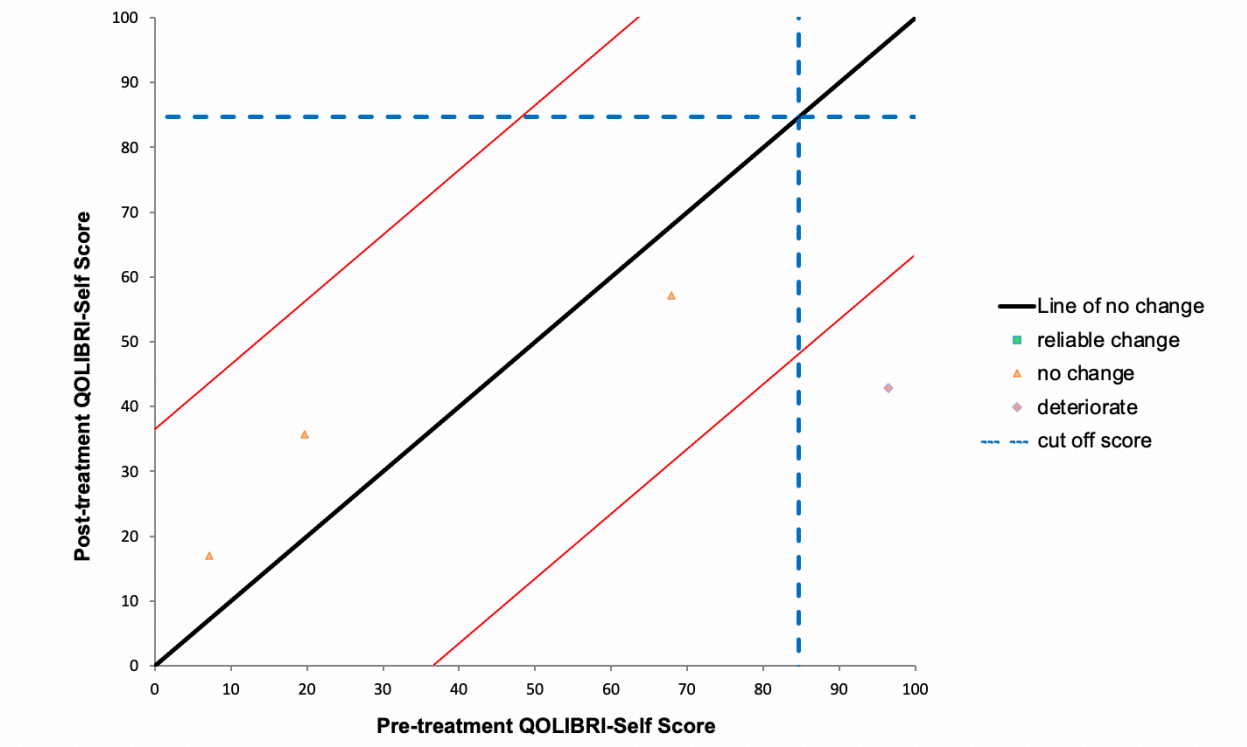
Note. Criterion C used for CSC.

Three participants (Pt1, Pt2, Pt3) reliably improved and met CSC for depression at T3. Pt4 showed a reduction in depression, however, this did not meet threshold for being 'reliable'. At T4, two participants (Pt2, Pt3) continued to meet criteria for reliable and clinically significant improvement, whereas Pt1 did not reliably change when compared to pre-intervention.

Quality of Life (QOLIBRI Self and Emotions subscales)

Figure 13

Comparison between Pre-intervention and Follow-up QOLIBRI-Self Scores (n=4)

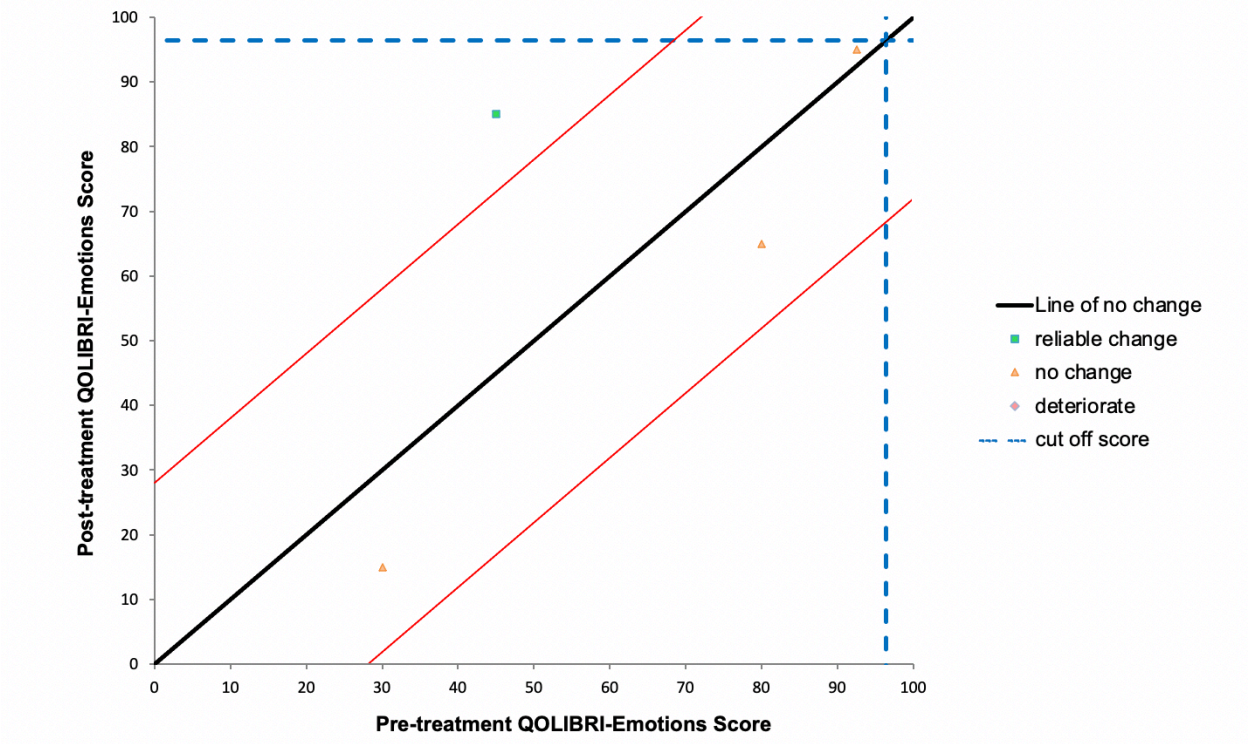


Note. Criterion A used for CSC.

None of the participants reliably changed on quality of life scores measuring self-perception at T3 compared to pre-intervention. Similarly, at T4, Pt1 and Pt3 did not significantly change when compared pre-intervention; however, Pt2 deterioriated, meeting clinical significance.

Figure 14

Comparison between Pre-intervention and Follow-up QOLIBRI-Emotions Scores (n=4)



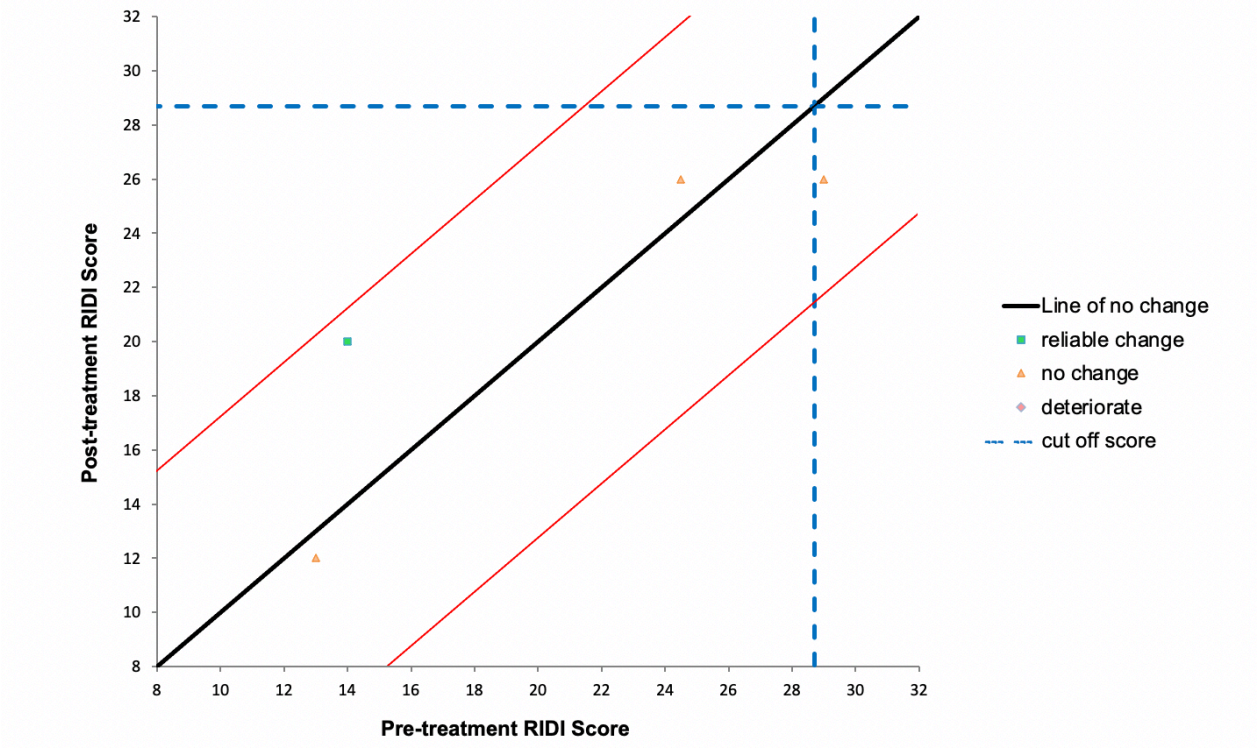
Note. Criterion A used for CSC.

For the Emotions subscale of the QOLIBRI, Pt1 reliably improved at T3 and T4 compared to pre-intervention, meeting clinical significance at both time points. No reliable change occurred for Pt2, Pt3 or Pt4 at T3, nor for Pt2 and Pt3 at T4.

Adjustment (RIDI)

Figure 15

Comparison between Pre-intervention and Follow-up RIDI-Adjustment Scores (n=4)



Note. Criterion A used for CSC.

At T3, Pt1 and Pt3 reliably improved for adjustment, with Pt1 meeting CSC. Adjustment did not reliably change for Pt2 or Pt4 at this time. At T4, Pt3's scores remained stable, reliably improving but not reaching clinical significance, whilst adjustment did not reliably change for either Pt1 or Pt2.

Summary of Standardised Results

Three out of four participants experienced reliable and clinically significant reductions in depression at T3, which were maintained at T4 for two participants. The QOLIBRI-Self subscale showed the least change, with no participants showing reliable change at T3 and one participant demonstrating a deterioration at T4.

Pt1 responded to treatment best, reliably and clinically improving on three out of four measures at T3 (HADS-D; RIDI; QOLIBRI-Emotions) and maintaining improvement on the QOLIBRI-Emotions at T4. Pt4 showed the least improvement

post-intervention, with no meaningful change detected. Pt2 was the only participant to reliably deteriorate on any measure (T4: QOLIBRI-Self). When considering standardised data alongside the VAS findings, inconsistencies are evident. That is, despite standardised measures showing clinically improved mood for three participants immediately post-intervention, no participant demonstrated significant changes in depression on VAS measures between baseline and intervention phases.

Future Thinking

It was hypothesised that, due to heightened depression scores, participants would demonstrate a negative bias in prospective cognition pre-treatment, which would reduce throughout the intervention. The FFT measured biases in prospective cognition at T1, T2, T3 and T4, with pre-intervention scores calculated by taking an average of T1 and T2 responses. Participants were given one minute to generate as many likely or plausible self-future experiences as possible for three time periods (next week, next year, and the next five to ten years). The total positive versus negative items were computed for each participant by summing across time periods. Positive bias was then calculated as the proportion of positive items out of all items generated (positive and negative); hence, a higher proportion indicates a more positive bias (Table 10).

Table 10

Findings from the Future Thinking Task Converted to Positive Bias Scores of 0-1

Pt	Condition	T1/T2	T3	T4
1	Positive	12.5	15	17
	Negative	4.5	0	0
	Total positive bias	.73	1	1
2	Positive	13.5	18	17
	Negative	10.5	10	9
	Total positive bias	.56	.64	.65
3	Positive	23	21	22
	Negative	16.5	15	15
	Total positive bias	.58	.58	.59
4	Positive	8	15	-
	Negative	4	6	-
	Total positive bias	.67	.71	-

Note. Scores >.5 = positive bias, scores <.5 indicate negative bias. Pt4 lost to follow up.

Pre-intervention, none of the participants demonstrated a negative bias in future thinking. Over the course of therapy, Pt1 and Pt2 demonstrated an increased

positive bias, with Pt1 exhibiting the largest change. Scores for Pt3 and Pt4 remained relatively stable, suggesting that the intervention did not impact their future thinking. No participant deteriorated across the course of therapy.

Acceptability of the Intervention

Client feedback, adherence to the protocol and recruitment and retention were considered when evaluating the acceptability of the intervention. To assess therapist competence, approximately 20% of therapy sessions were listened to by the therapist's Academic Supervisor, all of which were found to adhere to the protocol. Prior to publication, the therapist's Academic Supervisor will formally rate protocol adherence using the values-based parts of an ACT-specific adherence manual previously used in an ACT trial for OCD (Twohig et al., 2010). Figure 2 (see *Methods*) outlines full information relating to recruitment and retention. For several reasons, the recruitment target of six participants was not achieved within the proposed timeframe. Firstly, due to COVID-19, one of the two proposed research sites had stopped all non-covid related research; thus, it was not possible to recruit from this site. Secondly, the remaining recruitment site went into lockdown, dividing the hospital into 'zones' that could not be crossed, severely limiting the participant pool. Finally, two participants were withdrawn from the study. One participant withdrew during their baseline phase, due to an early discharge after contracting COVID-19. The second participant was withdrawn during their intervention phase, due to a significant rise in their risk following a separation from their partner. The research therapy was not reported to have contributed to this increase in risk. The CSQ was used to attain quantitative feedback from all clients that completed the intervention, as outlined in Table 11.

Table 11

CSQ Total Scores Converted to Acceptability Ratings of 0-100

Pt	Therapist	CSQ raw score /32	Acceptability /100
1	1	29	90.6
2	1	32	100
3	1	32	100
4	2	22	69

Note. Therapist 1 (RA)=final year clinical psychology trainee. Therapist 2 (SS)=Qualified Clinical Psychologist.

The acceptability of the values-based therapy was rated between 69 and 100% across the two therapists. All participants stated that the intervention was helpful and supportive and that they would complete a similar therapy if needed. Whilst other participants appeared to benefit from the present focus and short-term nature of the therapy, Pt2 reported that he would have appreciated further exploration of his past experiences (particularly relating to his relationships) and a longer-term therapeutic approach. Some participants commented that it felt novel to think about their values and that such conversations were often avoided by others in their life, whereas others reported that they had thought a lot about their values since their brain injury. Some

participants therefore benefited from the therapy reinforcing their existing values-based behaviour, whereas others benefited from the introduction of new behaviours. Overall, the intervention was found to be useful and was reported to have encouraged ongoing values-based thinking and behaviour.

Discussion

This study examined the use of a values-based intervention for neurorehabilitation inpatients with an ABI and symptoms of depression. The effect of the intervention was assessed using outcomes of valued behaviour, mood, quality of life, adjustment to brain injury and future thinking. The novel intervention was the first to draw upon the behavioural components of ACT (i.e., values and committed action) within this population. Mental imagery was an optional component of the intervention aimed at increasing motivation towards values-based goals; however, due to participants exhibiting high levels of motivation and positive biases in future thinking at baseline (evidenced by scores on the *Future Thinking Task*), imagery use was not indicated. Therefore, no imagery was delivered in the study.

Main Findings

Four participants attended an average of six one-to-one intervention sessions and one participant was lost to follow-up (moved countries). For all but one participant, standardised data outlined reliable and clinically significant change on at least one variable. Depression was the most improved variable, with three out of the four participants demonstrating reliable and clinically significant reductions on the HADS-D at T3. Two individuals maintained these reductions at T4. Adjustment was second to depression, with two participants reliably improving at T3, one of whom

met clinical significance; however, this was maintained for only one participant at T4. The Quality of Life 'Self' subscale, which assessed participants self-perception, outlined the least positive change. None of the participants reliably improved at either T3 or T4, with one participant reliably deteriorating at T4 and meeting clinical significance.

In terms of SCED data, low mood VAS did not significantly differ between study phases (i.e., baseline, intervention, follow-up) for any participant, suggesting that the intervention had little effect on daily reporting of mood. For three of the four participants, inconsistencies between the low mood VAS and standardised HADS-D data were therefore evident (i.e., participants demonstrated reductions in depression on the HADS-D with no significant changes in VAS for low mood). This may relate to a number of factors. Firstly, VAS were administered as close to daily as possible whereas the HADS-D was only administered at four timepoints throughout the study. Hence, VAS were more likely to be influenced by extraneous variables (e.g., interactions with family or staff members and the changing COVID-19 restrictions within the hospital). Secondly, specific instructions and pre-defined categories, which are provided on the HADS-D, are not provided for VAS measures, arguably allowing for more subjectivity in their completion (Klimek et al., 2017); hence, participants may not have considered the symptoms of depression assessed on the HADS-D in their daily mood ratings. Thirdly, common cognitive deficits (e.g., in memory and executive functioning) likely affected participants self-report of earlier experiences and emotions; thus, they may have answered based on how they felt in-the-moment as opposed to accurately reflecting on the specified time-period. This is most likely to have impacted on the HADS-D, which covered a two-week period, rather than the

VAS which covered a 24-hour period. Finally, the HADS-D was administered by the researcher, which may have introduced bias through demand characteristics. On some occasions, the researcher was present for VAS data collection, but on most this was not the case.

In terms of the meaningful living VAS, two of the four participants demonstrated significantly increased meaningful behaviour during the intervention phase when compared to baseline. For one participant, this was not maintained during the follow-up phase, with the second participant lost to follow-up. A third participant also demonstrated increased meaningful behaviour during the intervention and follow-up phases, though, this fell short of significance when compared to baseline. Despite VAS outlining some improvements in meaningful living, a clear effect of intervention was therefore not detected; that is, reliable improvements from week two of the intervention were not demonstrated for at least three participants across different baselines (as required when establishing causality in a MBD; Horner et al., 2005).

In contrast, the Values Bullseye outlined an increase in value-consistent behaviour during the intervention for all four participants. Such increases were maintained for the three participants who completed follow-up. What's more, throughout the intervention, most participants began to engage in self-directed values-based behaviours in addition to goals forumulated in sessions; thus, highlighting that participants were able to take some ownership of valued living and focus on the values themselves rather than the pursuit of specific goals. Discrepencies between the Bullseye and VAS measures are similar to those reported by Sharma (in prep) and may relate to the fact that the Bullseye tracked specific values that were identified

early in therapy, whilst the VAS measured meaningful living more broadly. Arguably, the VAS scale therefore allowed for increased subjectivity when interpreting what was 'meaningful', and participants may not have considered values in their responses. For example, on several occassions, participants reported basing their VAS scores on their experience of their rehabilitation that day; that is, how meaningful they had percieved other sessions (e.g., physiotherapy) to be. Consequently, the two scales likely captured different concepts. Despite inconsistencies, there is some evidence from this study that the intervention did increase values-based behaviour in this ABI group. As outlined below, this is in line with previous findings in both non-ABI (Villatte et al., 2016) and ABI (Sharma, in prep) populations.

Finally, in terms of future thinking none of the participants demonstrated a negative bias in future thinking pre-intervention (i.e., all participants reported more positive than negative plausible future events). This is opposing to previous research, which found a negative bias in future thinking in both ABI (Murphy et al., 2019) and non-ABI (Matthews & MacLeod, 2005) groups with depression. Across the course of therapy, two of the four participants exhibited an increased positive bias at T3 and T4, showing both an increase in positive future thoughts and a decrease in negative future thoughts. In relation to standardised and VAS data, both participants demonstrated significant reductions on the HADS-D at T3, one of which was maintained at T4; however, neither of the participants outlined significant changes on the low mood or meaningful living VAS (though, one participant approached significance for meaningful living). For the two participants that demonstrated stable future thinking scores, only one participant demonstrated reductions in depression on the HADS-D at either T3 or T4, neither outlined reliable reductions on their daily

mood reporting, and both outlined significant increases in meaningful living on the VAS, though this was not maintained into follow-up. Thus, in line with previous research (Murphy et al., 2019), this study showed some evidence of improved future thinking that corresponded to reductions in standardised depression scores. However, increased meaningful living on the VAS did not consistently correspond to improvements in mood and future thinking. Such findings may be explained by the ACT literature, which highlights ACT as aiming to increase functioning in the face of distress (Hayes et al., 2006) and proposes that acting in line with values is not necessarily enjoyable or mood enhancing (Harris, 2008).

According to standardised feedback, all participants found the intervention to be acceptable. All were able to identify their values, establish value-consistent goals and work towards these over the course of the intervention. Although two participants were withdrawn from the study, this was due to factors unrelated to the research intervention (an early discharge and a change in personal circumstances). This is particularly promising as previous SCEDS have outlined dropout rates of 20% or more (e.g., Jamieson et al., 2019), with high attrition rates also reported for other psychological therapies within ABI groups (Gertler et al., 2015).

Findings in Relation to Previous ACT Research

The standardised and VAS data outlined above are supported, in part, by previous research. For instance, researchers have demonstrated reductions in depression following individual (Whiting et al., 2017) and group-based (Whiting et al., 2019) ACT treatments in neurorehabilitation, as well as in ABI-groups more widely (e.g., Majumdar & Morris, 2019). Similarly, improvements in psychological distress

and adjustment are reported in studies using only the values and committed action components of ACT in non-ABI groups (Villatte et al., 2016); however, this corresponds only to the standardised, not VAS, findings in the present study. Moreover, Villatte et al. also reported quality-of-life improvements, which were not replicated in the current study; in fact, the self-perception subscale of the quality-of-life measure was the only measure on which any participant reliably deteriorated post-intervention. In ABI groups without depression, the valued and committed action components of ACT have also led to improvements in mood and adjustment on standardised measures (Sharma, in prep), again supporting the present findings. However, unlike the present study, Sharma found that VAS for low mood was also improved for most participants post-intervention. This may relate to the fact that, in contrast to participants in the present study, four of the six participants did not meet the threshold for depression at baseline in addition to issues with measurement as outlined above. In terms of meaningful living, Sharma found that all participants reported increased values-consistent behaviour on the Values Bullseye; though, similarly to the present study, this did not always translate onto the meaningful living VAS, which improved for just two of the six participants.

Methodological Issues

Various methodological issues arose during the study. For instance, given that all participants were neurorehabilitation inpatients, extraneous factors relating to their rehabilitation (e.g., the stage and progress of their rehabilitation and their access to social support) may have influenced the evaluation of the intervention (Sohlberg & Mateer, 2001). The main challenges of conducting research within this environment are discussed below.

The four participants were at vastly different stages of their rehabilitation, and thus exhibited differing levels of progress and adjustment. Two participants were inpatients in long-term care, with predicted discharge dates at least two months after their study involvement ended (Pt2, Pt3), whereas two participants were seen up until their discharge from rehabilitation (Pt1, Pt4). Interestingly, considering both VAS and standardised data, Pt1 demonstrated the greatest overall improvement, suggesting that being closer to discharge positively impacted treatment response. In contrast, Pt4 displayed the least improvement across measures, indicative of the opposite. This may be explained by the complex and idiosyncratic response experienced by individuals around discharge. For instance, Pt1 reported feeling excited by going home and demonstrated an increase in valued behaviour once back with his family. However, he also demonstrated a slight increase in low mood that corresponded to having to adapt to the home environment and his increased reliance on family members. Pt4, on the other hand, reported feeling extremely anxious about being discharged and struggled to make important decisions about discharge location (i.e., whether she would return to Poland). Although, such factors may have been controlled by recruiting participants that followed the same rehabilitation trajectory (i.e., starting and finishing at the same time), this would be difficult to control due to the frequent changing of discharge dates within this setting. Additionally, individual circumstances, thoughts and feelings towards discharge would likely continue to impact on findings.

Understandably, findings were impacted further by participants' experience of their rehabilitation and being in a hospital environment during the COVID-19 pandemic. For instance, both Pt1 and Pt3 contracted COVID-19 during their research involvement (in both cases, towards the end of the intervention and

overlapping with the follow-up stage of the study). Both participants reported that this impacted on their responses to study measures due to on-going feelings of fatigue and an inability to engage in enjoyed activities whilst unwell. Additionally, for all participants, COVID-19 restrictions meant that they were unable to have visitors throughout their admission, often had reduced therapy input, as well as being unable to leave their wards and, at times, their bays for prolonged periods of time. Participants reported feeling low in response to these restrictions, missing their families, and feeling increasingly bored. What's more, restrictions impacted heavily on the values-based goals set during therapy (e.g., activities had to be feasible on the ward or virtually).

Finally, factors such as participants' cognitive ability and level of insight may have also influenced outcomes. For instance, executive functioning (e.g., inflexibility, poor attention, and impaired reasoning and judgement) and memory difficulties were experienced by all four participants and may have affected their self-ratings. Difficulties remembering recent information and switching attention were particularly apparent for Pt1 and Pt2 who often based their overall daily or fortnightly ratings on their in-the-moment experience rather than reflecting on specified time-periods. Furthermore, all participants demonstrated concrete thinking styles, which may have contributed to more extreme ratings (e.g., Pt3 scoring at floor for the low mood VAS throughout her study involvement). Other explanations for floor ratings include reduced insight, which commonly results from organic impairment or psychological denial after ABI (Langer & Padrone, 1992). Improved insight can be achieved through neurorehabilitation sessions, emotional support, and/or cognitive recovery, and often correlates to reduced mood in ABI groups (Sohlberg & Mateer, 2001).

Thus, this may have also contributed to the lack of improvement seen in low mood across participants on daily VAS measures.

Strengths and Limitations

A particular strength of the study was the use of a SCED with baseline randomisation, which overcame some limitations of the existing research in this area and allowed for robust control of threats to internal validity. For example, as neurorehabilitation is a time of neurological growth and functional repair (Headway, 2019), participants were highly likely to change throughout their research involvement. It is therefore possible that observed changes could relate to maturation rather than the intervention; however, the requirement for effects to be demonstrated for at least three participants across different baselines controlled for this.

Another strength was the studies focus on the *pursuit* of goals throughout the intervention, rather than goal acheivement, as it is through this pursuit that meaningful behaviour occurs. Additionally, this reduced the possibility of self-percieved failure, as suggested when supporting adjustment (Brands et al., 2012), and demonstrated that the pursuit of meaningful goals, whether or not acheieved, can lead to positive changes in valued living and mood. Such findings could influence service delivery as currently, due to service targets and comissioning, neurorehabilitation is heavily focused on goal attainment (Turner-Stokes, 2009). A final strength of the study was the flexible nature of the intervention, which allowed goals to be tailored to each participants cognitive and physical abilities; thus, encouraging meaningful living despite the consequences of their injuries.

Limitations of the study include the fact that only four individuals completed the baseline and intervention phases, with with only three individuals completing follow-up despite the study being powered for five participants. Additonally, VAS data did not consistently reach the desired MBD power (0.8) as 18 timepoints per phase were not attained. This was due to COVID-19 restrictions (e.g., no crossing of wards) making it difficult to collect measures for some participants and an increasing reliance on external support (e.g. carers) to assist with VAS collection. Study findings are therefore tentative and further research is needed to confirm outcomes.

Furthermore, two of the four participants (Pt2, Pt4) were taking psychotropic medication for low mood during their research involvement, with Pt2 also engaging in psychological therapy for anxiety, which overlapped with the final session of the research intervention. Although such factors could influence findings, discussions with the hospital medical and psychology teams allowed for careful monitoring of both pharmacological treatment and additional therapeutic input. This ensured that the stability of medication effects could be evaluated throughout the study, and prevented any overlap of the values-based approach between psychological therapies.

A further study limitation is the sole use of self-report measures. Despite researchers recommending their use when assessing self-percieved concepts such as mood, adjustment and quality of life (Ditchman et al., 2019; Verdugo et al., 2019, von Steinbuechel et al., 2016), it is possible that findings do not accurately reflect participant experience. For instance, due to a social-desirability bias, participants may have responded to measures based on what they believed the therapist was hoping for (Rosenma, Tennekoon & Hill, 2011). This could have led to an underreporting of symptoms, in attempt to portray themselves as coping well with their injury following

the intervention. Alternatively, participants may have overreported symptoms in effort to gain support from the researcher. It is therefore recommended that future studies reduce the potential for bias by including an independent assessor to administer outcome measures, and increase the reliability of findings by including caregiver rated measures alongside self-report (e.g., from staff members) (Barlow, Nock & Hersen, 2008). Unfortunately, neither recommendation was possible in the present study due to understaffing and restrictions around new staff entering the hospital during COVID-19.

Additional limitations arise when examining the outcome measures used in the study. For instance, although the HADS-D is validated within ABI populations (Schönberger & Ponsford, 2010; Aben et al., 2002), certain items are arguably unsuitable for this group. Items measuring whether participants still enjoyed the things they 'used to enjoy' may relate more to being in a hospital environment, particularly during COVID-19 when participants were severely restricted and often unable to access previously enjoyed activities. Additionally, items that focus on how 'slowed down' participants were may have captured the effects of their physical impairments post-injury (Goldstein, Atkins & Leigh, 2002) rather than symptoms of depression. Furthermore, as there are no existing benchmarks for HADS-D scores during neurorehabilitation, it is difficult to assess whether changes on the measure go beyond what would be usual and expected for this group. Similarly, despite the QOLIBRI being a brain injury specific measure, it may omit specific life domains that hold personal significance to individuals (Fernandez et al., 2019). It is therefore possible that standardised measures failed to truly capture individual circumstances and experiences; hence, the idiosyncratic VAS measures partially controlled for this.

Finally, the two-week planned follow-up period is relatively short, particularly since previous studies have outlined delayed treatment effects of up to six months in ABI groups (Hsieh et al., 2012). A longer-term follow-up period would have provided further information around maintenance effects; however, this was not possible due to admission lengths and participant discharges. Further issues include the fact that two participants contracted COVID-19 around the time of their follow-up, meaning that Pt1's follow-up took place one month after his final session, following his discharge, and Pt3's final session and follow-up period took place after a three-month delay between her final two sessions. Hence, for both participants extraneous factors may have influenced follow-up measures (e.g., the aftereffects of being unwell and/or the fact that they were completed once in the home environment). Interestingly, following Pt1 up whilst in the community offered some insight into how values-based work can continue post-discharge, translating from the hospital to home environment when individuals are back to their usual routines and have their loved ones around them. Further exploration of values-based treatments following discharge is warranted, given that interventions aim to support individuals in living by their values as part of a lifelong process. Additionally, the imagery sections of the intervention are arguably more applicable when thinking about future events once at home rather than during rehabilitation. Participants reported that they were assisted and encouraged by staff to engage in identified valued activities on the ward, and thus, may benefit from strategies that increase motivation once home and in a less structured environment.

Future Directions

It would be helpful for future research to combat issues with measurement and self-report by also including observer-rated measures of mood and meaningful

behaviour. Observer-rated outcomes could be completed by those close to the participant, such as family or staff members. Furthermore, despite the use of standardised measures validated for ABI groups, issues with the applicability of measurements remained. Hence, it would be interesting to use clinical interviews with both the participant and caregivers to supplement standardised measures. Increased service user involvement would also be helpful in reviewing the chosen outcome measures and their applicability to ABI groups, in addition to reviewing the therapy protocol. Finally, future research could more closely examine the relationship between mood and valued-behaviour outcomes, which was inconsistent across participants in the present study and suggests that whilst increased valued-behaviour can improve mood, this is not always the case.

Moreover, in the present study, effects were not often maintained at follow-up; however several issues with follow-up periods arose (e.g., participant discharges or participants becoming unwell). Whilst such factors could not be prevented, including a consistent and longer follow-up period for all participants would be helpful in monitoring the effects of the intervention overtime. This may be more likely in community samples where discharge is less of a factor. Following individuals up in the community, or trialling the intervention within community ABI groups, would also inform how values-based approaches can be adapted to the home environment, better tailoring the intervention to an individuals life and supporting them to live by their values longterm. This is particularly interesting given the varied response to discharge between participants, and the adjustment issues highlighted by Pt1 once home (e.g., his realisation that he required increased support from his family), which negatively impacted on his mood. Furthermore, important decisions made once home (e.g.,

whether or not an individual can return to employment) are likely to heavily influence mood and valued-behaviour, and may be supported by a values-based approach.

Lastly, whilst some sites have begun to incorporate values-based goal-setting into neurorehabilitation, this is rare. The present study demonstrated that focusing on an individuals values can support them in living more meaningful lives, despite the consequences of their injuries; hence, it is advised that professionals draw upon an individuals values when setting collaborative rehabilitation goals.

Conclusions

This study used a MBD to evaluate the use of a values-based intervention for neurorehabilitation inpatients with an ABI and symptoms of depression. The design enabled stringent analysis, whilst allowing for cases to be studied individually and in detail, which is appropriate given the heterogeneity of the ABI population. The flexible nature of the research intervention meant that participants physical and cognitive difficulties could be considered when establishing values-based goals, encouraging them to engage in meaningful behaviours despite the consequences of their ABI. All participants reported increased values-consistent behaviours across the course of therapy, with most engaging in self-directed values-based behaviours in addition the goals formulated in sessions. Three out of four participants improved on at least one variable, with the most improvement made in depression. However, as the study was underpowered clear conclusions cannot be drawn. Additionally, limitations including the sole use of self-report, and the uncontrollibility of the rehabilitation environment during COVID-19 are likely to have impacted on findings.

Chapter IV: Integration, Impact and Dissemination

This chapter aims to first provide a synthesis of the main two aspects of the thesis, the systematic review (SR) and the empirical study (ES). It will then discuss the

potential academic and clinical impact of research findings, before reviewing how findings will likely be disseminated in the future. Reflections and critical appraisals of the project will be provided throughout.

Integration

This section discusses and reflects on the process of working on the two interrelated thesis components, focusing on the level of synergy achieved between them. When beginning the project my principal aim was to evaluate and advance the evidence-base for the use of psychological interventions for adults with an Acquired Brain Injury (ABI), which was achieved through the combination of the SR and ES. As recent reviews (e.g., Sharma, unpublished thesis) have examined the existing literature for Acceptance and Commitment Therapy (ACT) within the ABI population, the decision was made for the SR to instead review the available evidence-base for imagery use within psychological interventions in this group. Thus, relating to the proposed addition of imagery within the values-based therapy in the ES. However, as outlined below, whilst the SR influenced the study design, intended recruitment and service user involvement, the use of imagery was not indicated for the recruited ES participants, meaning that the relationship between the two components is less clear.

Conceptual Basis

The SR explored the effectiveness of imagery-based interventions on psychological outcomes after an ABI. It aimed to cover the common causes and consequences of an ABI, summarise the most heavily utilised psychological interventions to date, and develop the reader's understanding of mental imagery as a

method of improving cognitive function, mood and/or behaviour post-injury. It outlined that mental imagery aims to simulate or recreate perceptual experience in the absence of corresponding stimuli (Pearson et al., 2013), highlighting that imagery functions similarly to sensory perception (Pearson et al., 2015; Tartaglia et al., 2009) and can generalise from the imagined to the perceptual content (e.g., Lewis, O'Reilly, Khuu & Pearson, 2013). The SR demonstrated how, in non-ABI groups, imagery has been shown to enhance cognitive functions including perceptual learning (Tartaglia et al., 2009), memory, and executive functioning (e.g., planning and decision making; Pearson et al., 2015), and emphasised the key role of imagery in the development and maintenance of numerous psychological disorders, thus, highlighting how it has also informed the available clinical treatments. Additionally, the SR demonstrated how imagery has effectively impacted motivation across a range of maladaptive behaviours outside of the ABI population (e.g., May et al., 2015; Renner et al., 2019). However, whilst the consequences of ABI often correspond to these three areas (i.e., cognition, mood, and behaviour), I was surprised to find limited numbers of studies specifically exploring imagery use in this group, with research especially sparse outside of the cognitive domain.

Still, the SR provided an understanding of the theoretical underpinnings of mental imagery. The reviewed studies, using imagery within ABI groups, were instrumental in the development of the imagery component of the ES intervention. For instance, researchers reported incorporating detailed sensory information and a high level of repetition within imagery exercises, which was replicated in the imagery component of the ES. However, despite the ES planning to use imagery to increase motivation for values-consistent behaviours, this was not indicated. Participants in the

ES exhibited high levels of motivation and positive biases in future thinking, despite experiencing symptoms of depression. They reported that the encouragement from staff and structured hospital environment helped motivate them to engage with their values-based goals. I therefore wonder whether techniques to support motivation would be more applicable outside of this context (e.g., once discharged); thus, the use of imagery may be more useful in community ABI samples.

Nonetheless, aside from the imagery component, both the SR and ES required a thorough understanding of ABI and its consequences. Thankfully, whilst writing these sections, I undertook a six-month placement in neurorehabilitation, which took place at the ES recruitment site. Through both in-house training and working with a large caseload of patients with differing ABI aetiologies, I was able to integrate the two thesis components, enhancing both my theoretical and clinical knowledge of brain injury.

Design

The SR highlighted a number of limitations in previous ABI research, with the reviewed papers often including small sample sizes in addition to a lack of control groups. As recommended by some of the reviewed studies, the ES adopted a high-quality Single Case Experimental Design (SCED). Due to the level of control provided by randomisation and the strict criteria for causality to be established in SCED (i.e., effects needed to be demonstrated for at least three participants across different baselines; Horner et al, 2005; Kratchowill et al., 2010), a smaller sample size was appropriate. Additionally, considering the heterogeneity of ABI samples, and the diversity seen across participants in the ES (e.g., participants were at different stages of

their rehabilitation journey and were experiencing different symptoms post-injury) the use of a SCED appeared most fitting, allowing for data to be analysed individually and in detail, with participants acting as their own control. This is contrary to other controlled designs such as Randomised Control Trials (RCT), which recruit larger samples and analyse group data, thus, providing less detailed information around treatment response on an individual level.

Recruitment

Previous research, detailed in the SR, outlined a number of study limitations including the fact that studies were often underpowered due to small sample sizes. The ES attempted to overcome this, proposing a sample size of six. Sample size was predominantly determined by establishing power based on the design requirements (Shadish et al., 2014) and by reviewing previous SCEDs also conducted within ABI groups (e.g., Sharma, in prep). Unfortunately, the desired recruitment was not achieved due to COVID-19 restrictions heavily impacting on recruitment. Restrictions included the fact that one of the two recruitment sites paused all non-covid related research, meaning that it was not possible to recruit at all from this site. Additionally, the remaining recruitment site was divided into 'zones', which could not be crossed. For the majority of the recruitment period, this limited recruitment to just one ward, on which participants were admitted for approximately 12 weeks. Hence, new admissions were relatively infrequent and limited numbers of patients could be assessed for study eligibility. Two participants were recruited from a second ward during periods of eased restrictions; however, when restrictions were reintroduced, sessions were required to switch to videocall for one of these participants. The idea of virtual sessions was explored further in attempt to recruit additional participants;

however, this was not a feasible alternative due to the increased presence of communication and cognitive impairments in the ABI population. In addition to these restrictions, two participants who consented to the study were withdrawn during their research involvement. This was due to one participant contracting COVID-19 and being discharged early during his baseline period, and the second participant experiencing an increase in risk (i.e., increased suicidal thoughts and intent) following a separation from their partner mid-way through the intervention. Whilst this increase in risk was not considered to relate to the research therapy, it was deemed inappropriate to continue with sessions due to the novelty of the treatment. Instead, the participant was treated as per normal practice by the hospital psychology team. As a consequence, four participants completed the intervention, with one individual lost to follow due to an early discharge and moving countries. Hence, findings of the ES are tentative and further research with larger sample sizes is required.

In contrast to the ES, which solely recruited participants undergoing a period of inpatient neurorehabilitation, only one of the nine studies reviewed in the SR reported recruiting participants from inpatient wards. Due to differences in the two settings, this may have affected participant response to treatment. However, the decision to recruit for the ES from inpatient settings was made due to the wider literature, which argues that the principles of ACT fit well within neurorehabilitation when individuals are supported to rebuild a meaningful life by working towards personalised therapeutic goals (Kangas & McDonald, 2011; Soo et al., 2011; Turner-Stokes et al., 2005). Moreover, neurorehabilitation represents a critical time in an individual's recovery journey and intervening at this stage is likely to aid adjustment and increase the impact of rehabilitation long term. Nonetheless, I propose that future

research evaluates the use of values-based approaches within community ABI groups. I suggest this due not only to the SR, which outlined ongoing difficulties for individuals in the community, but also in consideration of the ES, in which participants were shown to have a complex and idiosyncratic response to discharge and community reintegration that may be supported by a values-based approach.

In terms of participant characteristics, the studies synthesised in the SR predominantly recruited individuals who had experienced a Traumatic Brain Injury (TBI) following a Road Traffic Accident (RTA) or a fall, despite inclusion criteria encompassing all non-progressive ABIs (e.g., injuries caused by anoxic or hypoxic events and infection-related diseases such as encephalitis, septicaemia, or meningitis). Moreover, a male predominance was found across the reviewed studies. This is reflective of national statistics, which outline a male predominance in cases of TBI in the UK (Anke et al., 2015; Numminen et al., 2011; Perez et al., 2012) usually resulting from falls or RTAs (Peeters et al., 2015). Surprisingly, in the ES, none of the participants experienced a TBI. Instead, participants experienced injuries predominantly caused by a stroke, anoxic or hypoxic events. Additionally, half of the participants in the ES were female, again at odds with the SR and wider literature. Differences between the ES and wider literature (including the SR) are most likely due to the small sample size in the study, which decreases the generalisability of results. Generalisability could have been increased by recruiting across a number of wards and hospital sites; however, as outlined above, this was not feasible in the context of COVID-19.

Due to the ES being underpowered, the study is continuing (with a new researcher) to provide further clarity around the usefulness of the values-based

intervention in ABI groups with depression. It is therefore helpful to reflect not only on the challenges faced, but also on what assisted with the recruitment and retention of four individuals despite the difficult circumstances discussed above. Firstly, I found that being on placement at the recruitment site was incredibly beneficial in establishing a presence within the wider psychology and multidisciplinary teams. This meant that I could speak regularly with the team about clients, staying mindful of the wider rehabilitation context. Additionally, other team members could be kept informed about the study, and thus, were able to assist participants in engaging with their values-based goals established during therapy. Secondly, being on site meant that I could hold the eligibility criteria in mind whilst assessing new admissions. Finally, prior to recruitment, I was able to present the study (background, design, and inclusion criteria) to the wider psychology team, following up with an information pack that outlined this information. At the time, this resulted in a number of referrals from wards around the hospital. Unfortunately, the introduction of new COVID-19 restrictions shortly afterwards prevented some of these individuals from partaking in the study.

Service User Involvement

When reflecting on the level of service user (SU) involvement across the SR and ES, I first consulted the 'ladder of participation' (Arnstein, 1969). This describes SU input as ranging from 'no control', whereby SU's are considered 'passive consumers' with no influence over the service that they receive, to 'full control' whereby SU's make service-related decisions at the highest level. As demonstrated below, SU involvement in the ES falls on the 'participation step' (the fourth step out of six) as SU's were able to make suggestions and influence outcomes.

SU feedback was particularly valuable in the development of study documents including the Participant Information Sheet (PIS; Appendix 3) and the Participant Consent Form (PCF; Appendix 4). These were drafted by Sharma (in prep) before two SU's at the recruitment site provided feedback on the content, wording, and style of the drafts. Additionally, SU's at the recruitment site were consulted about homework tasks likely to be set between sessions, and the daily VAS measures that were completed throughout the study. They were able to offer suggestions on how participants may be supported when completing these tasks, in consideration of their cognitive and physical abilities. In line with SU suggestions, the PIS and PCF were edited, and processes were put in place to offer participants support in completing the VAS measures (e.g., email reminders were sent, virtual copies of the measures were created, and staff or caregivers were contacted to ensure that participants could be assisted practically with measure completion).

In terms of the intervention, previous literature recommendations (e.g., Kangas & McDonald, 2011; Soo et al., 2011), including those highlighted by SR studies (e.g., Campbell et al., 2019; O'Neill & McMillan, 2012), were implemented to ensure applicability to ABI groups. For instance, participants were provided with easy-to-read handouts and summary sheets, and the therapist utilised simplified explanations, repetition, concrete examples, and metaphors to portray more complex concepts. Finally, each participant was consulted about how best study results may be communicated (see *dissemination* section below).

In terms of the SR, SU input fell on the 'no control' step of the ladder. Therefore, one way to increase SU involvement would have been to discuss possible review questions with SU groups. Additionally, only two individuals were approached

to offer feedback on elements of the ES, thus, the suggestions made may not be generalisable to the wider ABI population. Consulting higher numbers of SU's would have therefore been valuable. SU's could have also been approached prior to the development of study documents to ensure participation from the onset. Finally, in addition to consulting the relevant literature, gathering SU opinions on the intervention itself would have been useful, ensuring that the materials used were presented in a clear and accessible manner. Encouraging further SU involvement in this way would not only enhance the quality of study resources but would also empower the individuals approached.

Summary

Overall, there is some integration between SR and ES, with both components aiming to improve services for adults with an ABI. Both sections also inform the reader of the consequences of ABI and, when combined, offer critical appraisals on the most heavily researched psychological interventions in this group to date. The ES drew upon the wider literature, including papers referenced in SR, to identify downfalls in study design and to develop a higher quality study appropriate in the heterogeneous ABI population. Nonetheless, the lack of imagery use in the ES limits the level of synergy achieved between the two components.

Impact

The study outlined positive clinical implications for individuals with an ABI and depression following a values-based intervention. Participants were supported to engage in increased values-consistent behaviours across the course of therapy, whilst taking their individual desires, needs and abilities into account. This was

demonstrated through self-report measures in addition to informal qualitative feedback from participants and staff. What's more, three out of four participants reported a reduction in symptoms of depression on standardised outcomes, with half of participants also reporting heightened levels of adjustment immediately post-intervention. With up to 40% of mild to moderate ABI patients experiencing clinical levels of anxiety and/or depression (Seel & Kreutzer, 2003; Wellisch, Kaleita, Freeman, Cloughesy, & Goldman, 2002), such findings could have a substantial clinical impact in the future. The intervention exhibited less influence on quality-of-life (QoL) measures, with three participants demonstrating no reliable changes in QoL following the intervention and one individual reliably deteriorating in the QoL self-perception subscale at follow-up (a deterioration that was not present immediately post-intervention). Nonetheless, findings are comparable to previous research, in both ABI (Sharma, in prep) and non-ABI groups (Villatte et al., 2016), which has demonstrated that drawing upon individual ACT components can be as impactful for individuals as using ACT in its entirety. Additionally, both Villate et al. and Sharma highlighted how QoL does not always improve alongside symptom reduction, and vice versa.

Despite previous research beginning to explore a modularised approach to ACT, to my knowledge this is the first study to examine the impact of the 'behavioural components' (i.e., values and committed action) with individuals post-ABI who also score above clinical threshold for depression. The study confirmed that the values-based approach can be effectively delivered across an average of six 45-minute sessions in this group, with the intervention found to be accessible and acceptable by all participants. This is evidenced by formal feedback on a survey assessing client

satisfaction in addition to the fact that no sessions were declined. It is supported by the wider literature, with Soo et al. (2011) suggesting that using only the behavioural component of ACT reduces the cognitive demand placed on individuals and arguing that the cognitive components of ACT (e.g., cognitive defusion) are less suitable for ABI groups due to the presence of cognitive impairments.

Notably, the conclusions drawn by the study are tentative due mostly to the small sample size and the study being underpowered. Further research is therefore planned in order to provide additional information around treatment response in this group. As the evidence-base for a standalone values-based therapy increases, it would be beneficial to routinely offer this to patients undergoing neurorehabilitation, particularly given the short-term nature of the intervention and the favourable outcomes achieved in this context thus far. Moreover, as neurorehabilitation is heavily focused on goal attainment, with rehabilitation goals frequently informing important decisions such as admission lengths and continued funding, the research intervention could inform goal setting procedures within this setting. That is, services could incorporate an individual's values in their rehabilitation goals. In discussions with other inpatient services, a number of sites have expressed an interest in this, in addition to a desire to incorporate values-based work more broadly into everyday rehabilitation.

It is intended that the project will have further influence across a range of services, including community settings and the charitable sector. Given the promising findings for values-based approaches within inpatient neurorehabilitation, it is hoped that it will encourage further research to explore how the intervention can be utilised post-discharge. Focusing on an individual's values at this time could help them to

reintegrate into the community, adjust to life outside of a hospital setting and make important decisions about their future (e.g., returning to employment, living circumstances, and so on). Dissemination is likely to support this aim, raising awareness of how services can better support individuals by holding their personal values in mind at all stages of the available treatment pathways.

Carrying out this project positively impacted me on both a professional and personal level. Although conducting the therapy sessions was originally a daunting experience, I was well supported by my academic supervisor who provided invaluable guidance in applying the intervention in practice, strengthening my theory-practice links, and increasing my confidence in my clinical abilities. Working on placement at the recruitment site and managing the competing demands of my clinical work and research sessions was a challenging yet rewarding experience. Having direct involvement with patients meant that I witnessed first-hand the positive impact of focusing more on what was truly important and made the project feel extremely meaningful. This was particularly true in the context of COVID-19 when many individuals were severely restricted and unable to access these things in the way they would have previously. Overall, this project has informed my practice in a wider sense. I have begun to incorporate patients' values into my formulations, advocating for an individual's values to be considered in treatment planning, team meetings and joint sessions with other health professionals. I will continue to use values-informed philosophies in my work going forward, evidenced by a recent values-based group I developed, under supervision, for caregivers of individuals with learning disabilities. Keeping a client's personal values in mind has helped me to ensure that my practice remains person-centred, making me a more thoughtful and ethical clinician.

Dissemination

Research Community

In order to disseminate the thesis findings to the research community, the ES is due to be presented at the Association for Contextual Behavioural Science (ACBS) world conference in June 2021. Presentation at further relevant conferences such as the British Psychological Society (BPS) Division of Neuropsychology Annual Conference may also be possible. In addition to this, I hope to submit findings to a wider audience through publication in peer-reviewed journals. Possible journals include:

- The Archives of Clinical Neuropsychology
- Neuropsychological Rehabilitation; An International Journal
- The Neuropsychologist (The British Psychological Society)
- Behaviour Research and Therapy
- The Journal of Contextual Behavioural Science

Clinical Community

Aside from conference presentations and journal publication, clinicians at the recruitment site will be provided with a summary of the research findings and their key clinical implications. This will be offered in the form of a poster that can be distributed to the wider team, as well as a presentation that can be delivered to the psychology team during their weekly team meeting. From my discussions with various team members, the key areas of interest were: (1) the importance of incorporating a client's values into their neurorehabilitation goals, embedding them into the goal-setting procedures within the hospital. This is especially important as currently goals

are often primarily informed by commissioning requirements, clinical opinions, and staff expertise; (2) the suitability of SCED within ABI. This allows researchers to gather an in depth understanding about treatment response in heterogenous populations whilst maintaining increased experimental control; (3) the challenges faced when conducting research within neurorehabilitation; and (4) how this project may be progressed, for example, by examining the impact of the intervention in community settings or with caregivers of individuals with an ABI.

Service Users

All participants have been offered a summary of their research findings and expressed an interest in receiving this. Results will be presented to participants at a level appropriate to their cognitive abilities. Discussions with each individual informed me on how best I can achieve this, with suggestions including the use of visual representations of data (e.g., graphs), simplified language, less detailed statistical information, and the inclusion of the practical implications of findings. The lay summary (see Chapter 1) can also be disseminated more widely, for instance in hospitals and charitable organisations (e.g., Headway).

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Appendices

Appendix 1: Ethical approval from NHS Health Research Authority.

[EXT] RE: IRAS Project ID 242925. HRA Approval for the Amendment General

From: sheffield.rec@hra.nhs.uk <noreply@harp.org.uk>
Sent: 01 June 2020 16:57
To: Lock, Annette <Annette.Lock@rhul.ac.uk>; Andrews, Rebecca (2018) <Rebecca.Andrews.2018@live.rhul.ac.uk>
Cc: Sharma, Serena (2009) <Serena.Sharma.2009@live.rhul.ac.uk>
Subject: IRAS Project ID 242925. HRA Approval for the Amendment

Dear Miss Andrews,

IRAS Project ID:	242925
Short Study Title:	A value-based intervention for clients with acquired brain injury
Amendment No./Sponsor Ref:	Amendment 1
Amendment Date:	04 March 2020
Amendment Type:	Substantial Non-CTIMP

I am pleased to confirm **HRA and HCRW Approval** for the above referenced amendment.
You should implement this amendment at NHS organisations in England and Wales, in line with the conditions outlined in your categorisation email.

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website: http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance/.

Please contact [amendments@hra.nhs.uk]amendments@hra.nhs.uk for any queries relating to the assessment of this amendment.

Kind regards

Miss Nicole Curtis
Approvals Specialist
Health Research Authority

Appendix 2: Ethical approval from Royal Holloway University of London.

Ethics Review Details

You have chosen to self certify your project.	
Name:	Andrews, Rebecca (2018)
Email:	NFJT002@live.rhul.ac.uk
Title of research project or grant:	An imagery-enhanced, values-based intervention for neurorehabilitation inpatients with an acquired brain injury (ABI) and symptoms of depression.
Project type:	Royal Holloway postgraduate research project/grant
Department:	Psychology
Funding Body Category:	No external funder
Funding Body:	
Start date:	01/06/2020
End date:	01/08/2021

Research question summary:

The study aims to recruit six individuals with an acquired brain injury (ABI) who are undergoing neurorehabilitation at one of two London hospitals: Royal Hospital for Neurodisability (RHN) and The Wolfson at St Georges. All participants will be over the age of 18 and experiencing symptoms of depression, and will not be of high risk (i.e. they will not present with suicidal intent or substance misuse). Participants will partake in a values-based intervention, which aims to increase their engagement in activities that are personally meaningful to them. Elements of imagery will be included in the intervention, whereby participants will be guided in imagining themselves completing the values-based activities identified. Measures of psychological distress and values-based behaviour will be completed daily during the baseline period of 2, 3 or 4 weeks and the intervention stage (consisting of 5-7 sessions). Throughout the study participants will also be assessed using standardised measures of mood, quality of life, adjustment, future thinking and behaviour. These standardised measures will continue to be used over a 4-week follow up period. Data will be analysed by comparing participant's scores on each measure to their scores at earlier time points.

Research method summary:

A SCED will be used in the form of a randomised MBD. The design will be A1BA2. A1 represents the baseline phase whereby randomly selected baselines of either 2, 3 or 4 weeks will be selected for each participant. Phase B will be the intervention phase comprising 5-7 sessions of the research therapy. Phase A2 will be a two-week follow-up period used to monitor outcomes post-intervention.

Risks to participants

Does your research involve any of the below?

Children (under the age of 16),

No

Participants with cognitive or physical impairment that may render them unable to give informed consent,

No

Participants who may be vulnerable for personal, emotional, psychological or other reasons,

Yes

Participants who may become vulnerable as a result of the conduct of the study (e.g. because it raises sensitive issues) or as a result of what is revealed in the study (e.g. criminal behaviour, or behaviour which is culturally or socially questionable),

Yes

Participants in unequal power relations (e.g. groups that you teach or work with, in which participants may feel coerced or unable to withdraw),

No

Participants who are likely to suffer negative consequences if identified (e.g. professional censure, exposure to stigma or abuse, damage to professional or social standing),
No

Details,
Thinking about values could be distressing for clients given potential changed circumstances, feelings of regret, thoughts about loss and fears of the unknown. If a participant becomes distressed they will be invited to take a break, and reminded that they are free to withdraw from the study at any time. The Chief Investigator (CI) is taught how to contain these uncomfortable feelings for clients as part of her doctoral training. The CI, under supervision, will manage psychological distress and monitor risk in addition to the Psychology team and rehabilitation team as per usual practice. Clients will also be encouraged to speak to their Psychology team if they are feeling low or experiencing any difficult emotions. The Consultants and rehabilitation teams will be informed about the study in advance. The CI will be receiving her own supervision during which she can talk about any feelings that have been brought up for her during this work.
The CI is trained in monitoring risk. As part of the inclusion criteria, 'low risk' clients will be recruited to the study, that is, they will have no intent to harm themselves or others. During the study their risk will be monitored by the CI and their rehabilitation team as per usual practice. The participant's team have the overall responsibility for managing risk, and the CI will communicate any possible changes in risk to them. Any unexpected disclosure of information from participants which poses harm to themselves or others will be communicated to the rehabilitation team.

Design and Data

Does your study include any of the following?

Will it be necessary for participants to take part in the study without their knowledge and/or informed consent at the time?,
No

Is there a risk that participants may be or become identifiable?,
No

Is pain or discomfort likely to result from the study?,
No

Could the study induce psychological stress or anxiety, or cause harm or negative consequences beyond the risks encountered in normal life?,
No

Does this research require approval from the NHS?,
Yes

If so what is the NHS Approval number,
IRAS Project ID 242925

Are drugs, placebos or other substances to be administered to the study participants, or will the study involve invasive, intrusive or potentially harmful procedures of any kind?,
No

Will human tissue including blood, saliva, urine, faeces, sperm or eggs be collected or used in the project?,
No

Will the research involve the use of administrative or secure data that requires permission from the appropriate authorities before use?,
No

Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?,
No

Is there a risk that any of the material, data, or outcomes to be used in this study has been derived from ethically-unsound procedures?,
No

Details,

Risks to the Environment / Society

Will the conduct of the research pose risks to the environment, site, society, or artifacts?,
No

Will the research be undertaken on private or government property without permission?,
No

Will geological or sedimentological samples be removed without permission?,
No

Will cultural or archaeological artifacts be removed without permission?,
No

Details,

Risks to Researchers/Institution

Does your research present any of the following risks to researchers or to the institution?

Is there a possibility that the researcher could be placed in a vulnerable situation either emotionally or physically (e.g. by being alone with vulnerable, or potentially aggressive participants, by entering an unsafe environment, or by working in countries in which there is unrest)?,
No

Is the topic of the research sensitive or controversial such that the researcher could be ethically or legally compromised (e.g. as a result of disclosures made during the research)?,
No

Will the research involve the investigation or observation of illegal practices, or the participation in illegal practices?,
No

Could any aspects of the research mean that the University has failed in its duty to care for researchers, participants, or the environment / society?,
No

Is there any reputational risk concerning the source of your funding?,
No

Is there any other ethical issue that may arise during the conduct of this study that could bring the institution into disrepute?,

No

Details,

Declaration

By submitting this form, I declare that the questions above have been answered truthfully and to the best of my knowledge and belief, and that I take full responsibility for these responses. I undertake to observe ethical principles throughout the research project and to report any changes that affect the ethics of the project to the University Research Ethics Committee for review.

Certificate produced for user ID, NFJT002

Date:	28/05/2021 20:05
Signed by:	Andrews, Rebecca (2018)
Digital Signature:	Rebecca Andrews
Certificate dated:	28/05/2021
Files uploaded:	Full-Review-2379-2020-10-29-11-05-NFJT002.pdf Full-Review-2379-2021-05-28-20-38-NFJT002.pdf Full-Review-2379-2021-05-28-20-50-.pdf Full-Review-2379-2021-05-28-20-52-.pdf Full-Review-2379-2021-05-28-20-53-.pdf

Appendix 3: Participant information sheet.

PARTICIPANT INFORMATION SHEET

A values-based intervention for clients with acquired brain injury (ABI) within inpatient neurorehabilitation

We invite you to take part in a research study.

Yes

No

- *Taking part is entirely up to you*
- *Before you decide, it is important for you to understand why the project is being done and what it will involve for you*
- *Together, we will go through this information sheet. This may take around 25 minutes*

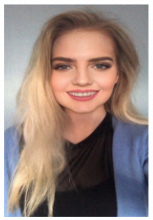
You can ask me questions at any point

- *You do not have to decide today. Please feel free to talk to others about the study if you wish*

IRAS Project ID: 242925
Version 2.7 Date 20/03/20

Research Team:

Chief investigator:
Rebecca Andrews (Trainee Clinical Psychologist at Royal Holloway University of London and therapist in this project)



Serena Sharma (Clinical Psychologist at Royal Hospital for Neuro-Disability and therapist in this project)

Supervisors:

1) **Dr Jessica Kingston** (Course Tutor at Royal Holloway University of London)

2) **Dr Richard Irwin** (Clinical Psychologist at Royal Hospital for Neuro-Disability, Putney)

3) **Dr Luke Goodliffe** (Clinical Neuropsychologist at Queen Mary's Hospital)

Photo

This study is part of a Doctorate of Clinical Psychology project, funded by Royal Holloway University of London and the Association of Contextual Behavioural Therapy.

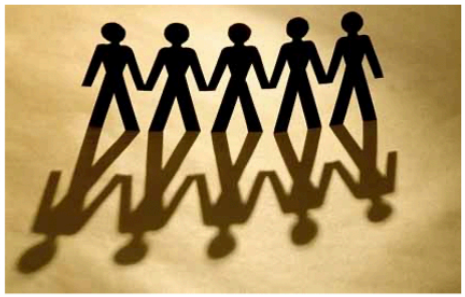
It is expected to begin in April 2020 and end in May 2021.

IRAS Project ID: 242925
Version 2.7 Date 20/03/20

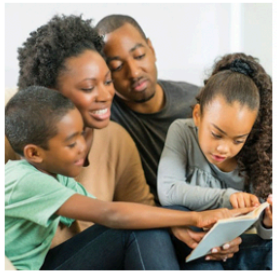
What is the research about?

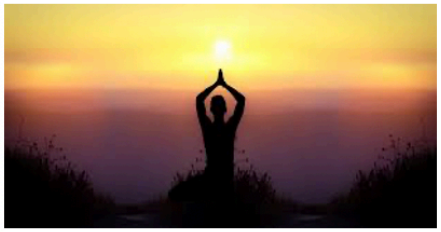
After a brain injury, you may be experiencing a change in your physical and/or mental functioning. This change might feel like it will stop you from doing some of the things that used to be important to you.

Focusing on your **values** can help to cope with this change. Our values are the things in life that are important to us. They give our lives meaning and purpose, and we can use these as a guide when choosing how to live our lives.
For example, you might want to live in a way that makes you feel connected with the important people in your life.



This study invites you to take part in a value-based therapy. The therapy focuses on your values and helping you to do things that are meaningful and important to you.





The activities you choose will be adapted to suit your needs, so that the physical/mental changes you are experiencing do not get in the way.

We already know that a value-based therapy has been helpful for many people with a range of difficulties. We want to see if it is also helpful for adults who have experienced brain injury. We will look at whether it will help your mood, quality of life, adjustment to your brain injury and your thoughts about the future.

Why have you picked me?

- You are able to understand what people are saying to you and communicate your thoughts and ideas back

- You are over the age of 18
- You have good English ability
- You would like some more help adjusting to your brain injury

What will I be doing?

START OF STUDY:

You will be given **4 questionnaires** (each could take 5-10 minutes) on your mood, quality of life, thoughts about the future and how you are adjusting to your brain injury.

You will also be given **shorter scales** which measure things like your values and how you are feeling. These are for daily use and are personalised to you.

THE FIRST 2-4 WEEKS:

You will be waiting for either 2, 3 or 4 weeks to start the values-based therapy. At the end of this period you will complete the same **4 questionnaires** (2nd time).

Values-based Therapy

You will have approximately 6 one-to-one therapy sessions with Rebecca Andrews or Serena Sharma (see page 2). Each session will be 30-60 minutes long and once or twice a week depending on your needs.

You will spend time talking about what you value – what is important and meaningful to you – and the therapist will help you to set goals that are in line with these values. For example, if your values include being caring and helpful, you will set goals around supporting others.

AFTER THE THERAPY:

As soon as you have finished, you will again complete the **4 questionnaires** (3rd time), and once more two weeks later (4th time). We will also ask you about your experiences of the values-based sessions.

Someone will always be available to support you should you need any assistance with any of the questionnaires. This could be a member of the research team, your psychology team, or another member of your rehabilitation team.

How many other participants will there be?

There will be around 6 of you taking part, from either Royal Hospital for Neuro-disability (RHN) in Putney, Queen Mary's Hospital (QMH) in Roehampton or St George's Hospital in Tooting.

What's in it for me?

We hope that that the values-based intervention will help you to think about and do the things that are important to you.

Since it is an additional part of your neurorehabilitation, you will be receiving an extra therapy without missing out on the intervention you receive as usual.

What are the disadvantages?

Taking part will require your time and effort. You will be attending a weekly values-based therapy sessions and completing questionnaires.

You may also have to put in some time and effort outside of these sessions, for example, thinking about your values, setting goals, and completing those goals.

The work may require you to think about what was meaningful before your brain injury, what is meaningful now, and what may be meaningful to you in the future. Doing so can be upsetting. The therapist will provide you with emotional support in the sessions. Outside of sessions, you can speak to a member of the Psychology team by approaching them directly or alerting a member of the ward staff. Your rehabilitation team will also continue to support you as usual and your 24/7 ward staff.

Will taking part in the study intervention affect the rest of my rehabilitation?

Your rehabilitation will take place as usual. The values-based therapy is an addition to your usual rehabilitation rather than a replacement.

However, if you are part of the 'Adjustment group' **(Queen Mary's Hospital only)**, we request that receiving sessions 5 and 6 of 'Adjustment Group' is delayed until after the study's values-based therapy has been completed. This is because sessions 5 and 6 involve values-based work, similar to the study intervention, Completing these at the same time as the study intervention could be confusing and could also make the results of the study less reliable.

What if I start, but want to stop later?

You can stop at any time. You do not have to tell us why.

Who will know that I am taking part?

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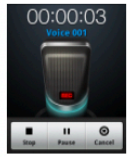
We will tell your Consultant and rehabilitation team that you are taking part in the study. The content of the sessions will not be shared with them unless there is a risk to you or anyone else at any point.

How will my data be protected?

As the study's sponsor, Royal Holloway University of London is responsible for looking after your information and using it properly at all times. Royal Holloway needs to manage your information in specific ways in order for the research to be reliable and accurate.

Any personal data such as your name and age will be stored safely in a secure electronic file at your hospital site. Only your therapist and Psychology Lead will be able to access this. It will be destroyed as soon as it is no longer needed and kept a maximum of 3 months after the study ends.

Research data (the questionnaires you complete) and your Consent form will be stored securely at Royal Holloway University of London for 5 years until 2026. Your research data will not have your name or any information that identifies you on it, so will be **completely anonymous.** Since your Consent form will have your name on it, it will be stored separately from the research data so that the documents cannot be linked.



To check that the therapist is following the therapy guidelines, sessions may be audio recorded. These recordings could be stored for up to 5 years at Royal Holloway University of London for audit purposes. These will be stored securely, labelled only by your anonymous code rather than your name or any other identifiable details.

If you withdraw from the study, we will make sure that the information kept about you is as minimally identifiable as possible.

You can find out more about how we use your information at:
https://www.hra.nhs.uk/information-about-patients/
and/or

https://understandingpatientdata.org.uk/what-you-need-know

You can also contact Dr Jessica Kingston (Research Supervisor) at Royal Holloway University of London on 01784 276533 if you have any questions.

What happens after?

Research data will be analysed and typed into a report as part of a Clinical Psychology Doctorate programme. The report will include information relating to your therapy, and any relevant details about your brain injury and rehabilitation. All information will be anonymous, so nobody will be able to identify you from this information. Even if the study is published, people will not know that the information is about you.

If you are interested, you can request to see a summary of the results, or to have the results explained to you.

Is this everything I need to know?

This is all of the important information. If you have any questions, please ask!

If new information about the study emerges at any time we will let you know immediately.

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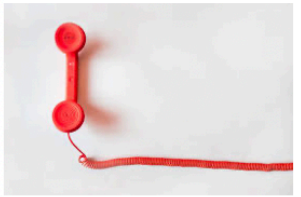
Version 2.7 Date 20/03/20

Who can I contact if I have more questions after this?

Please contact **Rebecca Andrews** on **01784 414012**.

You can also speak to **Dr Richard Irwin** if you are at RHN, or **Dr Luke Goodliffe** if you are at St George's.



What if I have concerns or want to make a complaint about the study?

There are many ways you can complain:

1) You can speak to somebody in your Psychology team, or to the ward manager

2) **If you are at Queen Mary's Hospital or St Georges Hospital:** You can complain to PALS (Patient Advice and Liaison Service). The number for PALS at Queen Mary's Hospital is 020 8308 5449 and the number for PALS at St George's Hospital is 020 8725 2453.

If you are at Royal Hospital for Neuro-disability: You can complain by calling 020 8780 4500 ext 5264 or by emailing agoodair@rhn.org.uk.

3) You can speak to Dr Jess Kingston at Royal Holloway by calling 01784 276533.

Thank you for taking the time to read this.

Please keep a copy for your records, along with the consent form.

Appendix 4: Participant consent form.

RESEARCH CONSENT FORM

A values-based intervention for clients with acquired brain injury (ABI) within inpatient neurorehabilitation

Research team:

Chief Investigator: **Rebecca Andrews** (Trainee Clinical Psychologist)

Supervisors: 1) **Dr Jessica Kingston** 2) **Dr Richard Irwin** **Dr Luke Goodliffe**

This study is part of a Doctorate of Clinical Psychology project at Royal Holloway University of London.

The participant should complete this form him/herself. If unable to write, a member of staff should complete the form under instruction from the participant, in the presence of a witness.

PLEASE INITIAL BOX:

1. I have read and understood the Information sheet (version 2.7, dated 20/03/20) for the above study. ☐
2. I have had the opportunity to consider the information and ask questions. ☐
3. My questions have been answered fully to my satisfaction. ☐
4. I understand that my participation is voluntary and that I can leave the study at any time without giving a reason. This will not affect my rehabilitation. The information kept about me will be as minimally identifiable as possible. ☐
5. I understand that information collected about me will be kept confidential. ☐
6. I understand that my anonymised data will be kept securely by Royal Holloway University of London for up to five years after the study has ended. ☐
7. I understand that my sessions will be audio recorded to check that my therapist is following the guidelines. ☐

PLEASE INITIAL BOX:

8. I understand that the information collected about me may be used to support other research in the future and may be published. ☐
9. I understand that my words may be anonymously quoted in publications. ☐
10. My rehabilitation team will be informed about the study. ☐
11. I would like to be given a link to view a summary of the results once the study is complete. ☐

PLEASE INITIAL BOX:

I agree to take part in the above study. ☐

Name of Participant	Date	Signature
Name of Researcher	Date	Signature
Name of Witness (if applicable)	Date	Signature

Please keep a signed copy of this for your records, along with the Information sheet.

Appendix 5: Visual Analogue Scales (VAS) used for all participants.

Visual Analogue Scales (from 'ACT Daily Scales') on Association for Contextual Behavioural Science website https://contextualscience.org/

Date:

Time:

Meaningful living

Has what you have done in the past 24 hours felt meaningful and important to you?

Not at all ☹	0
	1
	2
	3
	4
	5
	6
	7
	8
	9
Very much so ☺	10

Visual Analogue Scales (from 'ACT Daily Scales') on Association for Contextual Behavioural Science website https://contextualscience.org/

Psychological distress

How down, depressed or hopeless have you been feeling in the last 24 hours?

Not at all ☺	0
	1
	2
	3
	4
	5
	6
	7
	8
	9
Extreme amount ☹	10

Appendix 6: Quality of Life after Brain Injury (QOLIBRI; von Steinbüchel et al., 2010). Part B and E used.

QOLIBRI - QUALITY OF LIFE AFTER BRAIN INJURY

In the first part of this questionnaire we would like to know **how satisfied** you are with different aspects of your life since your brain injury. For each question please choose the answer which is closest to how you feel now (including the past week) and mark the box with an "X". If you have problems filling out the questionnaire, please ask for help.

PART 1

A. These questions are about your thinking abilities now (including the past week).

	Not at all	Slightly	Moderately	Quite	Very
1. How satisfied are you with your ability to concentrate, for example when reading or keeping track of a conversation?					
2. How satisfied are you with your ability to express yourself and understand others in a conversation?					
3. How satisfied are you with your ability to remember everyday things, for example where you have put things?					
4. How satisfied are you with your ability to plan and work out solutions to everyday practical problems, for example what to do when you lose your keys?					
5. How satisfied are you with your ability to make decisions?					
6. How satisfied are you with your ability to find your way around?					
7. How satisfied are you with your speed of thinking?					

B. These questions are about your emotions and view of yourself now (including the past week).

	Not at all	Slightly	Moderately	Quite	Very
1. How satisfied are you with your level of energy?					
2. How satisfied are you with your level of motivation to do things?					
3. How satisfied are you with your self-esteem, how valuable you feel?					
4. How satisfied are you with the way you look?					
5. How satisfied are you with what you have achieved since your brain injury?					
6. How satisfied are you with the way you perceive yourself?					
7. How satisfied are you with the way you see your future?					

C. These questions are about your independence and how you function in daily life now (including the past week).

	Not at all	Slightly	Moderately	Quite	Very
1. How satisfied are you with the extent of your independence from others?					
2. How satisfied are you with your ability to get out and about?					
3. How satisfied are you with your ability to carry out domestic activities, for example cooking or repairing things?					
4. How satisfied are you with your ability to run your personal finances?					
5. How satisfied are you with your participation in work or education?					
6. How satisfied are you with your participation in social and leisure activities, for example sports, hobbies, parties?					
7. How satisfied are you with the extent to which you are in charge of your own life?					

D. These questions are about your social relationships now (including the past week)

	Not at all	Slightly	Moderately	Quite	Very
1. How satisfied are you with your ability to feel affection towards others, for example your partner, family, friends?					
2. How satisfied are you with your relationships with members of your family?					
3. How satisfied are you with your relationships with your friends?					
4. How satisfied are you with your relationship with a partner or with not having a partner?					
5. How satisfied are you with your sex life?					
6. How satisfied are you with the attitudes of other people towards you?					

PART 2

In the second part we would like to know **how bothered** you feel by different problems. For each question please choose the answer which is closest to how you feel now (including the past week) and mark the box with an "X". If you have problems filling out the questionnaire, please ask for help.

E. These questions are about how bothered you are by your feelings now (including the past week).

	Not at all	Slightly	Moderately	Quite	Very
1. How bothered are you by feeling lonely, even when you are with other people?					
2. How bothered are you by feeling bored?					
3. How bothered are you by feeling anxious?					
4. How bothered are you by feeling sad or depressed?					
5. How bothered are you by feeling angry or aggressive?					

F. These questions are about how bothered you are by physical problems now (including the past week).

	Not at all	Slightly	Moderately	Quite	Very
1. How bothered are you by slowness and/or clumsiness of movement?					
2. How bothered are you by effects of any other injuries you sustained at the same time as your brain injury?					
3. How bothered are you by pain, including headaches?					
4. How bothered are you by problems with seeing or hearing?					
5. Overall, how bothered are you by the effects of your brain injury?					

Appendix 7: Reactions to Impairment and Disability Inventory (RIDI; Livneh & Antonak, 1990). Adjustment subscale used.

Reactions to Impairment and Disability Inventory

Following is a list of possible reactions to the occurrence of an impairment or disabling condition. Please circle the appropriate number beneath each statement that indicates to what extent you are experiencing each specific reaction to your impairment or disability. There are no "right" or "wrong" answers. The degree to which you truly experience each reaction, as expressed by the statements, should be your answer. Please respond to all statements on the inventory as honestly as possible.

1 = **Never** Reaction is never experienced
2 = **Rarely** Reaction is seldom experienced, 1 to 4 times per month
3 = **Sometimes** Reaction is occasionally experienced, 5 to 9 times per month
4 = **Often** Reaction is frequently experienced, 10 or more times per month

Adjustment Scale:

1. I am satisfied with my present abilities despite my disability.
   1 2 3 4

2. There are more important things in life than those that my impairment prevents me from doing.
   1 2 3 4

3. Although I am restricted in certain ways, there is still much I am able to do.
   1 2 3 4

4. When I look in the mirror, I see myself and not a disability.
   1 2 3 4

5. Everything in my life is coming together again.
   1 2 3 4

6. I realize that my impairment is part of me, but I do not let it interfere with my life.
   1 2 3 4

7. Despite my impairment, I can do most things non-impaired people can do.
   1 2 3 4

8. I can cope with almost all problems I face.
   1 2 3 4

Appendix 8: Future Fluency Task (FFT; MacLeod et al., 1997).

Future-thinking Task

Overview

The task was devised to assess positive thinking and negative thinking about the future. It is an adaptation of a standard verbal fluency task where subjects are given three letters of the alphabet and asked to think of as many words as they can beginning with each letter. In the Future-thinking Task (FTT), subjects are cued with three future time periods ("the next week", "the next year", and "the next five to ten years") and asked in turn to think of positive things and negative things that might occur within each time period. As in the standard verbal fluency task, subjects are given a set time in each condition to generate as many responses as they can. In the present version of the task, subjects are also re-presented with their responses and asked to rate each one on how likely it is to happen and, if it did happen, how positive or negative they would feel. The overall score can then represent the amount, likelihood, and emotional value of positive and negative future thinking.

Administration

Because the task elicits subjects' spontaneous thoughts it is important that it is given as early as possible in any session before such thoughts might have been prompted or primed by questionnaires or interviewing.

Control task (FAS)

The FTT is preceded by the standard verbal fluency task (FAS). This task assesses general levels of cognitive fluency and also gets subjects into the right mental set for doing the FTT (i.e., generating as many responses as they can think of within a set time).

Instructions for FAS:

"First I'd like you to think of as many words as you can beginning with a certain letter of the alphabet. I will ask you to do this for 3 different letters. You will have a minute in each case to think of as many words as you can beginning with that letter. Please say the words aloud and I will write them down. The words can be anything that comes to mind except that they shouldn't be proper names, that is names of people or places, or numbers or sequences involving the same basic word, for example, run, runner, running, and so on. I want you to give me as many words as you can beginning with the letter F".

(subjects are asked to do this for the letters F, A and S in that fixed order and given one minute to think of words for each of the letters). The Researcher writes down the words, or if the participant is going too fast to do this, just indicates on the scoring sheet that a valid respone was given.

Future-thinking Task (FTT)

Following completion of the FAS, subjects are given the FTT. Subjects are given three future time periods (the next week, the next year, the next five to ten years) and asked to try to think of positive things (things they are looking forward to) and negative things (things they are not looking forward to) for each of those time periods.

Instructions for FTT:

"Now I'd like to ask you to think about things that might happen to you in the future. I will give you 3 different time periods in the future, one at a time, and I'd like you to try to think of things that might happen to you in those time periods. Like before, I will give you a minute to try to think of as many things as you can. It doesn't matter whether the things are trivial or important, just say what comes to mind. But, they should be things that you think will definitely happen or are at least quite likely to happen. If you can't think of anything or if you can't think of many things, that's fine, but just keep trying until the time limit is up.

First I'm going to ask you to think of positive things in the future. So, I'd like you to try to think of things that you are looking forward to, in other words, things that you will enjoy. So, I want you to give me as many things as you can that you're looking forward to over the next week including today".

(R gives one minute and writes down as close to verbatim as time allows what subject says)

Now, I'd like you to do the same but this time I want you to give me things that you're looking forward to over the next week.

(R does same as for one week)

Now, I'd like you to do the same but this time I want you to give me things that you're looking forward to over the next five to ten years.

(R does same as for previous)

"Now, I'd like you to think of things that you're worried about or not looking forward to, in other words, things that you would rather not be the case or rather not happen. So, I want you to give me as many things as you can that you're worried about or not looking forward to over the next week including today".

(R does same as for previous)

"Now I want you to give me as many things as you can that you're worried about or not looking forward to over the next year"

(R does same as for previous)

Finally, I want you to give me as many things as you can that you're worried about or not looking forward to over the next five to ten years"

(R does same as for previous)

The order of presentation of negative and positive conditions should be counterbalanced across subjects, although within each condition the time periods are always presented in the same order (week, year, 5-10 years).

If subject says during the thinking time that they can't think of anything or, for example, that there is nothing that they are looking forward to over the next week, say "*that's OK, but just keep trying to think until I tell you to stop*".

Scoring sheets are given on the following two pages.

FAS

F

A

S

FUTURE POSITIVE

The next week

The next year

The next 5-10 years

FUTURE NEGATIVE

The next week

The next year

The next 5-10 years

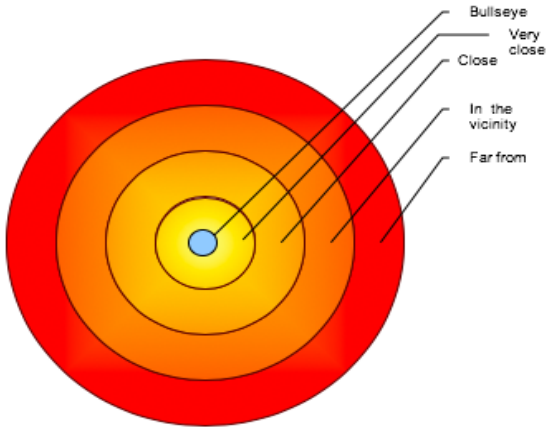
Appendix 9: Bullseye Values Survey (BEVS; Lundgren, Luoma, Dahl, Strosahl & Melin, 2012).

Value 1

The first value that I really want to be living is:

This value is important to me because:

How close was I to totally living this value in the last two weeks? Place an X:



Actions that moved me *towards* the bull's eye over these two weeks were:

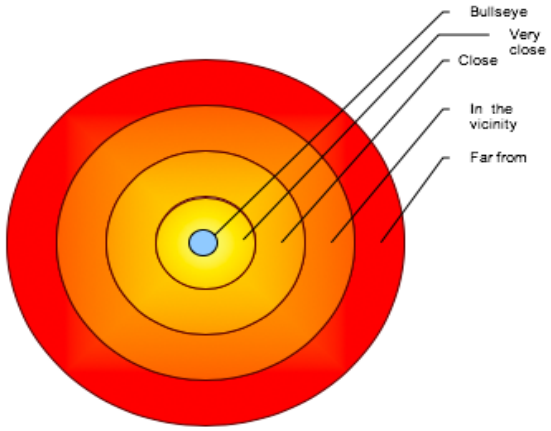
Actions that moved me *away* from the bull's eye over these two weeks were:

Value 2

The second value that I really want to be living is:

This value is important to me because:

How close was I to totally living this value in the last two weeks? Place an X:



Actions that moved me *towards* the bull's eye over these two weeks were:

Actions that moved me *away* from the bull's eye over these two weeks were:

Appendix 10: Client Satisfaction Questionnaire (CSQ; Larsen, Attkisson, Hargreaves & Nguyen, 1979).

TABLE 4

THE CLIENT SATISFACTION QUESTIONNAIRE (CSQ)

Please help us improve our program by answering some questions about the services you have received at the _____. We are interested in your honest opinions, whether they are positive or negative. *Please answer all of the questions.* We also welcome your comments and suggestions. Thank you very much, we appreciate your help.

CIRCLE YOUR ANSWER

1 How would you rate the quality of service you received?

4	3	2	1
Excellent	Good	Fair	Poor

2 Did you get the kind of service you wanted?

1	2	3	4
No, definitely not	No, not really	Yes, generally	Yes, definitely

*3 To what extent has our program met your needs?

4	3	2	1
Almost all of my needs have been met	Most of my needs have been met	Only a few of my needs have been met	None of my needs have been met

4 If a friend were in need of similar help, would you recommend our program to him/her?

1	2	3	4
No, definitely not	No, I don't think so	Yes, I think so	Yes, definitely

5 How satisfied are you with the amount of help you received?

1	2	3	4
Quite dissatisfied	Indifferent or mildly dissatisfied	Mostly satisfied	Very satisfied

6 Have the services you received helped you to deal more effectively with your problems?

4	3	2	1
Yes, they helped a great deal	Yes, they helped somewhat	No, they really didn't help	No, they seemed to make things worse

*7 In an overall, general sense, how satisfied are you with the service you received?

4	3	2	1
Very satisfied	Mostly satisfied	Indifferent or mildly dissatisfied	Quite dissatisfied

*8 If you were to seek help again, would you come back to our program?

1	2	3	4
No, definitely not	No, I don't think so	Yes, I think so	Yes, definitely

WRITE COMMENTS BELOW

Appendix 11: Full therapy protocol.

Values-based Intervention Protocol

Serena Sharma & Dr Jessica Kingston

Introductions

- Introduce self and role, confidentiality and risk
- Remind why we are meeting. Do they know why? Recap on main parts of study
- Difference between values-based goals and rehabilitation goals:

You might find yourself having lots of goals during your time in rehab as goal-setting is a big part of rehab. The types of goals we will be thinking about together are different. Our goals will be based on the things that mattered to you before your brain injury and will continue to matter to you now and in the future. They are goals related more generally to our life, rather than specifically to your rehabilitation. However, there may be an overlap between these goals and your rehabilitation goals, and research shows that the type of goals we will work on can help you during the rehabilitation process.

Ask client to summarise understanding so far.

- Toolbox analogy: *You will be learning a process that you can take away from here and carry on using independently. This learning will be like a tool that you own, that you can use to protect yourself from what life throws at you and strengthen your resilience.*

Phase 1: Introducing and identifying values (1-2 sessions)

- Introduce idea of values
  - What are values? Explain to client and check understanding - include below explanations:

very personal, freely chosen (what you choose, not what your partner or parents would choose), life directions (they guide what we do in our day-to-day life), what you want to live by, the things that matter to you deep down, the things that still matter even if no one knew about them, everybody has them; what you want to stand for in life, even in the face of difficulty; how you would want to be described by others.

Give examples of possible values, e.g.:

being loving, being adventurous, guiding others, contributing to the community, learning, being independent, being fair, being connected with others

'Can you think of any others?'

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Find a celebrity or well-known person likely to be known by your client (e.g. Trump, Beyonce, sports player) and give examples of possible values (e.g. power, female power, teaching, entertaining). **Can use Appendix E for assistance 'Who do you admire?' task**

Provide rationale to engage client in the process: *Spending time thinking about **your own** values can be really helpful for mood and quality of life, as shown by research. Values-based work can support the recovery process and make life more meaningful.*

Would it be ok for us to spend the rest of this session thinking about your values? (When we've worked out your top values we will help you to have more of that value in your day-to-day life).

You might not have done this before so it might feel unusual, but we can use these cards to guide us. We can do this together and see if thinking about values becomes a bit clearer.

Values cards exercise:

Each card has a value written on it, and a description below, but I will also talk through them with you. There will be some cards that don't mean much to you, and then some that you see as very important. We will sort them into piles according to this.

1. *Sort into piles of Very Important, Important and Less important*
2. *Pick 1-2 values from Very Important pile*

Prompting questions during card task:

Would you want your life to be about that?

Would you want this to be a value we work on together over the next few weeks?

Even if you don't feel you are doing much of this right now, is it still important to you?

Is this something you would like to develop?

Consider these as alternatives if need more help in establishing values:

Prioritised option: 80th birthday speech metaphor (Appendix D) who are the important people in your life and what would you want them to say about you?

Option 2: Areas of importance before brain injury OR What has been the most meaningful moment in your life so far? (Appendix C)

- Help the client to engage in thinking about these values. *Can you think of two occasions when these values really mattered to you?* This can help clarify whether these seem to be values for them.

It's useful for us to ensure that these are the values that are important to *you. Would they still matter if nobody else knew about them? Or are these the values you think you should have?*

- *To what extent do you feel you are able to do things that are consistent with these / this values at the moment?* Ideally use Values bullseye (Appendix F and G). The chosen method can be used every session to track progress of value-based behaviour.

- Set homework (content depends on where client is at with identifying values)
  - *Think about your chosen 1-2 values over the week, and why they are really important to you. (It might help if you think of things you are doing, or want to be doing, that tie in with these values).*

Phase 2: Setting goals based on values (session 3-4)

- Introduction to phase and agenda. Review of homework. *Do you remember which values you chose? Why are they important to you? Any barriers to completing this?*

Now that we know which values to work on, we have the choice to work towards these to make our life more meaningful:

The Choice Point- Dr Russ Harris (Towards moves vs Away moves)

https://www.youtube.com/watch?v=tW6vWKVrmLc

Your value is not something you can reach, but you can always keep working in a direction towards it if this is your lifelong value (Show Appendix B). For example, if your value is friendliness, we will set a goal together to bring more of this into your life by talking about this value and setting goals that tie in with it. Imagine friendliness is at the top of the page here (Appendix B), and this is a direction you are heading towards through your goals. Friendliness will not be a value just for a week, it will be something you continue to have in mind and work towards, even after your goal is completed. Goals are like stepping stones leading you along a path of friendliness- when this goal is completed we can set a new one. A great thing about values, is that if you cannot complete one goal, you can set another one that works towards your value.

Only explain difference between goals and values if it feels important: How do values differ from goals? (Appendix B) Values are about how you want to behave now, and on an ongoing basis throughout life e.g. to keep learning; goals are short-term and to be attained or completed, and future-orientated e.g. to attain a degree. Emphasise overarching message of process over outcome/journey over destination.

Can emphasise that values-based goal setting is about the process, without time spent on difference between goals and values:

Hiking metaphor

This exercise introduces values as related to the experience of living. *"Imagine you are going to go on a 20-mile hike. You pack the things you need, dress for cold weather, and put on your hiking shoes. You hike for a few minutes, and then a man comes in a helicopter and asks you were you are going. You tell him your destination, and he delivers you there. How would you respond to that? You might protest that you were trying to go on a hike and he might say "but you got there faster this way, and you avoided the cold." You go hiking because you enjoy the process, not just to get to the end of the trail. Although we may have some goals in life, valuing is about the experience we get of a particular pursuit and part of the experience may involve some rough terrain or cold along the way. If we just took a helicopter to the end goals of our lives, we would miss a lot of living."*

OR

Kelly Wilson Garden metaphor- garden is never finished, always maintaining it.

- Focusing on one value, help the client to develop a small number (1-2) of short term goals that they aim to work on over the next week. Ideally use SMART goals structure (Appendix I).

  Alternatives:
  - Trying on a value metaphor (Appendix H)
  - Values cards: Envisaging obstacles; Setting goals; Breaking into smaller steps

- Help clients to consider - when, where, who will help, how will you remember, what obstacles might set you off track:

- How will I know if I carried out my goal? If you carried out your intention you carried out your goal, regardless of another person's response e.g. if your value is friendliness, you may not be received as friendly by someone is having a bad day, but if your intention was carried out then the goal was completed.
  Once you have completed a goal based on your value e.g. friendly, it does not mean that being friendly is ticked off the list. Being friendly presumably will continue to be your value, and you can continue to live in a way that is more friendly.

Imagery

Set up that you are about to do a short piece of imagining – I would include something like, imagery is a really useful way of increasing the chances that we follow through with out plans and meet our goals etc

- I would now like you to imagine yourself doing this activity that you have just been describing. If you feel comfortable, please shut your eyes as we do this. Please bring the scene to mind as vividly as possible. Please try to imagine the scene as if you were there now.
- Focus on what you are able to hear and feel. As vividly as you can. Imagine it is [DATE/TIME]. And you are at [PLACE/SITUATION/CONTEXT]. You have planned to [ACTIVITY]. Imagine yourself in this situation. Notice your surroundings at [PLACE/SITUATION/CONTEXT] that reminds you to engage in your planned activity. Take a second to focus vividly on that ___ [PAUSE]
- Now imagine that you are following your plan of [ACTIVITY]. Imagine the details, as if you are really doing it, what you can see … hear ... smell … feel … [PAUSE]
- If you would like, go back and imagine it one more time to get it really right and just how you would like the activity to be …. [PAUSE]
- Now focus on the part of your image that will help you most to be motivated to actually do [ACTIVITY]. Make it really vivid. As vivid and as real as you can. Well done. Try to remember this part. These are the aspects of your image I'd like you to be able to bring back to mind. Later. Mentally photograph this part of your image – take a snapshot image of the part that is most powerful/significant and that will most help to motivate you to actually do the activity. This is your ACTIVITY IMAGE. Remember that image.

  Assess Vividness: Using a 5-point scale ranging from *I cannot imagine the event at all* (1) to *the event is very detailed and vivid* (5) assess the vividness of the images they generated.

Phase 3: Identifying and addressing obstacles (session 5-6)

- Reminder of overarching message of process over outcome/journey over destination
- Review of week and values:

-How did thinking about your values make you feel?

-How did you feel at the time and how do you feel now?

-Were you able to work towards your goals? What was this like?

-If you were not able to work towards your goals, why do you think that was? (Use Appendix J)

- No such thing as a failed goal- if a goal is not attainable right now, find one that is, that will lead you in the right direction towards your value. Metaphor of road stops (Appendix B and K)
- Path up a mountain is not a straight line, it may curve (Appendix K)
- If goal was not reached – look for opportunities to find examples of valued-living even though the 'goal' hasn't been done. This can be as small as thinking about / being aware of the value during your week. Did you think about it? Did you have any other ideas about how you might move towards this value? Is another value more important? What got in the way? (Appendix L)
- If lacking in motivation, reflect on why this action is being done- what is meaningful about it; how much does it matter? Acting according to values not feelings. Garden metaphor (Appendix M).
- Making public commitment e.g. involving family/friends/staff (this can come at phase 2 for participants who wish to involve significant others early on)
- Identify intrinsic rewards
- Final session: summary and therapy blueprint. What was most helpful? Which of this will you continue doing? Will you need any support to continue doing this?

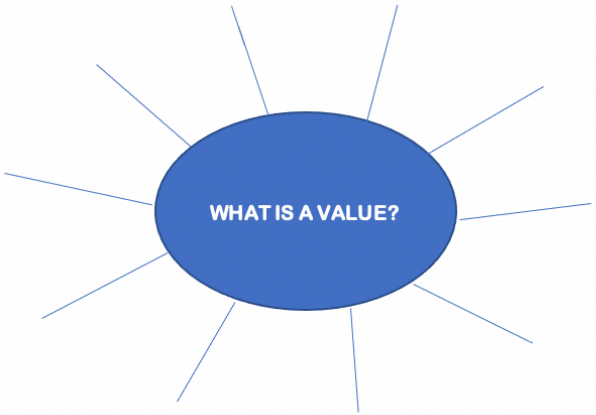
Modifications for client group (Soo, Tate & Lane-Brown, 2011, Kangas & McDonald, 2011):

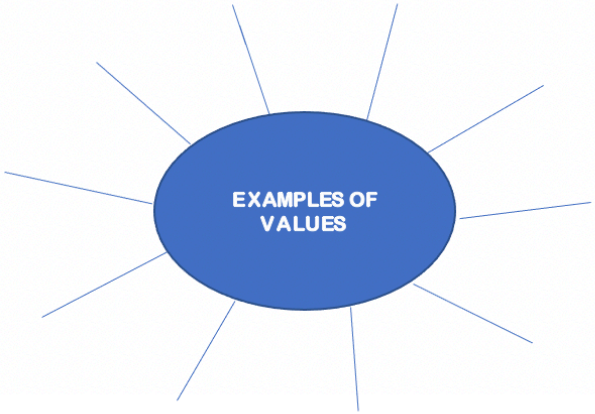
- Easy-to-read handouts
- Summary sheets with key components of sessions
- Simplified explanations
- Metaphors
- Slower presentation of materials
- Repetition
- Concrete examples

Appendices:

PHASE 1: INTRODUCING AND IDENTIFYING VALUES

Appendix A:





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Appendix B:

Values are like a compass. A compass gives you direction and keeps you on track when you're travelling. And our values do the same for the journey of life. We use them to choose the direction in which we want to move and to keep us on track as we go. So when you act on a value, it's like heading North. No matter how far North you travel, you never get there, there's always further to go. But goals are like the things you try to achieve on your journey: they're like the sights you want to see or the mountains you want to climb while you keep on traveling North.

For example, if I had the value of feeling connected with others, my goals may be to stay in contact with people after we have parted ways, call my friends once a week, or visit my family every other month.

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Appendix C:

What has been the most meaningful moment of your life so far?

"Close your eyes for a few minutes and reflect on some of the times in your life that have been most important to you. Imagine you have photographs of some of the moments of you life you consider to be the most meaningful. Start with your earliest memory, then a memory from when you were beginning school, then a memory from when you were a teenager. Think of a moment from a year or two ago, then a moment in the last few months. If there has been one moment in your life so far that has made everything in your life worth it, what would it be? Now share the moment you chose. Your job is to hear a one-word value in your moment. Your therapist can help you with this"

OR

Areas of Importance Before Brain Injury

What was I doing that felt important to me?	Why was I doing it?	What did I like about it?
1.		
2.		
3.		

4.		

Appendix D:

80th Birthday Exercise for Values Exploration

Rationale

This is an exercise that's about getting a sense for what you want to be about in your life. It's a way of exploring what you would like to treat as important and how you want to be with yourself or with others. If you're willing to give it a try, we'll both close our eyes and I'll guide us through noticing different aspects of our experience. I'll ask you some questions. You don't need to answer out loud. Just notice what comes up for you. There are no right or wrong answers in this exercise – it's all about noticing what comes up. Are you willing?

Exercise

OK, let's start by closing our eyes. Take a moment to get centred by noticing your breath and noticing how your body feels. (Pause). If you find yourself getting distracted or notice your mind wandering, that's OK. Just notice that and gently bring your attention back to this exercise. (Pause). Now, imagine moving forward through time. Imagine yourself aging and growing older as you move through life. Imagine now that you are turning 80 years old, and your friends, family, and co-workers have gathered to celebrate your 80th birthday.

Imagine what you will look like on your 80th birthday. And, I invite you to imagine not who you think would likely be there, but who you would most want to be at your 80th birthday party – even if that means they would be very old. There could even be people you haven't met yet. (Pause). Try to really picture who would be there. (Pause). Now the time has come in the party where people are starting to give speeches. They are taking turns standing up and speaking about what you have meant to them. They are speaking about what you have stood for as a person, and the impact you have had. (Pause). Again, I'm not asking you to imagine what they would likely say. I'm inviting you to imagine, if you were to be bold in this moment, what you would most want them to say. Deep down in your heart, imagine what you would most want others to say about what you've meant. (Pause).

Imagine the first person standing up to speak. Imagine it's someone very close to you. Take a moment now and imagine what you would most want them to say about the impact you've had. Try to really hear them saying that. (Pause).

Now, imagine the next person standing up to speak. This could be someone from a different part of your life – perhaps a coworker or neighbor. And for them too, imagine what you would most want for them to say about what you have stood for in your life. (Pause).

Now thank your mind for this experience, and gently bring your attention back to the present moment. (Pause). Take a moment to get centered here, noticing your breath and how your body feels. And when you're ready, you can open your eyes.

Debriefing

There are lots of ways to debrief from this exercise. The direction you take will depend on what comes up for the participant. Here are some possibilities.

Questions to ask:
What came up for you?
Who did you imagine speaking?
What did you most want them to say about you?
What other thoughts/feelings did you notice?

Ideas to explore:
Values as a choice (in contrast to "shoulds")
Values as an on-going direction or agenda in life (in contrast to specific goals)
Values as a quality of action (in contrast to an emotion or object)
To care about something is to be vulnerable to it (pain and values are connected)

Notes
This exercise can be tailored in many ways to fit the goals and abilities of the current audience.

For example, the length of time between the present and the imagined future can be manipulated for varying levels of intensity. You can make the exercise more intense by having participants imagine their own funerals. Or, you can make it less intense by having them imagine a reunion 10 years from now. You can even have them imagine themselves one week from today, looking back on what they treated as important with their behavior in the next week.

Also, you can vary the prompts you give for who participants will imagine speaking about them. For example, if you are working with a group of teachers, you might ask them to imagine a former student speaking at their retirement party.

It's important to note that this exercise requires a fair amount of skillfulness in the participants. For example, it requires the skill of sitting quietly and focusing attention. Not everyone is capable of doing this. However, those skills could be shaped over time with other interventions, and there are other ways to explore values.

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Appendix E: Who do you Admire?

Think of someone that you see as an inspiration. It could be someone famous, or someone you know. What do you think their values are? What's important to them? What do they stand for in life? Use this space to think about this

Appendix F: Part 1 of Bullseye

Bull's-Eye

The Bull's Eye dartboard on page 3 is divided into four areas of living that are important in people's lives: work/education, leisure, relationships and personal growth/health.

1) Work/Education refers to your career aims, your values about improving your education and knowledge, and generally feeling of use to those close to you or to your community (i.e., volunteering, overseeing your household, etc.)

2) Leisure refers to how you play in your life, how you enjoy yourself, your hobbies or other activities that you spend your free time doing (i.e., gardening, sewing, coaching a children's soccer team, fishing, playing sports);

3) Relationships refers to intimacy in your life, relationships with your children, your family of origin, your friends and social contacts in the community;

4) Personal growth/health refers to your spiritual life, either in organized religion or personal expressions of spirituality, exercise, nutrition, and addressing health risk factors like drinking, drug use, smoking, weight;

In this exercise, you will be asked to look more closely at your personal values in each of these areas and write them out. Then, you will evaluate how close you are to living your life in keeping with your values. You will also take a closer look at the barriers or obstacles in your life that stand between you and the kind of life you want to live. Don't rush through this; just take your time.

Part 1. Identify Your Values

Start by describing your *values* within each of the four values areas. Think about each area in terms of your dreams, like you had the possibility to get your wishes completely fulfilled. What are the qualities that you would like to get out of each area and what are your expectations from these areas of your life? Your value should not be a specific goal but instead reflect a way you would like to live your life over time. For example, getting married might be a goal you have in life, but it just reflects your value of being an affectionate, honest and loving partner. To accompany your son to a baseball game might be a goal; to be an involved and interested parent might be the value. **Note!** Write your value for each area on the lines provided below. It is ***your*** personal values that are important in this exercise.

Work/education:

_____

_____

Leisure:

_____

_____

Relationships:

_____

_____

Personal growth/health:

_____

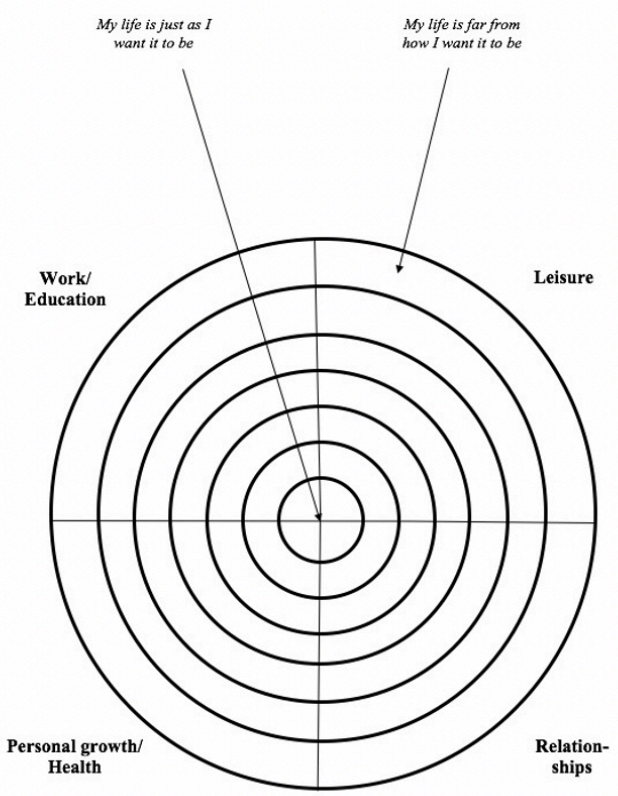
_____

PHASE 2: GOAL-SETTING

Appendix G: Part 2 of Bullseye

Now, look again at the values you have written in the last session. Think of your value as "Bull's Eye" (the middle of the dart board). Bull's Eye is exactly how you want your life to be, a direct hit, where you are living your life in a way that is consistent with your value. Now, make an X on the dart board in each area that best represents where you stand today. An X in Bull's Eye means that you are living completely in keeping with your value for that area of living. An X far from Bulls Eye means that your life is way off the mark in terms of how you are living your life.

Since there are four areas of valued living, you should mark **four Xs** on the dart board. **Note!** Use the dart board on this page before you go to Part 2 of this exercise.



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Part 2: Identify Your Obstacles

Now write down what stands between you and living your current life as you want to, from what you have written in your areas of value. When you think of the life you want to live and the values that you would like to put in play, what gets in the way of you living that kind of life? Describe any obstacle (s) on the lines below.

_____

_____

_____

_____

Now estimate to what extent the obstacle (s) you just described can prevent you from living your life in a way that is in keeping with your values. Circle one number below that best describes how powerful this obstacle (s) is in your life.

1 2 3 4 5 6 7

Doesn't prevent me at all Prevents me completely

Part 3. My Valued Action Plan

Think about actions you can take in your daily life that would tell you that you are zeroing in on the bulls-eye in each important area of your life. These actions could be small steps toward a particular goal or they could just be actions that reflect what you want to be about as a person. Usually, taking a valued step includes being willing to encounter the obstacle (s) you identified earlier and to take the action anyway. ***Try to identify at least one value based action you are willing to take in each of the four areas listed below.***

Work/education:

_____

_____

Leisure:

_____

_____

Relationships:

_____

_____

Personal growth/health:

_____

_____

OR

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Bulls' Eye Exercise: Living Your Values

This exercise looks at the consistency between your *activities* in life and your *values* in life. It is designed to monitor your progress towards living the kind of life you want. Part A of the exercise looks at where you are in relation to your chosen values; Part B looks at what might be standing in the way.

Part A

On the next three pages, you'll have space to explore your activities in three chosen value areas over the last two weeks. First, write down an important value. This exercise is most useful after you have already done some work on identifying several values that are important to you, so if you have not already done so, you might wish to engage in some values clarification exercises, such as a values card sort or the Personal Values Questionnaire (PVQ).

Then, in the space provided, try to sum up in a few sentences why this value is important to you. If you were really living this value, how would your experience/life/relationships be different? If you were living in line with this value, what would you be getting out of it?

Next, mark an "X" in the area of the dartboard that represents where you have been *overall, over the last two weeks*, in relation to your chosen value. The centre of the dartboard – the so-called *bull's eye* - represents *exactly where you want to be* with living in line with this value. The outer circle represents feeling very far from living your chosen value.

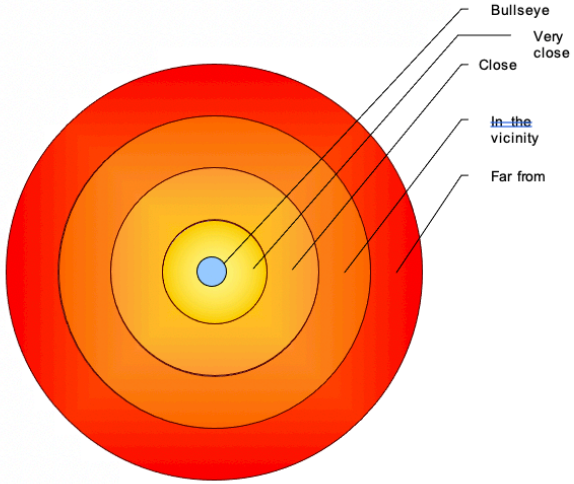
Finally, identify some moves/actions/behaviours over the last two weeks that moved you either towards or away from the bull's eye. It doesn't matter if the moves were small or large – everything counts.

Value 1

The first value that I really want to be living is:

This value is important to me because:

How close was I to totally living this value in the last two weeks? Place an X:



Actions that moved me *towards* the bull's eye over these two weeks were:

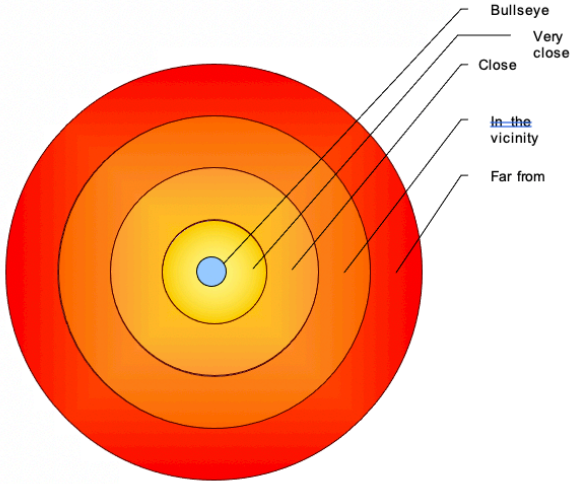
Actions that moved me *away* from the bull's eye over these two weeks were:

Value 2

The second value that I really want to be living is:

This value is important to me because:

How close was I to totally living this value in the last two weeks? Place an X:



Actions that moved me *towards* the bull's eye over these two weeks were:

Actions that moved me *away* from the bull's eye over these two weeks were:

Part B

Think about everything you put on the prior three pages – the values you identified, your descriptions of why those values are important. Combine those three values and think of them as representing the life you want.

Now think about where your X marks were placed on the three dartboards. Overall, how are you doing? At this moment in time, over the last two weeks, how close or far away are you from living the kind of life you want, to being the kind of person you want to be? How does the placement of the X marks compare to previous times you have completed this exercise (if applicable)? Write down some of your observations below:

Now, think about what is standing in the way of moving those X marks towards the bull's eyes. Anxiety? Insecurity? Hopelessness? Lack of motivation? Lack of self-belief? Barriers to do with your environment, with other people? Other factors?

Now, identify a move or two you can make during the next two weeks towards *each* of your valued directions. Be specific and be realistic, but also be courageous and bold! Just think: what would it mean for your life if you were to move closer to the bull's eye?

Value 1:

Value 2:

Take a moment and mentally *commit* to making the moves you identified.

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Appendix H:

Ten Steps to Trying on a Value

1. **Choose a Value.** Choose valued directions that you are willing to try on for at least a week. This should be a value that *you* can enact and a value that you care about. This is not a time to try to change others or manipulate them into changing.

2. **Notice Reactions.** Notice anything that comes up about whether or not this is a good value, or whether or not you really care about this value. Just notice all thoughts for what they are. Remember that your minds job is to create thoughts. Let your mind do that and you stay on the exercise.

3. **Make a List.** Take a moment to list a few behaviors that one might say are related to the chosen value.

4. **Choose a Behavior.** From this list, choose one behavior or set of behaviors you can commit to between now and next session or the next few sessions.

5. **Notice Judgments.** Notice anything that comes up about whether or not that is a good behavior, whether or not you will enjoy it, or whether you can actually do that to which you are committing yourself.

6. **Make a Plan.** Write down how you will go about enacting this value in the very near future (today, tomorrow, this coming weekend, at the next meeting with your supervisor). Consider anything you will need to plan or get in order (e.g., call another person, clean the house, make an appointment, etc.). Choose when to do that – the sooner the better.

7. **Just Behave.** Even if this value involves other people, *do not tell them what you are doing*. See what you can notice if you just enact this value without telling them it is an 'experiment'.

8. **Keep a Daily Diary of Your Reactions.** Things to look for are other's reactions to you, any thoughts feelings or body sensations that occur before, during and after the behavior, and how you feel doing it for the second (or fifth, or tenth, or hundredth) time. Watch for evaluations that indicate whether this activity, value, or valued direction was 'good' or 'bad' or judgments about others, or yourself in relation to living this value. Gently thank your mind for those thoughts, and see if you can choose not to buy into the judgments it makes about the activity.

9. **Commit.** Every day. Notice anything that shows up as you do so.

10. **Reflect.** Please bring your Daily Reactions Diary back to session on:
    _____

Appendix I: (Use sheet per value)

GOAL-SETTING

My chosen value for this goal:

S	Specific	‘I’ll make more time for people’ ‘I’ll phone or message friends at least once a week’ Friendly: What do you think friendliness is? How might you do it? Being nice to everyone. How? Smile and ask how your day Might be to just mother
M	Meaningful	Is the goal in line with my chosen value(s) above? Is it my value or someone else’s? Does it have personal meaning and purpose?
A	Achievable	Will this goal benefit me in some way? Could it move my life in the direction I want it to go in?
R	Realistic	Is this goal realistic for me right now? Do I have the resources I need e.g.

		time, money, ability, energy, skills, support? If needed resources are missing, a goal before this might be to find these missing resources e.g. develop the skills, save money.
T	Time-Framed	I want to work on this goal until Date: Time:

My SMART Goals:

1.

2.

Do these goals fit with my chosen value?

Are these goals better done by a live person or dead person? E.g. ‘to be less busy’ is better done by a dead person, whereas ‘to manage my time better and fit more things in’ is better done by a live person.

Preparation checklist:

Is my goal meaningful?

What obstacles might get in the way?

How can I prepare to overcome these?

What resources will I need?

Do I need someone to help me? Who?

How will I remember to work towards my goal? (i.e. phone reminders, written reminders, asking staff to remind, asking family to check in)

Breaking my goal into steps:

What can I do…

Now (small, simple, can be done in the next 24 hours)

In the short-term (over the next few days)?

In the medium-term? (over the next few weeks)

In the long-term? (over the next few months)

Making a commitment:

When we make a verbal or written commitment to our goals we are more likely to follow through. How can you do this?

I will tell my rehabilitation team or someone on the ward that I am working towards this goal ☐

I will tell a family member or friend ☐

I will say it out loud to myself ☐

I will write it in the front page of my diary/notebook ☐

I will store the end date for this goal in my phone calendar, and set weekly reminders ☐

Appendix J:

OBSTACLES

What got in the way of me working on my values-based goal this week?

Can I address this so that it does not happen again? How?

Is this still the value I would like to work towards? Does it still feel important?

If it is difficult to overcome an obstacle, the goal may need to be changed. It will still follow the value you want to work towards.

Appendix K:

ADAPTING MY GOAL:

The path up a mountain is not a straight line, it can curve

Your route may have some twists and turns, you may even have to change route, but you will still carry on in the same direction up the mountain…

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You can change your route (goal), while sticking to your direction (value).

VALUE GUIDING THE GOAL:

CURRENT GOAL:

NEW GOAL:

Does this goal fit with my chosen value(s)?

Is this goal better done by a live person or dead person? E.g. 'to be less busy' is better done by a dead person, whereas 'to manage my time better and fit more things in' is better done by a live person.

Appendix L:

So my goal wasn't met…
But what was met along the way?

¯_(ツ)_/¯

Even if the planned goal was not met, you might find you gained something else from the process. Take a few moments to think about this, and make some notes in the space below:

Did you, for example?

- think about your value this week
- try working towards your value this week
- think about alternative goals or values
- learn anything about yourself or the process

Appendix M:

Garden metaphor:

"Many people confuse values with feelings.

Values are more like a garden and feelings are more like weather.

Pursuing a value can be like cultivating a garden. You pick a plot and select some seeds to plant. After a while, you start to have seedlings that are sprouting. You might then start to have second thoughts. You might notice that the rain is accumulating more in a different garden plot or another area is getting more sun on a particular day. When you notice these things, you could abandon your garden and start cultivating another plot. There's nothing wrong with this, although you lose the time and effort you put into your first garden, and on another day you may find the weather in your garden is different. When your second garden starts to sprout, however, the same thing may happen. If you decide to plant a third garden, this problem may compound – the seasons may not be correct for many plants and even more effort will be wasted. You are also probably going to experience gardening very differently from someone who is staying with their original choice of plants and watching them grow. Life can be a lot like gardening in that whatever choices we make around it are generally going to include some weeds, some bad weather and some choices we might have made differently. Many people are indecisive

gardeners, and others will only grow one set of crops that they know will tolerate most weather, even if they aren't too excited about them. These are valid ways to garden, but you get a certain experience of gardening around never committing to your garden or just going with an easy garden as opposed to one that really interests you. You can probably think of people you know who are indecisive gardeners or who just grow what they have seen other people grow or are pretty sure they can grow successfully.

Appendix 12: TAU-U Analysis for Participants VAS Data Across Phases.

Table 12

		Low Mood				Meaningful Living			
Pt	Comparison	*Tau*	SD *Tau*	*p*-value	90% CI	*Tau*	SD *Tau*	*p*-value	90% CI
1	A x B	-.22~	.22~	.32~	-0.586<>0.146~	.42	.22	.06	0.050<>0.782
	B x FU	.73	.63	.25	-0.305<>1	1	.63	.11	-0.032<>1
	A x (B+FU)	-.18~	.22~	.39~	-0.540<>0.172~	.46	.22	.03*	0.109<>0.821
2	A x B	.07	.22	.73	-0.281<>0.430	-.07	.21	.73	-0.408<>0.268
	B x FU	-.26	.28	.34	-0.717<>0.190	0	.27	1	-0.439<>0.439
	A x (B+FU)	.02	.21	.91	-0.315<>0.361	-.09	.22	.67	-0.448<>0.264
3	A x B	0	.23	1	-0.379<>0.379	.57	.22	.01**	0.208<>0.940
	B x FU	0	.30	1	-0.498<>0.498	-.68	.30	.02*	-1<>-0.197
	A x (B+FU)	0	.29	1	-0.484<>0.484	.44	.21	.04*	0.152<>0.870
4	A x B	.24	.25	.34	-0.172<>0.646	.53	.25	.03*	0.125<>0.942

Note. Pt=Participant; A=Baseline phase; B=Intervention phase; FU=Follow-up phase; SD=Standard deviation; CI=Confidence Interval; * = $p<.05$; ** = $p<.01$; ~ = baseline trend corrected

Appendix 13: Raw Scores for Standardised Measures (HADS-D, QOLIBRI, RIDI).

Table 13

Pt	Measure	T1	T2	T3	T4
1	HADS-D	8	9	4	5
	QOLIBRI-Self	61	75	57	57
	QOLIBRI- Emotions	50	40	90	85
	RIDI	24	25	30	26
2	HADS-D	8	8	3	3
	QOLIBRI-Self	96	86	86	43
	QOLIBRI- Emotions	80	80	80	65
	RIDI	29	29	29	26
3	HADS-D	9	8	2	2
	QOLIBRI-Self	11	14	20	36
	QOLIBRI- Emotions	100	85	93	95
	RIDI	14	14	20	20
4	HADS-D	15	18	13	-
	QOLIBRI-Self	7	7	17	-
	QOLIBRI- Emotions	55	5	15	-

RIDI	12	14	12	-

Note. Desired direction of change: decrease in HADS-D scores, and an increase in QOLIBRI and RIDI scores. QOLIBRI transformed scores are used ranging from 0-100.